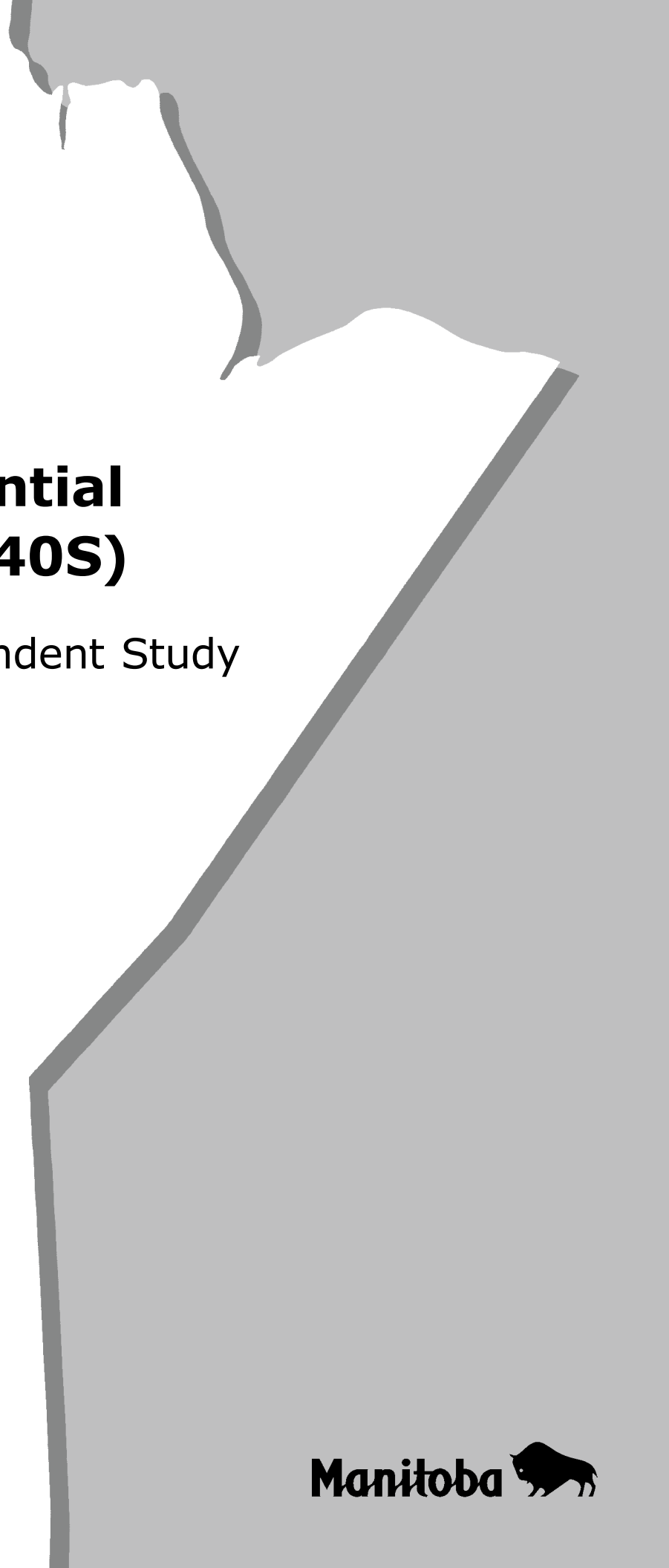
Grade 12 Essential Mathematics (40S)

A Course for Independent Study



Manitoba

Grade 12 Essential Mathematics (40S)

A Course for Independent Study

2014, 2019
Manitoba Education and Training

Manitoba Education and Training Cataloguing in Publication Data

Grade 12 essential mathematics (40S) : a course for independent study

ISBN: 978-0-7711-5838-4

1. Mathematics—Study and teaching (Secondary).
2. Mathematics—Study and teaching (Secondary)—Manitoba.
3. Mathematics—Programmed instruction.
4. Distance education—Manitoba.
5. Correspondence schools and courses—Manitoba.
I. Manitoba. Manitoba Education and Training.
510

Manitoba Education and Training
Winnipeg, Manitoba, Canada

This resource was published in 2014 and updated in 2019.

Disponible en français.

Available in alternate formats upon request.

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Acknowledgements

Manitoba Education and Training gratefully acknowledges the contributions of the following individuals in the development of *Grade 12 Essential Mathematics (40S): A Course for Independent Study.*

Writers	Megan Hudson Instructional Design Assistant	Development Unit Instruction, Curriculum and Assessment Branch
	Amanda Konrad Instructional Design Assistant	Development Unit Instruction, Curriculum and Assessment Branch
Reviewer	Irv Peters	Independent Consultant Winkler
Manitoba Education and Training	Carole Bilyk Project Leader	Development Unit Instruction, Curriculum and Assessment Branch
	Louise Boissonneault Coordinator	Document Production Services Unit Instruction, Curriculum and Assessment Branch
	Ian Donnelly Consultant (since February 2012)	Development Unit Instruction, Curriculum and Assessment Branch
	Lynn Harrison Desktop Publisher	Document Production Services Unit Instruction, Curriculum and Assessment Branch
	Myrna Klassen Consultant	Distance Learning Unit Instruction, Curriculum and Assessment Branch
	Gilles Landry Project Manager	Development Unit Instruction, Curriculum and Assessment Branch
	Philippe Leclercq Conseiller pédagogique	Conseiller pédagogique — Mathématiques 9 à 12 Division du Bureau de l'éducation française Division
	Susan Lee Coordinator	Distance Learning Unit Instruction, Curriculum and Assessment Branch
	Grant Moore Publications Editor	Document Production Services Unit Instruction, Curriculum and Assessment Branch
	John Murray Consultant (until August 2011)	Development Unit Instruction, Curriculum and Assessment Branch

Grade 12 Essential Mathematics (40S)

Introduction

Introduction to the Course

Overview

Welcome to Grade 12 Essential Mathematics! This course is a continuation of the concepts you have been studying in previous years, as well as an introduction to new topics.

As a student enrolled in a distance learning course, you have taken on a dual role—that of a student and a teacher. As a student, you are responsible for mastering the lessons and completing the learning activities and assignments. As a teacher, you are responsible for checking your work carefully, noting areas in which you need to improve, and motivating yourself to succeed.

What Will You Learn in This Course?

In this course, Grade 12 Essential Mathematics, you will build on the knowledge and skills you gained while studying Grade 11 Essential Mathematics. You will put to use many of the skills that you have already learned to solve problems and do basic arithmetic operations. This course helps you develop the skills, ideas, and confidence that you will need to make decisions and solve problems related to consumer applications of mathematics.

How Is This Course Organized?

The Grade 12 Essential Mathematics course consists of the following eight modules:

- Module 1: Home Finance
- Module 2: Geometry and Trigonometry
- Module 3: Business Finance
- Module 4: Probability
- Module 5: Vehicle Finance
- Module 6: Career Life
- Module 7: Statistics
- Module 8: Precision Measurement

Each module in this course consists of several lessons, which contain the following components:

- **Lesson Focus:** The Lesson Focus at the beginning of each lesson identifies one or more specific learning outcomes (SLOs) that are addressed in the lesson. The SLOs identify the knowledge and skills you should have achieved by the end of the lesson.
- **Introduction:** Each lesson begins with an explanation of what you will be learning in that lesson.
- **Lesson:** The main body of the lesson is made up of the content that you need to learn. It contains text, explanations, images, diagrams, and completed examples.
- **Learning Activities:** Many (most) lessons include one or more learning activities that will help you learn about the lesson topics and prepare you for the assignments, the midterm examination, and the final examination. Once you complete a learning activity, check your responses against those provided in the Learning Activity Answer Key found at the end of each applicable module. You will not submit the completed learning activities to the Distance Learning Unit.
- **Assignments:** Assignments are found at the end of each lesson that has an assignment. You will mail or electronically submit all your completed assignments to the Distance Learning Unit for assessment at the end of each module. In total, all assignments are worth seventy-five percent (75%) of your final course mark.
- **Summary:** Each lesson ends with a brief review of what you just learned.

This course also includes the following appendix:

- **Appendix A: Glossary:** The glossary at the end of the course provides definitions for an alphabetical list of the terms identified throughout the course. You can use the glossary to review terms used in the course.

What Resources Will You Need for This Course?

You do not need a textbook for this course. All the content is provided directly within the course. You will, however, need access to a variety of resources.

The required and optional resources for this course are identified below.

Required Resources

For this course, you will need access to the following resources. If you do not have access to one or more of these resources, contact your tutor/marker.

- **A calculator:** Use a graphing or scientific calculator as you work through this course. You **will** need the calculator for the examination(s).
- **A metric ruler, an imperial ruler, and a protractor:** Use the rulers and protractor as you work through this course. You **will not** need the rulers or protractor for the examinations.

Optional Resources

It would be helpful if you had access to the following resources:

- **Access to a computer with spreadsheet and graphing capabilities:** Access to a computer with spreadsheet software and graphing capabilities will be an advantage but not a requirement.
- **A computer with Internet access:** Use of the Internet may be suggested as a resource in some places, but if you do not have access to an online computer you can still complete the related learning activities and assignments without it.
- **Access to a photocopier:** With access to a photocopier/scanner, you could make a copy of your assignments before submitting them so that if your tutor/marker wants to discuss an assignment with you over the phone, each of you will have a copy. It would also allow you to continue studying or to complete further lessons while your original work is with the tutor/marker. Photocopying or scanning your assignments will also ensure that you keep a copy in case the originals are lost.

Who Can Help You with This Course?

Taking an independent study course is different from taking a course in a classroom. Instead of relying on the teacher to tell you to complete a learning activity or an assignment, you must tell yourself to be responsible for your learning and for meeting deadlines. There are, however, two people who can help you be successful in this course: your tutor/marker and your learning partner.

Your Tutor/Marker

Tutor/markers are experienced educators who tutor Independent Study Option (ISO) students and mark assignments and examinations. When you are having difficulty with something in this course, contact your tutor/marker, who is there to help you. Your tutor/marker's name and contact information were sent to you with this course. You can also obtain this information in the learning management system (LMS).

Your Learning Partner

A learning partner is someone **you choose** who will help you learn. It may be someone who knows something about mathematics, but it doesn't have to be. A learning partner could be someone else who is taking this course, a teacher, a parent or guardian, a sibling, a friend, or anybody else who can help you. Most importantly, a learning partner should be someone with whom you feel comfortable and who will support you as you work through this course.

Your learning partner can help you keep on schedule with your coursework, read the course with you, check your work, look at and respond to your learning activities, or help you make sense of assignments. You may even study for your examination(s) with your learning partner. If you and your learning partner are taking the same course, however, your assignment work should not be identical.

How Will You Know How Well You Are Learning?

You will know how well you are learning in this course by how well you complete the learning activities, assignments, and examinations.

Learning Activities

Each learning activity has two parts—Part A has BrainPower questions and Part B has questions related to the content in the lesson

Part A: BrainPower

The BrainPower questions are provided as a warm-up activity for you before trying the other questions. Each question should be completed quickly and without using a calculator, and most should be completed without using pencil and paper to write out multiple steps. Some of the questions will relate directly to content of the course. Some of the questions will review content from previous courses—content that you need to be able to answer efficiently.

Being able to do these questions in a few minutes will be helpful to you as you continue with your studies in mathematics. If you are finding it is taking you longer to do the questions, you can try one of the following:

- work with your learning partner to find more efficient strategies for completing the questions
- ask your tutor/marker for help with the questions
- search online for websites that help you practice the computations so you can become more efficient at completing the questions.

None of the assignment questions or examination questions will require you to do the calculations quickly or without a calculator. However, it is for your benefit to complete the questions as they will help you in the course. Also, being able to successfully complete the BrainPower exercises will help build your confidence in mathematics. BrainPower questions are like a warm-up you would do before competing in a sporting event.

Part B: Course Content Questions

One of the easiest and fastest ways to find out how much you have learned is to complete Part B of the learning activities. These have been designed to let you assess yourself by comparing your answers with the answer keys at the end of each module. There is at least one learning activity in each lesson. You will need a notebook or loose-leaf pages to write your answers.

The learning activities in this course will help you to review and practise what you have learned in the lessons. You will not submit the completed learning activities to the Distance Learning Unit. Instead, you will complete the learning activities and compare your responses to those provided in the Learning Activity Answer Key found at the end of each module.

Make sure you complete the learning activities. Doing so will not only help you to practise what you have learned, but will also prepare you to complete your assignments and the examination(s) successfully. Many of the questions on the examination(s) will be similar to the questions in the learning activities. Remember that you **will not submit learning activities to the Distance Learning Unit**.

Assignments

Each module in this course contains assignments, which you will complete and submit to the Distance Learning Unit for assessment. The assignments are worth a total of 75% of your final course mark.

There are two types of assignments that you must submit to the Distance Learning Unit. Each module has a cover assignment, which you can complete at any time during the module. Lesson assignments are located throughout the modules, and include questions similar to the questions in the learning activities of previous lessons. The cover assignments and lesson assignments have space provided for you to write your answers on the question sheets. **You need to show all your steps as you work out your solutions, and make sure your answers are clear (include units, where appropriate).**

The tutor/marker will mark your assignments and return them to you. Remember to keep all marked assignments until you have finished the course so that you can use them to study for your examinations.

Resource Sheet

When you write your midterm and final examinations, you will be allowed to take an Examination Resource Sheet with you into the examination. This sheet will be one letter-sized page, 8½ " by 11", with both sides in your handwriting or typewritten. It is to be submitted with your examination. The Examination Resource Sheet is not worth any marks.

Creating your own resource sheet is an excellent way to review. It also provides you with a convenient reference and quick summary of the important facts of each module. Each student is asked to complete a resource sheet for each module to help with studying and reviewing.

The lesson summaries are written for you to use as a guide, as are the module summaries at the end of each module. Refer to these when you create your own resource sheet. Then, go to Appendix A: Glossary (at the end of the course) to check the information on your resource sheet.

After you complete each module's resource sheet, you should summarize the sheets from all of the modules to prepare your Examination Resource Sheet. The midterm examination is based only on the first four modules of the course, while the final examination is based on Modules 5 to 8.

Midterm and Final Examinations

This course contains a midterm examination and a final examination.

- The midterm examination is based on Modules 1 to 4, and is worth 12.5% of your final mark in this course. You will write the midterm examination when you have completed Module 4.

  As a student, you can use your Midterm Examination Resource Sheet to bring any formulas you have not memorized into the examination with you. You will be required to bring the following supplies to the midterm examination: pens and pencils (2 or 3 of each), blank paper, a scientific or graphing calculator, and your Midterm Examination Resource Sheet.

  The following tables from the course are attached to the back of the midterm examination:

  - Amortization Table
  - Manitoba Homeowner's Insurance Rates Table
  - Interest Rate Factor Table
  - Local Improvement Costs for Property Tax Credits

  Formulas are not included with the examination. Be sure to include these on the resource sheet.

- The final examination is based on Modules 5 to 8, and is worth 12.5% of your final mark in this course. You will write the final examination when you have completed Module 8.

  You can use your Final Examination Resource Sheet to bring any formulas you have not memorized into the examination with you. Formulas are not provided on the examination. You will be required to bring the following supplies to the final examination: pens and pencils (2 or 3 of each), blank paper, a scientific or graphing calculator, and your Final Examination Resource Sheet.

The following tables from the course are attached to the back of the final examination:

- Driver Safety Rating Chart
- Amortization Table
- MPI Passenger Vehicle Rate Groups Table
- MPI Basic Rate Table

Formulas are not included with the examination. Be sure to include these on the resource sheet.

The two examinations are worth a total of 25% of your final course mark. You will write both examinations under supervision.

To do well on each examination, you should review all the work you have completed from the modules, including all learning activities and assignments.

Practice Examinations and Answer Keys

To help you succeed in your examinations, you will have an opportunity to complete a Midterm Practice Examination and a Final Practice Examination. These examinations, along with the answer keys, are found in the learning management system (LMS). If you do not have access to the Internet, contact the Distance Learning Unit at 1-800-465-9915 to obtain a copy of the practice examinations.

These practice examinations are similar to the actual examinations you will be writing. The answer keys enable you to check your answers. This will give you the confidence you need to do well on your examinations.

Requesting Your Examination(s)

You are responsible for making arrangements to have the examinations sent to your proctor from the Distance Learning Unit. Please make arrangements before you finish Module 4 to write the midterm examination. Likewise, you should begin arranging for your final examination before you finish Module 8.

To write your examinations, you need to make the following arrangements:

- **If you are attending school,** your examination will be sent to your school as soon as all the applicable assignments have been submitted. You should make arrangements with your school's ISO school facilitator to determine a date, time, and location to write the examination.

- **If you are not attending school,** check the Examination Request Form for options available to you. Examination Request Forms can be found on the Distance Learning Unit's website, or look for information in the learning management system (LMS). Two weeks before you are ready to write the examination, fill in the Examination Request Form and mail, fax, or email it to

  Distance Learning Unit
  500–555 Main Street
  PO Box 2020
  Winkler MB R6W 4B8
  Fax: 204-325-1719
  Toll-Free Telephone: 1-800-465-9915
  Email: distance.learning@gov.mb.ca

How Much Time Will You Need to Complete This Course?

Learning through independent study has several advantages over learning in the classroom. You are in charge of how you learn and you can choose how quickly you will complete the course. You can read as many lessons as you wish in a single session. You do not have to wait for your teacher or classmates.

From the date of your registration, you have a maximum of **12 months** to complete this course, but the pace at which you proceed is up to you. Read the following suggestions on how to pace yourself.

Chart A: Semester 1

If you want to start the course in September and complete it in January, you can follow the timeline suggested below.

Module	Completion Date
Module 1	Middle of September
Module 2	End of September
Module 3	Middle of October
Module 4	End of October
Midterm Examination	Beginning of November
Module 5	Middle of November
Module 6	End of November
Module 7	Middle of December
Module 8	Middle of January
Final Examination	End of January

Chart B: Semester 2

If you want to start the course in February and complete it in May, you can follow the timeline suggested below.

Module	Completion Date
Module 1	Middle of February
Module 2	End of February
Module 3	Beginning of March
Module 4	Middle of March
Midterm Examination	End of March
Module 5	Beginning of April
Module 6	Middle of April
Module 7	End of April
Module 8	Beginning of May
Final Examination	Middle of May

Chart C: Full School Year (Not Semestered)

If you want to start the course in September and complete it in May, you can follow the timeline suggested below.

Module	Completion Date
Module 1	End of September
Module 2	End of October
Module 3	End of November
Module 4	End of December
Midterm Examination	Middle of January
Module 5	Middle of February
Module 6	Middle of March
Module 7	Beginning of April
Module 8	Beginning of May
Final Examination	Middle of May

Timelines

Do not wait until the last minute to complete your work, since your tutor/marker may not be available to mark it immediately. It may take a few weeks for your tutor/marker to assess your work and return it to you or your school.

If you need this course to graduate this school year, all coursework must be received by the Distance Learning Unit on or before the first Friday in May, and all examinations must be received by the Distance Learning Unit on or before the last Friday in May. Any coursework or examinations received after these deadlines may not be processed in time for a June graduation. Assignments or examinations submitted after these recommended deadlines will be processed and marked as they are received.

When and How Will You Submit Completed Assignments?

When to Submit Assignments

While working on this course, you will submit completed assignments to the Distance Learning Unit eight times. The following chart shows you exactly what assignments you will be submitting at the end of each module.

Submission of Assignments

Submission	Assignments You Will Submit
1	**Module 1: Home Finance** Module 1 Cover Sheet Module 1 Cover Assignment: Investments Using Spreadsheets Assignment 1.1: Affordability, Initial Costs, and Mortgages Assignment 1.2: Insurance and Property Tax Assignment 1.3: Making Decisions
2	**Module 2: Geometry and Trigonometry** Module 2 Cover Sheet Module 2 Cover Assignment: Circle Geometry Assignment 2.1: Polygons Assignment 2.2: The Sine Law Assignment 2.3: Trigonometry
3	**Module 3: Business Finance** Module 3 Cover Sheet Module 3 Cover Assignment: Marginal Income Tax Rates Assignment 3.1: Profitability of a Small Business Assignment 3.2: Income Tax
4	**Module 4: Probability** Module 4 Cover Sheet Module 4 Cover Assignment: Applying Probability to Games Assignment 4.1: Expressing Probability and Odds Assignment 4.2: Applications of Probability
5	**Module 5: Vehicle Finance** Module 5 Cover Sheet Module 5 Cover Assignment: Vehicle Analysis Assignment 5.1: Financing a New Vehicle Assignment 5.2: Used Vehicles and Using Vehicles Assignment 5.3: Insurance Costs

continued

Submission of Assignments (continued)	
Submission	Assignments You Will Submit
6	**Module 6: Career Life** Module 6 Cover Sheet Module 6 Cover Assignment: Personal Costs and Taxes Assignment 6.1: Self-Assessment Report Assignment 6.2: Career Descriptions Assignment 6.3: Education/Training Requirements Assignment 6.4: Expected Lifestyle Report Assignment 6.5: Resumé and Reflection
7	**Module 7: Statistics** Module 7 Cover Sheet Module 7 Cover Assignment: Problem Analysis Assignment 7.1: Mean, Median, Mode, and Outliers Assignment 7.2: Five Measures of Central Tendency Assignment 7.3: Analyzing Percentiles
8	**Module 8: Precision Measurement** Module 8 Cover Sheet Module 8 Cover Assignment: Puzzles in Design Assignment 8.1: Accuracy, Precision, and Uncertainty Assignment 8.2: Measurements and Tolerances

How to Submit Assignments

In this course, you have the choice of submitting your assignments either by mail or electronically.

- **Mail:** Each time you **mail** something, you must include the print version of the applicable Cover Sheet (found at the end of this Introduction). Complete the information at the top of each Cover Sheet before submitting it along with your assignments.
- **Electronic submission:** You do not need to include a cover sheet when submitting assignments electronically.

Submitting Your Assignments by Mail

If you choose to mail your completed assignments, please photocopy/scan all the materials first so that you will have a copy of your work in case your package goes missing. You will need to place the applicable module Cover Sheet and assignment(s) in an envelope, and address it to

Distance Learning Unit
500–555 Main Street
PO Box 2020
Winkler MB R6W 4B8

Your tutor/marker will mark your work and return it to you by mail.

Submitting Your Assignments Electronically

Assignment submission options vary by course. Sometimes assignments can be submitted electronically and sometimes they must be submitted by mail. Specific instructions on how to submit assignments were sent to you with this course. In addition, this information is available in the learning management system (LMS).

If you are submitting assignments electronically, make sure you have saved copies of them before you send them. That way, you can refer to your assignments when you discuss them with your tutor/marker. Also, if the original hand-in assignments are lost, you are able to resubmit them.

Your tutor/marker will mark your work and return it to you electronically.

The Distance Learning Unit does not provide technical support for hardware-related issues. If troubleshooting is required, consult a professional computer technician.

What Are the Guide Graphics For?

Guide graphics are used throughout this course to identify and guide you in specific tasks. Each graphic has a specific purpose, as described below.

Lesson Introduction: The introduction sets the stage for the lesson. It may draw upon prior knowledge or briefly describe the organization of the lesson. It also lists the learning outcomes for the lesson. Learning outcomes describe what you will learn.

Learning Partner: Ask your learning partner to help you with this task.

Learning Activity: Complete a learning activity. This will help you to review or practise what you have learned and to prepare for an assignment or an examination. You will not submit learning activities to the Distance Learning Unit. Instead, you will compare your responses to those provided in the Learning Activity Answer Key found at the end of the applicable module.

Assignment: Complete an assignment. You will submit your completed assignments to the Distance Learning Unit for assessment at the end of a given module.

Mail or Electronic Submission: Mail or electronically submit your completed assignments to the Distance Learning Unit for assessment at this time.

Phone or Email: Telephone or email your tutor/marker.

Resource Sheet: Indicates material that may be valuable to include on your resource sheet.

Examination: Write your midterm or final examination at this time.

Note: Take note of and remember this important information or reminder.

Remember: If you have questions or need help at any point during this course, contact your tutor/marker or ask your learning partner for help.

Good luck with the course!

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Module 1: Home Finance
Cover Sheet

Please complete this sheet and place it on top of your assignments to assist in proper recording of your work. Submit the package to:

Drop-off/Courier Address

Distance Learning Unit
555 Main Street
Winkler MB R6W 1C4

Mailing Address

Distance Learning Unit
500–555 Main Street
PO Box 2020
Winkler MB R6W 4B8

Contact Information

Legal Name: _____ Preferred Name: _____

Phone: _____ Email: _____

Mailing Address: _____

City/Town: _____ Postal Code: _____

Attending School: ❑ No ❑ Yes

School Name: _____

Has your contact information changed since you registered for this course? ❑ No ❑ Yes

Note: Please keep a copy of your assignments so that you can refer to them when you discuss them with your tutor/marker.

For Student Use	For Office Use Only	
Module 1 Assignments Which of the following are completed and enclosed? Please check (✓) all applicable boxes below.	**Attempt 1** _____ Date Received	**Attempt 2** _____ Date Received
❑ Cover Assignment 1: Investments Using Spreadsheets	_____ /10	_____ /10
❑ Assignment 1.1: Affordability, Initial Costs, and Mortgages	_____ /50	_____ /50
❑ Assignment 1.2: Insurance and Property Tax	_____ /15	_____ /15
❑ Assignment 1.3: Making Decisions	_____ /33	_____ /33
	Total: ____ /108	**Total: ____ /108**
For Tutor/Marker Use		
Remarks:		

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Module 2: Geometry and Trigonometry
Cover Sheet

Please complete this sheet and place it on top of your assignments to assist in proper recording of your work. Submit the package to:

Drop-off/Courier Address

Distance Learning Unit
555 Main Street
Winkler MB R6W 1C4

Mailing Address

Distance Learning Unit
500–555 Main Street
PO Box 2020
Winkler MB R6W 4B8

Contact Information

Legal Name: _____ Preferred Name: _____

Phone: _____ Email: _____

Mailing Address: _____

City/Town: _____ Postal Code: _____

Attending School: ❑ No ❑ Yes

School Name: _____

Has your contact information changed since you registered for this course? ❑ No ❑ Yes

Note: Please keep a copy of your assignments so that you can refer to them when you discuss them with your tutor/marker.

For Student Use	For Office Use Only	
Module 2 Assignments Which of the following are completed and enclosed? Please check (✓) all applicable boxes below.	**Attempt 1** _____ Date Received	**Attempt 2** _____ Date Received
❑ Cover Assignment 2: Circle Geometry	_____ /10	_____ /10
❑ Assignment 2.1: Polygons	_____ /31	_____ /31
❑ Assignment 2.2: The Sine Law	_____ /33	_____ /33
❑ Assignment 2.3: Trigonometry	_____ /23	_____ /23
	Total: ____ /97	**Total: ____ /97**
For Tutor/Marker Use		
Remarks:		

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Module 3: Business Finance
Cover Sheet

Please complete this sheet and place it on top of your assignments to assist in proper recording of your work. Submit the package to:

Drop-off/Courier Address

Distance Learning Unit
555 Main Street
Winkler MB R6W 1C4

Mailing Address

Distance Learning Unit
500–555 Main Street
PO Box 2020
Winkler MB R6W 4B8

Contact Information

Legal Name: _____ Preferred Name: _____

Phone: _____ Email: _____

Mailing Address: _____

City/Town: _____ Postal Code: _____

Attending School: ❑ No ❑ Yes

School Name: _____

Has your contact information changed since you registered for this course? ❑ No ❑ Yes

Note: Please keep a copy of your assignments so that you can refer to them when you discuss them with your tutor/marker.

For Student Use	For Office Use Only	
Module 3 Assignments Which of the following are completed and enclosed? Please check (✓) all applicable boxes below.	**Attempt 1** _____ Date Received	**Attempt 2** _____ Date Received
❑ Cover Assignment 3: Marginal Income Tax Rates	_____ /10	_____ /10
❑ Assignment 3.1: Profitability of a Small Business	_____ /30	_____ /30
❑ Assignment 3.2: Income Tax	_____ /3	_____ /3
	Total: ____ /43	**Total: ____ /43**

For Tutor/Marker Use
Remarks:

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Module 4: Probability
Cover Sheet

Please complete this sheet and place it on top of your assignments to assist in proper recording of your work. Submit the package to:

Drop-off/Courier Address

Distance Learning Unit
555 Main Street
Winkler MB R6W 1C4

Mailing Address

Distance Learning Unit
500–555 Main Street
PO Box 2020
Winkler MB R6W 4B8

Contact Information

Legal Name: _____ Preferred Name: _____

Phone: _____ Email: _____

Mailing Address: _____

City/Town: _____ Postal Code: _____

Attending School: ❑ No ❑ Yes

School Name: _____

Has your contact information changed since you registered for this course? ❑ No ❑ Yes

Note: Please keep a copy of your assignments so that you can refer to them when you discuss them with your tutor/marker.

For Student Use	For Office Use Only	
Module 4 Assignments Which of the following are completed and enclosed? Please check (✓) all applicable boxes below.	**Attempt 1** _____ Date Received	**Attempt 2** _____ Date Received
❑ Cover Assignment 4: Applying Probability to Games	_____ /10	_____ /10
❑ Assignment 4.1: Expressing Probability and Odds	_____ /47	_____ /47
❑ Assignment 4.2: Applications of Probability	_____ /35	_____ /35
	Total: ____ /92	**Total: ____ /92**

For Tutor/Marker Use
Remarks:

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Module 5: Vehicle Finance
Cover Sheet

Please complete this sheet and place it on top of your assignments to assist in proper recording of your work. Submit the package to:

Drop-off/Courier Address

Distance Learning Unit
555 Main Street
Winkler MB R6W 1C4

Mailing Address

Distance Learning Unit
500–555 Main Street
PO Box 2020
Winkler MB R6W 4B8

Contact Information

Legal Name: _____ Preferred Name: _____

Phone: _____ Email: _____

Mailing Address: _____

City/Town: _____ Postal Code: _____

Attending School: ❑ No ❑ Yes

School Name: _____

Has your contact information changed since you registered for this course? ❑ No ❑ Yes

Note: Please keep a copy of your assignments so that you can refer to them when you discuss them with your tutor/marker.

For Student Use	For Office Use Only	
Module 5 Assignments Which of the following are completed and enclosed? Please check (✓) all applicable boxes below.	**Attempt 1** _____ Date Received	**Attempt 2** _____ Date Received
❑ Cover Assignment 5: Vehicle Analysis	_____ /10	_____ /10
❑ Assignment 5.1: Financing a New Vehicle	_____ /34	_____ /34
❑ Assignment 5.2: Used Vehicles and Using Vehicles	_____ /41	_____ /41
❑ Assignment 5.3: Insurance Costs	_____ /21	_____ /21
	Total: ____ /106	**Total: ____ /106**
For Tutor/Marker Use		
Remarks:		

Grade 12 Essential Mathematics (40S)

Module 6: Career Life
Cover Sheet

Please complete this sheet and place it on top of your assignments to assist in proper recording of your work. Submit the package to:

Drop-off/Courier Address

Distance Learning Unit
555 Main Street
Winkler MB R6W 1C4

Mailing Address

Distance Learning Unit
500–555 Main Street
PO Box 2020
Winkler MB R6W 4B8

Contact Information

Legal Name: _____ Preferred Name: _____

Phone: _____ Email: _____

Mailing Address: _____

City/Town: _____ Postal Code: _____

Attending School: ❑ No ❑ Yes

School Name: _____

Has your contact information changed since you registered for this course? ❑ No ❑ Yes

Note: Please keep a copy of your assignments so that you can refer to them when you discuss them with your tutor/marker.

For Student Use	For Office Use Only	
Module 6 Assignments Which of the following are completed and enclosed? Please check (✓) all applicable boxes below.	**Attempt 1** _____ Date Received	**Attempt 2** _____ Date Received
❑ Cover Assignment 6: Personal Costs and Taxes	_____ /10	_____ /10
❑ Assignment 6.1: Self-Assessment Report	_____ /19	_____ /19
❑ Assignment 6.2: Career Descriptions	_____ /27	_____ /27
❑ Assignment 6.3: Education/Training Requirements	_____ /24	_____ /24
❑ Assignment 6.4: Expected Lifestyle Report	_____ /21	_____ /21
❑ Assignment 6.5: Resumé and Reflection	_____ /29	_____ /29
	Total: ____ /130	**Total: ____ /130**

For Tutor/Marker Use
Remarks:

Grade 12 Essential Mathematics (40S)

Module 7: Statistics
Cover Sheet

Please complete this sheet and place it on top of your assignments to assist in proper recording of your work. Submit the package to:

Drop-off/Courier Address

Distance Learning Unit
555 Main Street
Winkler MB R6W 1C4

Mailing Address

Distance Learning Unit
500–555 Main Street
PO Box 2020
Winkler MB R6W 4B8

Contact Information

Legal Name: _____ Preferred Name: _____

Phone: _____ Email: _____

Mailing Address: _____

City/Town: _____ Postal Code: _____

Attending School: ❑ No ❑ Yes

School Name: _____

Has your contact information changed since you registered for this course? ❑ No ❑ Yes

Note: Please keep a copy of your assignments so that you can refer to them when you discuss them with your tutor/marker.

For Student Use	For Office Use Only	
Module 7 Assignments Which of the following are completed and enclosed? Please check (✓) all applicable boxes below.	**Attempt 1** _____ Date Received	**Attempt 2** _____ Date Received
❑ Cover Assignment 7: Problem Analysis	_____ /8	_____ /8
❑ Assignment 7.1: Mean, Median, Mode, and Outliers	_____ /34	_____ /34
❑ Assignment 7.2: Five Measures of Central Tendency	_____ /46	_____ /46
❑ Assignment 7.3: Analyzing Percentiles	_____ /20	_____ /20
	Total: ____ /108	**Total: ____ /108**
For Tutor/Marker Use		
Remarks:		

Grade 12 Essential Mathematics (40S)

Module 8: Precision Management
Cover Sheet

Please complete this sheet and place it on top of your assignments to assist in proper recording of your work. Submit the package to:

Drop-off/Courier Address

Distance Learning Unit
555 Main Street
Winkler MB R6W 1C4

Mailing Address

Distance Learning Unit
500–555 Main Street
PO Box 2020
Winkler MB R6W 4B8

Contact Information

Legal Name: _____ Preferred Name: _____

Phone: _____ Email: _____

Mailing Address: _____

City/Town: _____ Postal Code: _____

Attending School: ❑ No ❑ Yes

School Name: _____

Has your contact information changed since you registered for this course? ❑ No ❑ Yes

Note: Please keep a copy of your assignments so that you can refer to them when you discuss them with your tutor/marker.

For Student Use	For Office Use Only	
Module 8 Assignments Which of the following are completed and enclosed? Please check (✓) all applicable boxes below.	**Attempt 1** _____ Date Received	**Attempt 2** _____ Date Received
❑ Cover Assignment 8: Puzzles in Design	_____ /10	_____ /10
❑ Assignment 8.1: Accuracy, Precision, and Uncertainty	_____ /29	_____ /29
❑ Assignment 8.2: Measurements and Tolerances	_____ /49	_____ /49
	Total: ____ /88	**Total: ____ /88**
For Tutor/Marker Use		
Remarks:		

Released 2019

Printed in Canada
Imprimé au Canada

Grade 12 Essential Mathematics (40S)

Module 1
Home Finance

Module 1:
Home Finance

Introduction

In previous mathematics courses, you explored personal finances as they apply to you now. This module focuses on financial concerns that you may have in the future. You probably don't own your own home at this point in your life, so you may not be aware of the costs of home ownership. This module will focus on costs that are associated with buying and owning a home. You will calculate the amount of money you can afford to spend on a house, how much your mortgage would cost, and the costs of home insurance, property taxes, and buying compared to renting a house. You will also become aware of the various expenses that are incurred when you buy a house.

Assignments in Module 1

When you have completed the assignments for Module 1, submit your completed assignments to the Distance Learning Unit either by mail or electronically through the learning management system (LMS). The staff will forward your work to your tutor/marker.

Lesson	Assignment Number	Assignment Title
	Cover Assignment	Investments Using Spreadsheets
2	Assignment 1.1	Affordability, Initial Costs, and Mortgages
3	Assignment 1.2	Insurance and Property Tax
5	Assignment 1.3	Making Decisions

Resource Sheet

When you write your midterm examination, you are encouraged to take a Midterm Examination Resource Sheet with you into the examination. This sheet will be one letter-sized page, 8½ " by 11", with both sides in your handwriting or typewritten. You will submit it with your examination, but you do not receive any marks for it.

Many students have found that preparing a resource sheet is an excellent way to review. It provides you with a summary of the important facts of each module. You should complete a resource sheet for each module to help with your studying and reviewing. Lesson summaries and module summaries are included for you to use as a guide.

You may use the following list of instructions to help you with preparing your resource sheet for the material in Module 1. On this sheet, you should record mathematics terms and definitions, formulas, sample questions, or a list of places where you often make mistakes. You should also identify special areas that require extra attention or review by writing the page numbers.

After you have completed each module's resource sheet, you may summarize the sheets from Modules 1, 2, 3, and 4 to prepare your Midterm Examination Resource Sheet. The midterm examination for this course is based on Modules 1 to 4.

Resource Sheet for Module 1

As you go through the lessons of this module, you may want to consider the following suggestions regarding the creation of a resource sheet.

1. List all the important mathematics terms, and define them if necessary.
2. List all the formulas and perhaps a sample problem that shows how each formula is used.
3. If necessary, write the solutions to some problems, showing in detail how you did the calculations.
4. Copy any questions that represent the key points of the lesson, and perhaps include the solutions as well.
5. Identify the problems you found most difficult, and copy the page numbers onto the resource sheet so that you can review them before writing the examination. You may also copy the problems and the solutions onto your resource sheet, and later write them onto your Midterm Examination Resource Sheet.
6. Write any comments, ideas, shortcuts, or other reminders that may be helpful during an examination.

Module 1 Cover Assignment: Investments Using Spreadsheets

A Tax Free Savings Account (TFSA) can help you reduce the amount of income tax you pay while you create a savings nest egg for future purposes.

With any savings account, money you invest will earn interest. If it is an ordinary savings account, you need to declare the interest as income when you fill out your income tax return. If it is a TFSA, then you do not need to declare the interest as income. By reducing your income, you will pay less income tax.

The following cover assignment demonstrates this situation.

Notes

Module 1 Cover Assignment

Investments Using Spreadsheets

Total: 10 marks

In this cover assignment, you will investigate the difference in two investments—one made within a Tax Free Savings Account (TFSA) and one made in a regular savings account.

- Choose the same amount of money for each investment. The amount should be between $1000 and $4000. Assume you invest the same amount each year in each investment.
- Choose an annual interest rate you believe is reasonable, between 2% and 8%. Assume both investments earn the same rate of interest. Assume you have the same interest rate each year.
- Both investments should be held for 50 years. If you do not have a computer with a spreadsheet program, use 5 years.
- If you have a computer with a spreadsheet program, use the spreadsheet program to create two worksheets. If you do not have a computer with a spreadsheet program, you can use your calculator to create the tables by hand. In the first worksheet, the investment is held in a TFSA and you pay no income tax on the interest earned. In the second worksheet, the investment is held in a regular savings account and you pay between 30% to 50% in income tax on the interest. Choose your income tax rate.

The following worksheets are provided as examples to help with the project. The worksheets begin with an investment of $500 and an interest rate of 6%. The Income Tax Rate for the contributions outside a TFSA is shown as 30%.

Worksheet 1: Investment within a TFSA

	A	B	C	D	E	F	G	H	I
1	Previous	Contribution	New Value	Rate of Interest	$ Interest	Income Tax Rate	Income Tax	Interest after Tax	Final Value
2	$ 0.00	$500	$ 500.00	0.06	$ 30.00	0.00	$0.00	$ 30.00	$ 530.00
3	$ 530.00	$500	$1030.00	0.06	$ 61.80	0.00	$0.00	$ 61.80	$1091.80
4	$1091.80	$500	$1591.80	0.06	$ 95.51	0.00	$0.00	$ 95.51	$1687.31
5	$1687.31	$500	$2187.31	0.06	$131.24	0.00	$0.00	$131.24	$2318.55
6	$2318.55	$500	$2818.55	0.06	$169.11	0.00	$0.00	$169.11	$2987.66

continued

Module 1 Cover Assignment: Investments Using Spreadsheets (continued)

Worksheet 2: Investment in a regular savings account

	A	B	C	D	E	F	G	H	I
1	Previous	Contribution	New Value	Rate of Interest	$ Interest	Income Tax Rate	Income Tax	Interest after Tax	Final Value
2	$ 0.00	$500	$ 500.00	0.06	$ 30.00	0.30	$ 9.00	$ 21.00	$ 521.00
3	$ 521.00	$500	$1021.00	0.06	$ 61.26	0.30	$ 18.38	$ 42.88	$1063.88
4	$1063.88	$500	$1563.88	0.06	$ 93.83	0.30	$ 28.15	$ 65.68	$1629.56
5	$1629.56	$500	$2129.56	0.06	$ 127.77	0.30	$ 38.33	$ 89.44	$2219.00
6	$2219.00	$500	$2719.00	0.06	$ 163.14	0.30	$ 48.94	$ 114.20	$2823.20

The following worksheet contains the formulas that can be filled down to complete the remaining rows of the spreadsheets. Note: In column F, remember to use the appropriate income tax rate that you chose.

	A	B	C	D	E	F	G	H	I
1	Previous	Contribution	New Value	Rate of Interest	$ Interest	Income Tax Rate	Income Tax	Interest after Tax	Final Value
2	$ 0.00	$500.00	=A2+B2	0.06	=C2*D2	0.00	=E2*F2	=E2−G2	=C2+H2
3	=I2	$500.00		0.06		0.00			
4		$500.00		0.06		0.00			
5		$500.00		0.06		0.00			
6		$500.00		0.06		0.00			

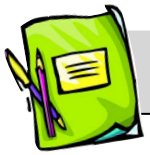
How much more do you save with your investment within a TFSA?

When you have completed this assignment, print both worksheets, give the answer to the question above, and include them with the remaining hand-in assignments for Module 1.

You will receive four marks each for the two completed worksheets—Worksheet 1: Investment within a TFSA, and Worksheet 2: Investment in a regular savings account. Both of these worksheets should examine the investment of the same amount of money each year for 50 years (or 5 years if working without a computer) with the same annual interest rate. Also, the income tax rate for Worksheet 2 has to be included.

You will receive an additional two marks for stating the difference in dollar value between the two investments, and explaining why that difference occurs.

Lesson 1: Affordability and Initial Costs



Learning Activity 1.1

Learning Activity 1.1 is the only one that does not include a BrainPower section, although it does have two parts. Be sure to complete this learning activity before you begin your first lesson.

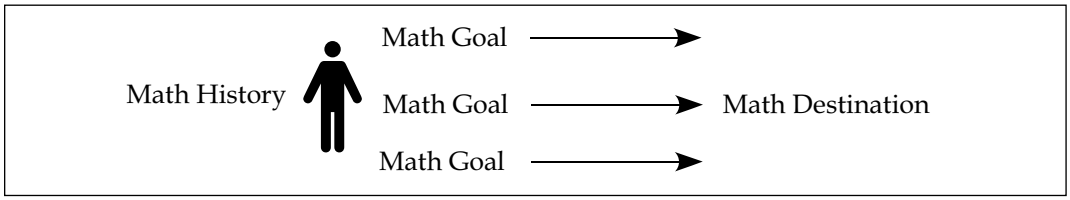
This activity involves you having a conversation with your tutor/marker. Having this conversation with your tutor/marker has two important purposes. First, it introduces you to a very valuable resource—your tutor/marker. He or she is available for you to answer questions, explain concepts, and guide you through this course. You can discuss your math learning and progress. Feel free to contact your tutor/marker by phone or email at any time during this course.

The second important purpose of this assignment is to get you thinking about your math goals. You may have a future career in mind, and this course is getting you one step closer to it by completing a prerequisite for a future required course. There may be specific skills or topics you are interested in learning about, and they are covered in this course.

If you are unsure of your math goals or why they are important, consider this:

- goals give you a sense of direction and purpose in taking this course
- goals help motivate you to learn and do your best, even when it's tough
- when you accomplish your goals, there is a great sense of achievement and success

Good goals need to be realistic and specific, and they should reflect what is important to you. They should give you direction and take you further down the path from where you have been to where you want to go.



Goals can be long term or short term, but they are the pathway that takes **you** from where you were/are, closer to where you want to go.

continued

Learning Activity 1.1 (continued)

Part A: Your Tutor/Marker

Fill in the following blanks using information provided with your course:

My tutor/marker's name is _____

I can phone my tutor/marker at 1-866-_____

My tutor/marker's email is _____

Be ready to discuss the following topics and the reasons for your answers with your tutor/marker during your phone conversation. If you'd like, make some notes below before you call in order to help you feel prepared. Feel free to add other questions or comments that you may have as well.

1. I am taking this course by distance education because…

_____

_____

_____

_____

2. What I like about math and can do mathematically is… (favourite topic, skill, where you use math, etc.).

_____

_____

_____

_____

3. What I dislike about math or have difficulty doing is…

_____

_____

_____

_____

continued

Learning Activity 1.1 (continued)

4. Previous math experiences that influence the way I feel about math are…

5. The next math course I would like to take is…

6. What I am hoping this course will help me accomplish and learn for the future…

7. What I am doing/how I will organize things to help me succeed in this course…

continued

During your phone conversation, jot down a sentence or two in the spaces above about what you and your tutor/marker talk about. For example, if you are taking this course because it doesn't fit into your schedule at school or because you travel a lot with your basketball team and this is more convenient, state that in the space below Question 1.

Part B: Your Math Pathway

Use the answers to the questions from the conversation with your tutor/marker as a starting point, and fill in the following diagram. In the Math History box, jot down point-form notes about your prior experience and knowledge about math (Questions 2, 3, and 4). In the Math Destination box, jot down what completing this course will help you accomplish in the future (Questions 5 and 6).

In the middle column, write down what you will need to do to move down the pathway from your History to your Destination.

Math History	Pathway	Math Destination

continued

Learning Activity 1.1 (continued)

For example, if your destination includes needing a 75% in this course so that you can feel confident applying to a post-secondary institution such as college or university, or so that you can learn how to make smart consumer decisions, what will help you accomplish this? It may mean figuring out how you best learn and study math. It may mean setting up a schedule so you complete the assignments on time. You may need to find your calculator manual and figure out how to use it, set up regular appointments with your learning partner, research a topic on the Internet, or read a textbook about a certain math concept or skill. Your pathway is unique to you.

As you move through this course and work on achieving your goals, self-assessment becomes important. It is the way for you to determine if you are getting closer to your destination, and if the steps along your pathway are taking you in the right direction. You will need to periodically ask yourself the following questions: Am I doing my assignments? Are my note-taking skills improving? How often have I contacted my tutor/marker or worked with my learning partner? Have I found useful homework websites? Is my schedule working? What do I need to change or adjust so I can get to my destination?

Several times during this course, you will go through this cycle of looking at where you have been, where you want to go, and where you currently are. At any time, you may want to revise your goals or set new ones, as you evaluate your own progress and learning.

- Look back/history—reflect on what you know, how far you have come
- Look around/pathway—assess if you are achieving your goals, determine if new learning or understanding has occurred, and check your progress
- Look forward/destination—determine what you want to know, set goals

Each time you go through these steps, you will become better at mathematics!

It is important that you keep the chart you created handy, as you will revisit it at other points in this course.

Notes

Lesson Focus

In this lesson, you will

- ❑ calculate the Gross Debt Service Rate
- ❑ determine the price range of houses that you can afford to buy
- ❑ explore the various costs involved in purchasing a home

Lesson Introduction

As you probably know, houses cost a lot of money. You may save for a long time in order to buy a house and still need to get a loan from a bank! The focus of this lesson is on calculating what you can afford to pay for a house, as well as some of the initial costs that you must pay when buying a house.

This lesson introduces you to some of the language used when discussing home ownership. If some of the words are new to you, write them down in your notes or on your resource sheet so that you can refer back to them later.

Affordability

In Grade 11 Essential Mathematics, you learned how to create a personal budget. Budgets are an important part of personal finance because they help you plan how much money you can spend, or indicate if you are spending too much on certain things. Calculating the amount of money you can afford to spend on a house is important when you want to buy a house. In this lesson, you will explore some formulas that are designed to help you decide how much you should spend when you decide to buy a house. As well, there are calculations that show the actual costs associated with buying a house.

Gross Debt Service Ratio

The **Gross Debt Service Ratio** is an important formula for calculating whether you can afford a house, or how much you can afford to pay for a house. It compares the total cost of your monthly mortgage payment, taxes, and heating to your gross monthly income (from all sources). A **mortgage** is a loan from a financial institution to pay for your house—we will cover mortgages in depth in the next lesson.

$$\text{Gross Debt Service Ratio (GDSR)} = \frac{\text{Monthly Mortgage Payment} + \text{Property Taxes} + \text{Heating}}{\text{Gross Monthly Income}}$$

Include this formula on your resource sheet.

The general rule is that your Gross Debt Service Ratio should not exceed 32%, but you should note that the Gross Debt Service Ratio is calculated using your gross income. Remember that gross income is the amount of money you earn *before* deductions. Your net income is the actual amount that you receive, *after* deductions. Because of this, the closer the Gross Debt Service Ratio is to 32%, the more difficult it is to budget for other expenses.

There are two ways to use the Gross Debt Service Ratio:

Number 1: Can I afford a certain house?

You can use the Gross Debt Service Ratio to calculate whether you can afford to own a house. This is done by calculating what your Gross Debt Service Ratio would be if you owned the house. If the calculated Gross Debt Service Ratio is less than 32%, then you can afford the house, but if it is greater than 32%, you should not buy the house because it will be extremely difficult to stretch your budget to cover all your expenses.

Example 1

The Menzies family is considering buying a two-storey house with a purchase price of $210,000. The family can make a down payment of $25,000. The family's gross monthly income is $4,236. The monthly mortgage payment is $925.00. The annual property taxes are $2,500 and the annual heating costs are $1,500.

a) Calculate the Gross Debt Service Ratio.

b) Can the family afford this house?

Solution

Since you are given the monthly mortgage payment, disregard the purchase price of the home and the down payment.

a) Monthly property taxes = \$2,500.00 ÷ 12 = \$208.33

Monthly heating costs = \$1,500 ÷ 12 = \$125

$$\text{Gross Debt Service Ratio (GDSR)} = \frac{\text{Monthly Mortgage Payment + Property Taxes + Heating}}{\text{Gross Monthly Income}}$$

$$= \frac{\$925.00 + \$208.33 + \$125.00}{\$4236.00} \times 100$$

$$= \frac{\$1258.33}{\$4236.00} \times 100$$

$$= 29.7\% \text{ (round to the nearest tenth)}$$

b) Since the Gross Debt Service Ratio is under 32%, the Menzies family can afford this house. However, because the Gross Debt Service Ratio is close to 32%, the family may want to reconsider buying this house, or they may prefer to reduce their monthly mortgage payment by making a larger down payment.

A **down payment** is the initial amount you pay for a house. It is a percentage of the purchase price of the home, usually around 20%. We will introduce down payments in our mortgage calculations in the next lesson.

Number 2: Determining how much money you have to spend on a home

You can use the Gross Debt Service Ratio to determine the maximum amount you can spend on housing (the affordability). In order to do this, you need to know the interest rate factor, which can be found in the table below.

Note: This chart will be made available to you for your midterm examination.

Chart 1.1
Interest Rate Factor Table
Based on 25-Year Amortization

Interest Rate	Payment Factor For Each Dollar of Loan
2.5%	0.00448
3.0%	0.00473
3.5%	0.00499
4.0%	0.00526
4.5%	0.00553
5.0%	0.00582
5.5%	0.00610
6.0%	0.00640
6.5%	0.00670
7.0%	0.00700
7.5%	0.00732
8.0%	0.00763

Note that this table is based on a 25-year amortization rate (the amount of time it will take to pay off the mortgage). If you took out a mortgage for a different time period, the factor would be different. In this course, we will only consider a 25-year amortization rate when using interest rate factors.

Example 2

A newly married couple wishes to purchase a condominium. The couple has a gross monthly income of $3,750, and is able to make a $15,000 down payment towards the purchase of a condo. The monthly mortgage the financial institution offers them is with an interest rate of 4.5%. They estimate the monthly property taxes to be about $165 and the heating costs to be about $70 per month. They anticipate that the condo fees will be $300. Calculate the maximum they can afford to pay for a condominium.

Solution

To solve this problem (and other problems like this one), you should set up the following calculation.

Maximum Affordable Home Price		
Gross monthly household income		$ 3,750.00
Multiply: (GDSR)	32%	
Total affordable household expenses		$ 1,200.00
Subtract:		
Monthly property taxes	$ 165.00	
Monthly heating costs	$ 70.00	
One-half of condo/strata fees (if applicable)	$ 150.00	
Monthly affordable mortgage payment		$ 815.00
Divide: Interest factor (from Chart 1.1)	0.00553	
Amount of affordable mortgage		$ 147,377.94
Add: Cash down payment	$ 15,000.00	
Maximum affordable home price		$ 162,377.94

The steps to complete this calculation are:

Step 1: Enter the amount of the gross monthly household income. *($3750.00)*

Step 2: Multiply the gross monthly household income by the Gross Debt Service Ratio to find the total affordable household expenses. **We always assume the Gross Debt Service Ratio is the maximum of 32%.** *(3750.00 × 0.32 = $1200.00)*

Step 3: Enter the values of the monthly property taxes, heating costs, and half of the condo/strata fees (if applicable). *($165.00, $70.00, $150.00)*

Step 4: Subtract the values of the monthly property taxes, heating costs, and half of the condo/strata fees (if applicable) from the total affordable household expenses. The money that is left can be used for a monthly mortgage payment. *(1200 − (165 + 70 + 150) = $815.00)*

Step 5: Enter the interest rate factor value for each dollar of loan at 4.5% by referring to Chart 1.1. *(0.00553)*

Step 6: Divide the value of the monthly affordable mortgage payment by the interest rate factor table value to find the amount for an affordable mortgage when monthly payments are made for 25 years. *(815 ÷ 0.00553 = $147,377.94)*

Step 7: Enter the amount of the down payment. *($15,000.00)*

Step 8: Add the amount of the down payment to the amount of the affordable mortgage to find the maximum affordable home price. *($147,377.94 + $15,000.00 = $162,377.94)*

The maximum amount that the couple can afford for a condo is $162,378.00. They are probably better off spending less than this because they may have other expenses at this time (e.g., furniture, vehicle, etc.), as well as savings. Remember that the Gross Debt Service Ratio is based on the *gross* income, so there are deductions and the couple will not receive the full amount of $3750 per month.

You can also use a spreadsheet program such as Microsoft Excel to perform the calculation. Financial institutions access spreadsheet programs in order to determine the maximum affordable home price for their clients. If you prefer to use a spreadsheet program to solve the problems in the following learning activity and in Assignment 1.1, please do so. The Interest Rate Factor Table will be available during the midterm examination. Just remember that you will not have access to a computer during your examination, so it is important that you know the steps involved for calculating the maximum affordable housing cost. Write these steps (in full or in point form) on your resource sheet.

Example 3 (Using a spreadsheet—Microsoft Excel)

Refer to Example 2 for the question.

Solution

Follow along on your computer if you have Microsoft Excel. If you are using a different spreadsheet program, the ideas should be similar but you are responsible for determining the exact steps. As you work through these steps, you may want to make an information sheet outlining how to use the program. Appendix A includes useful commands for making spreadsheets in Excel.

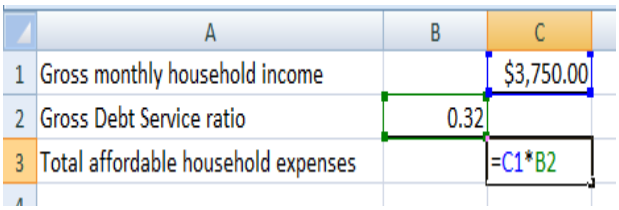
Note: If you have access to a computer, you should use a spreadsheet program such as Microsoft Excel to complete this module, including the assignments. However, you will not be given access to a spreadsheet program when you write the midterm and final examinations. You may, for example, use a spreadsheet to complete the Maximum Affordable Home Price table above, but you should also know how to complete it without using a spreadsheet.

Before starting to perform calculations, you must enter all the categories from the table in Example 2. Once you have entered the categories into your spreadsheet, you must enter the gross monthly income (3750.00) and the Gross Debt Service Ratio (0.32).

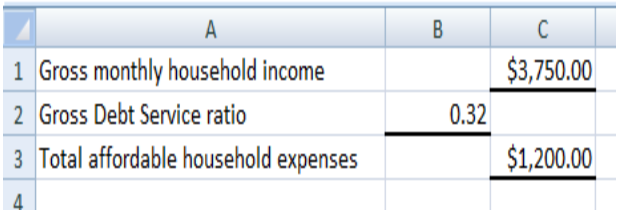
	A	B	C
1	Gross monthly household income		$3,750.00
2	Gross Debt Service ratio	0.32	
3	Total affordable household expenses		
4			
5	Monthly property taxes		
6	Monthly heating costs		
7	½ of condo/strata fees (if applicable)		
8			
9	Monthly affordable mortgage payment		
10			
11	Interest factor (from Chart 1.1)		
12			
13	Amount of affordable mortgage		
14			
15	Down payment		
16			
17	Maximum affordable home price		

In order to calculate the total affordable household expenses, you can enter a formula into cell C3. In this sample spreadsheet, our formula is **=C1*B2** because cell C1 is the value of the gross monthly household income and cell B2 is the Gross Debt Service Ratio value.

Note: In order for the calculations to work, you must include only the number. **Do not type in the dollar sign.** In order to format the cell to have a dollar sign, right-click on the cell, select **Format Cells**, and then under the **Number** tab select **Currency** from the list of options.



	A	B	C
1	Gross monthly household income		$3,750.00
2	Gross Debt Service ratio	0.32	
3	Total affordable household expenses		=C1*B2

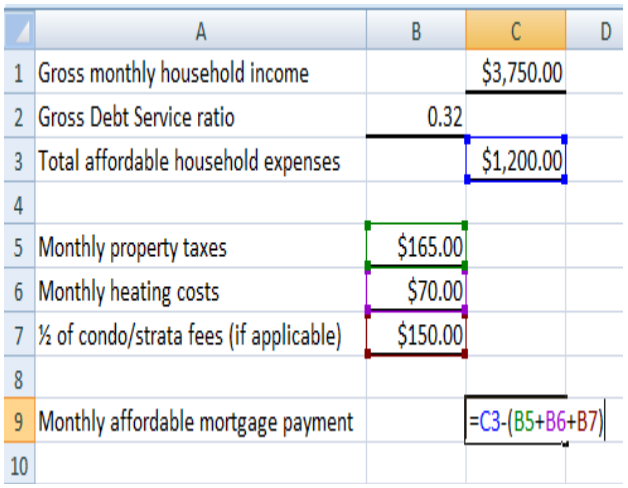


	A	B	C
1	Gross monthly household income		$3,750.00
2	Gross Debt Service ratio	0.32	
3	Total affordable household expenses		$1,200.00
4			

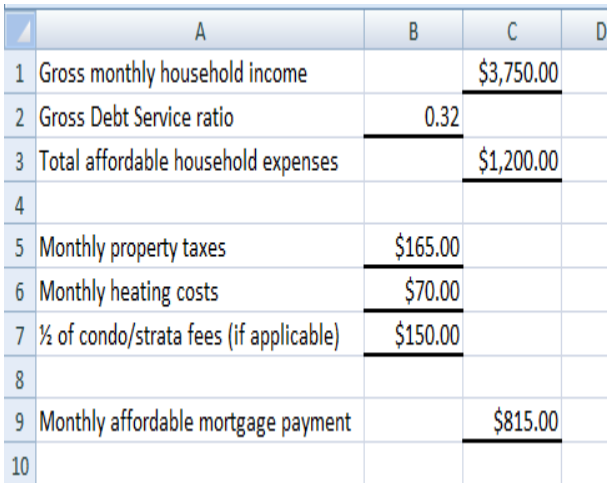
Once you have entered the formula, press Enter, and the value will appear for the **Total affordable household expenses** ($1,200.00). If you change the value for the **Gross monthly household income**, the **Total affordable household expenses** will change as well.

Next you must enter the monthly expenses (taxes = 165.00, heating = 70.00, condo fees = 150.00).

After you have done this, enter the formula to calculate the monthly affordable mortgage payment. In the cell beside **Monthly affordable mortgage payment** (cell C9), you must enter the formula **=C3-(B5+B6+B7)**. This formula subtracts the monthly costs (taxes, heating, and condo fees) from the **Total affordable household expenses**.



	A	B	C	D
1	Gross monthly household income		$3,750.00	
2	Gross Debt Service ratio	0.32		
3	Total affordable household expenses		$1,200.00	
4				
5	Monthly property taxes	$165.00		
6	Monthly heating costs	$70.00		
7	½ of condo/strata fees (if applicable)	$150.00		
8				
9	Monthly affordable mortgage payment		=C3-(B5+B6+B7)	
10				



	A	B	C	D
1	Gross monthly household income		$3,750.00	
2	Gross Debt Service ratio	0.32		
3	Total affordable household expenses		$1,200.00	
4				
5	Monthly property taxes	$165.00		
6	Monthly heating costs	$70.00		
7	½ of condo/strata fees (if applicable)	$150.00		
8				
9	Monthly affordable mortgage payment		$815.00	
10				

Now that you have calculated the **Monthly affordable mortgage payment** ($815.00), enter the **Interest rate factor** (0.00553), which gives the monthly payment amount for each $1 of loan over 25 years. If you enter the **Interest rate factor**, then click on another cell, the number may lose a decimal place or two. If this happens, right-click on the cell, select **Format Cells**, and under the **Number** tab select **Number** from the menu. Make sure that it allows for 5 decimal places.

Using the **Monthly affordable mortgage payment** (cell C9) and the **Interest rate factor** (cell B11), you can calculate the **Amount of affordable mortgage** (cell C13) using the formula **=C9/B11**.

	A	B	C
1	Gross monthly household income		$3,750.00
2	Gross Debt Service ratio	0.32	
3	Total affordable household expenses		$1,200.00
4			
5	Monthly property taxes	$165.00	
6	Monthly heating costs	$70.00	
7	½ of condo/strata fees (if applicable)	$150.00	
8			
9	Monthly affordable mortgage payment		$815.00
10			

	A	B	C
1	Gross monthly household income		$3,750.00
2	Gross Debt Service ratio	0.32	
3	Total affordable household expenses		$1,200.00
4			
5	Monthly property taxes	$165.00	
6	Monthly heating costs	$70.00	
7	½ of condo/strata fees (if applicable)	$150.00	
8			
9	Monthly affordable mortgage payment		$815.00
10			

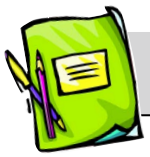
Finally, enter the value for the **Down payment** (15000.00), then calculate the **Maximum affordable home price**. Can you think of the formula to calculate this? Because the **Maximum affordable home price** is the sum of the **Amount of affordable mortgage** (cell C13) and the **Down payment** (cell B15), the formula will be **=C13+B15**.

1	Gross monthly household income		$3,750.00
2	Gross Debt Service ratio	0.32	
3	Total affordable household expenses		$1,200.00
4			
5	Monthly property taxes	$165.00	
6	Monthly heating costs	$70.00	
7	½ of condo/strata fees (if applicable)	$150.00	
8			
9	Monthly affordable mortgage payment		$815.00
10			
11	Interest factor (from Chart 1.1)	0.00553	
12			
13	Amount of affordable mortgage		$147,377.94
14			
15	Down payment	$15,000.00	
16			
17	Maximum affordable home price		=C13+B15

1	Gross monthly household income		$3,750.00
2	Gross Debt Service ratio	0.32	
3	Total affordable household expenses		$1,200.00
4			
5	Monthly property taxes	$165.00	
6	Monthly heating costs	$70.00	
7	½ of condo/strata fees (if applicable)	$150.00	
8			
9	Monthly affordable mortgage payment		$815.00
10			
11	Interest factor (from Chart 1.1)	0.00553	
12			
13	Amount of affordable mortgage		$147,377.94
14			
15	Down payment	$15,000.00	
16			
17	Maximum affordable home price		$162,377.94

Using the spreadsheet, you got an answer of $162,377.94—the same as when you calculated the **Maximum affordable home price** using the table. What is convenient about this spreadsheet is that now all you have to do is make small changes (e.g., gross monthly household income, monthly property taxes, monthly heating costs, condo fees, interest factor, and the down payment), and the spreadsheet will make all of the calculations.

Now that you have seen how to perform affordability calculations and how to use a spreadsheet, complete the following learning activity to make sure that you understand the first part of this lesson (focusing on the Gross Debt Service Ratio). You can also use this learning activity to create a spreadsheet for solving problems involving maximum affordability. Regardless of how you solve each question, be sure to check your answers so that you are confident that you can complete these calculations successfully.



Learning Activity 1.2

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Evaluate for $z = -1$: $3z - (-7)$
2. How much tax would you have to pay on an item that costs $49.99 (approximately) if the PST = 7% and the GST = 5%?
3. Since 10% of 440 is 44, what is 35% of 440?
4. Evaluate: $\left(\frac{8}{16}\right) \times 12$
5. You have to buy a new toaster for your house. The toaster you want to buy costs $54.45, including tax. If you give the cashier $60, how much change should you get back?

continued

Part B: Calculations Using the Gross Debt Service Ratio

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand. Don't forget that you can ask your learning partner or tutor/marker for help if you are having a hard time understanding.

1. State the Gross Debt Service Ratio. How does it relate to home affordability?
2. Calculate the Gross Debt Service Ratio for the following situations. For each situation, state the likelihood of a financial institution granting a mortgage for the house.
   a) Monthly mortgage payment is $710, monthly property taxes are $118, monthly heating costs equal $96, and the gross monthly income is $3000.
   b) Monthly mortgage payment is $716, annual property taxes are $2500, the monthly heating costs are $116, and the gross monthly income is $2340.
   c) Monthly mortgage payment is $1000, annual property taxes are $2300, monthly heating costs average $105, and the gross annual income is $68,000.
3. The Cadloff family are planning to purchase a home. The family has a gross monthly income of $4400. They are able to make a down payment of $20,000 toward the purchase of their home. The bank offers the family an interest rate of 4%. They estimate their monthly property taxes to be around $230 and their heating costs to be about $120 per month. Calculate the maximum price the Cadloffs can pay for a home. (Use the chart below or create your own spreadsheet.)

Maximum Affordable Home Price		
Gross monthly household income		$ _____
Multiply: (GDSR)	_____	
Total affordable household expenses		$ _____
Subtract:		
Monthly property taxes	$ _____	
Monthly heating costs	$ _____	
One-half of condo/strata fees (if applicable)	$ _____	
		$ _____
Monthly affordable mortgage payment	_____	
Divide: Interest factor (from Chart 1.1)		$ _____
Amount of affordable mortgage	$ _____	
Add: Cash down payment		$ _____
Maximum affordable home price		

continued

Learning Activity 1.2 (continued)

4. Alex Gardner wants to purchase a condominium. Alex has a gross annual income of $42,600. He has saved $10,000 for a down payment. His financial institution offered him an 3.5% interest rate on a mortgage. Alex estimates his monthly property taxes will be $110 and his monthly heating costs will be $40. Condo fees are $275 per month. Calculate the maximum price Alex can pay for his condominium. (Use either the chart below or your own spreadsheet.)

Maximum Affordable Home Price		
Gross monthly household income		$ _____
Multiply: (GDSR)	_____	
Total affordable household expenses		$ _____
Subtract:		
Monthly property taxes	$ _____	
Monthly heating costs	$ _____	
One-half of condo/strata fees (if applicable)	$ _____	
		$ _____
Monthly affordable mortgage payment	_____	
Divide: Interest factor (from Chart 1.1)		$ _____
Amount of affordable mortgage	$ _____	
Add: Cash down payment		$ _____
Maximum affordable home price		

Additional Costs

If you have never bought a house, you might assume that it works the same way as if you were buying a chocolate bar at the grocery store (i.e., you would only expect to be charged PST and GST in addition to the cost of the chocolate bar itself). Unfortunately, buying a house is not that easy, and there are a lot of additional costs. What sounds like a low price at the beginning can grow to a much larger price with all of the additional costs.

If you are inexperienced in buying a home, read through this section with your learning partner. If you cannot read through this section with your learning partner, be sure to note any terms or statements that you do not understand so that you can ask your tutor/marker. If there are any terms that are particularly difficult for you, include them on your resource sheet.

Initial Costs

- **Inspection fee**—Before you make a decision to purchase a home, it is highly recommended you have it inspected by a professional building inspector.
- **Appraisal fee**—When borrowing money, the lender must determine the value of the property. A certified appraiser will be appointed by the lending agency (bank) to appraise the property to determine its value.
- **Mortgage application fee**—Your financial institution may charge a fee for processing your mortgage application.

Lawyers' Disbursements and Fees

When you purchase a home, you need to retain a lawyer or notary to act on your behalf. As a convenience to you, your lawyer will pay many of your purchase costs. These costs are known as **disbursements**. Your lawyer will include the costs of these disbursements with the legal fees.

Two of the largest disbursements are the land transfer tax and the survey certificate. There are additional legal costs and lawyers' fees, as well.

- **Land transfer tax**—You pay this tax to the Manitoba Land Titles Office at the time the title of your home is registered. The land transfer tax is a percentage of the purchase price as outlined below. Remember to add these dollar amounts and percentages to your resource sheet.

$0 – $30,000	nil
$30,000 – $90,000	0.5%
$90,000 – $150,000	1.0%
$150,000 – $200,000	1.5%
over $200,000	2.0%

- **Survey certificate**—You may be able to obtain this document from the seller. If you require a new survey certificate, a surveyor will charge you approximately $300 for a city or municipal property survey.

  Property survey—This will supply information on how buildings, fences, and other structures are situated on the property. If a recent survey is available to you, a property survey may not be necessary. If there are any easements or encroachments on your property, it is a good idea to know about this before making the purchase. An **easement** is the right of way by a town, city, or utility company to access your land for a specific purpose, such as repairing telephone or television cables. An **encroachment** is an intrusion on your land by a neighbour's structure, or possibly an intrusion on your neighbour's land by a structure on your property. In either case, you would want to know this prior to purchasing the property.

- **Additional legal costs**—These include disbursements such as registration costs, zoning memorandum, tax certificate, title searches, administration costs, and GST.
- **Lawyers' fees**—Real-estate lawyers will charge about $300 to $400 for the legal work involved in the purchase of your home.

Adjustments

Adjustments are not the actual costs related to the purchase of a home, they are adjustments that must be made based on the date you take possession of your new home. The **possession date**, or **closing date**, is the day the ownership of the house is officially transferred from the seller to the buyer. All the costs of home ownership before the possession date are the responsibility of the seller, and all the costs after the closing date are the responsibility of the buyer. Some of the adjustments are handled by your lawyer's office.

- **Interest adjustment**—If you require a mortgage, the processing time required by the land titles office means that your mortgage money is not released until after you take possession of your new home. During this time, you must pay interest to the seller. As a rule, you pay one month's interest to your lawyer at the time you take possession of your home. Your lawyer distributes the appropriate amount of interest to the seller, and the remaining amount either to your financial institution or back to you (as applicable).
- **Property tax adjustment**—Homeowners are required to pay property tax to the city or municipality each year. Property tax is calculated based on the calendar year (January to December), but is paid on a given due date during the year. For example, the due date in Winnipeg is June 30, the due date for Dauphin is July 31, and the due date for Brandon is September 30. In all cases, the amount paid covers January to December of that year. The City of Winnipeg has a monthly Tax Installment Payment Plan (TIPP) that allows homeowners to pay their annual tax bill in monthly installments.

  Depending on when you purchase property, you may have to reimburse the seller for property tax paid, or the seller may credit you for tax paid. If you purchase property after the due date, and the annual taxes have been paid by the seller, you will need to reimburse the seller for your share (the months during that calendar year you owned the home). If you purchase a property before the due date for annual property taxes is to be paid, the seller will have to credit you for their share of the year's taxes (the months they owned the house).

For the purposes of this course, the property tax adjustments will be made in terms of months. In reality, the property tax adjustments are made in terms of days.

- **Insurance adjustment**—You also make a property insurance payment during the calendar year. Property insurance covers you in case of loss or damage to your property due to fire, flooding, or theft. Property insurance is valid for one year from the date of renewal. If you use the same insurance company, and if the cost of insurance for your new home is not the same as the insurance of your previous home, your insurance company will make an adjustment for the time period between your possession date and the insurance renewal date. This adjustment must be paid to the insurance company by the buyer.

Other Additional Costs

- **Moving expenses**—There will be moving expenses that you will have to pay, even if it is only the price of gasoline as you move yourself.
- **Service charges**—Hookup fees may be charged for utilities, such as phone, Internet, water, and gas, and will be reflected in your first bill.
- **Immediate repairs**—Some of these may be necessary prior to your moving in. You may want to negotiate the cost of these repairs with the seller.
- **Appliances and furniture**—Sometimes the appliances are included in the purchase of the house, and sometimes you must buy appliances before you can move into your new home.
- **Decorating costs**—Sometimes a new owner may want to repaint the house or install new flooring before moving in. It is usually easier to do this before moving all your belongings into the house.

Knowing that these costs exist is the first step in being prepared for them when you are buying a house. The following examples demonstrate the calculations associated with these additional costs. You may want to make a note of the following types of problems, along with their solutions, on your resource sheet.

Example 1: Land Transfer Tax Problem

Calculate the land transfer tax on a home with a purchase price of $125,000.

Solution

To do this calculation, you need to find the percentages by referring back to the section that describes the land transfer tax. You should have written these dollar amounts and percentages on your resource sheet. Like the income tax deduction calculations you may have done in Grade 10 Essential Mathematics, different percentages for land transfer tax apply to different parts of the purchase price. This means that you have to find the amounts in each part of the purchase price, and then multiply the amount by the percentage given.

Amount under $30,000 = $30,000

Tax on this amount = $0

Amount between $30,000 and $90,000 = 90,000 − 30,000 = $60,000

Tax on this amount = 0.5% × 60,000 = $300

Amount between $90,000 and $125,000 = 125 000 − 90,000 = $35,000

Tax on this amount = 1.0% × 35 000 = $350

Land transfer tax = 0 + 300 + 350 = $650

Example 2: Home Insurance Adjustment

The Leopp family has just purchased a new home in Winnipeg. The possession date of their new home is April 15. The family's home insurance is renewed September 1 of each year. The family has to increase its home insurance from $325 to $450 per year and pay the difference for the extra months. Calculate the family's home insurance adjustment.

Solution

Step 1: Calculate how much money is owed for the yearly home insurance.

450 − 325 = $125

Step 2: How many months remain before the Leopp family will renew their home insurance?

April 15 to May 1 = 0.5 months

May 1 to September 1 = 4 months

Total = 4.5 months

Step 3: What portion of the yearly (12 months) home insurance is owed for the months (4.5 months) between when the Leopp family takes possession of the house and when they renew their insurance?

$$\frac{4.5}{12} \times 125 = \$46.88$$

Example 3: Property Tax Adjustment Problem

Lannis Jones has just purchased a new home. The possession date is September 1. Annual property taxes are $1878, and they are due on June 30. Calculate Lannis's property tax adjustment.

Solution

Step 1: Decide who owes money and who needs to be paid. Since the previous owner has already paid the property taxes for the year, Lannis has to pay the seller for the months she will own the home.

Step 2: How many months worth of tax are owed? Since Lannis takes possession of the house in September, she owes the seller property taxes for four months (September, October, November, and December).

Step 3: Calculate how much is money is owed.

Lannis owes the seller $\frac{4}{12} \times \$1878 = \$626$

The fraction $\frac{4}{12}$ comes from the 4 months that Lannis owns the house, divided by the number of months in a year. Another way to do this calculation could be

Monthly taxes: $\frac{1878}{12} = \$156.50$

Total cost: $4 \times 156.50 = \$626.00$

Note: If Lannis had taken possession of the home before June 30, the owner would have owed her money for the months *before* Lannis took possession. This amount would be credited to the purchaser of the home, so it would be *subtracted* from the total closing costs. **Total closing cost** includes the total of all additional costs that the purchaser must pay when buying the house.

Example 4: Total Closing Cost Problem

Claire Bland and Jim Gerrard are a married couple who have just purchased a house in Winnipeg. The purchase price of their new home is $114,500. Before finalizing their offer on the house, Claire and Jim have a professional building inspector inspect the house. The inspector assures the couple that the house is structurally sound. The inspection costs them $275. The couple obtains a fixed mortgage from their financial institution. They are charged $60 for a mortgage application fee and $45 for an appraisal fee.

The couple retains a lawyer to act for them in the purchase of their house. The cost of the land transfer tax is $545 (0% × 30,000 + 0.5% × 60,000 × 1.0% + 24,500). They need a property survey of their new property. The cost of this survey is $300. Their lawyer's fee is $300. Other legal disbursements are $172.

Claire and Jim's possession date for the home is August 15. The amount of interest owing to the seller on their first monthly payment is $472. Property taxes for the year are $2640. The due date for property taxes in Winnipeg is June 30. Their home insurance is renewed November 15 each year. They have to increase their home insurance from $390 to $480 per year.

The cost to hook up the phone is $65. The cost to activate the natural gas is $45. Claire and Jim hire movers to move their possessions to their new home. The mover charges them $600. Before they move in, the couple wants to install new carpeting. The cost of the new carpeting is $2085. The couple purchases a new refrigerator at $960 and a new oven at $725. They also are having interior walls painted for $514.25.

Calculate the couple's total closing costs and extras to purchase their new home.

Solution

Total Closing Costs		
Initial Fees		
Inspection Fee	$ 275.00	
Mortgage Application Fee	$ 60.00	
Appraisal Fee	$ 45.00	
Total Initial Fees		$ 380.00
Lawyer's Disbursement and Fees		
Land Transfer Tax	$ 545.00	
Property Survey	$ 300.00	
Other Legal Disbursements	$ 172.00	
Legal Fees	$ 300.00	
Total Lawyer's Disbursement and Fees		$ 1,317.00
Adjustments		
Interest Adjustment	$ 472.00	
Property Tax Adjustment ($2,640 × 4.5/12)	$ 990.00	
Home Insurance Adjustment ($480 − $390) × 3/12)	$ 22.50	
Total Adjustments		$ 1,484.50
Other Additional Costs		
Service Charges ($65 + $45)	$ 110.00	
Moving Expenses	$ 600.00	
Immediate Repairs	$ 2,085.00	
Appliances ($960 + $725)	$ 1,685.00	
Decorating Costs	$ 514.25	
Total Other Additional Costs		$ 4,994.25
Total Closing Costs and Extras		$ 8,175.75

Example 5: Closing Cost Percentage Problem

Determine the percent of Claire and Jim's total closing costs and extras compared to the purchase price of the home from the previous example.

Solution

Percent is a comparison of a quantity to 100. You can find the rate of percent by setting up a proportion between two ratios as follows. The ratio on the left is always the percent expressed as a comparison to 100. The ratio on the right consists of the total costs compared to the cost of the home.

Method 1

Let x represent the unknown rate in the following proportion.

$$\frac{x}{100} = \frac{8{,}175.75}{114{,}500}$$

$$114{,}500x = (100)(8{,}175.75) \qquad \text{(cross-multiply)}$$

$$114{,}500x = 817{,}575$$

$$\frac{114{,}500x}{114{,}500} = \frac{817{,}575}{114{,}500} \qquad \text{(divide both sides by 114,500)}$$

$$x = 7.1 \qquad \text{(rounded to the nearest tenth)}$$

The rate of percent = 7.1%

Method 2

There are other ways of finding the rate of percent. The following method indicates that you can find the rate of percent by dividing 8,175.75 by 114,500 and then multiplying by 100.

$$\text{Rate of percent} = \frac{8{,}175.75}{114{,}500} \times 100 = 7.1\%$$

Use the method you prefer to find the rate of percent.

Because of all the detail, these examples may seem scary while you're reading them, so it is important that you try to do them yourself in the following learning activity. Don't forget to check your answers after you have completed the learning activity to be absolutely sure that you understand how to complete these problems. Similar problems will appear on the midterm examination.

Learning Activity 1.3

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Evaluate: $\left(\frac{3}{7}\right) \times \left(\frac{14}{6}\right)$

2. You are furnishing your new apartment with a budget of $2800. You have already bought a couch for $925, table and chairs for $750, and a stove for $1075. How much money do you have left in your budget to buy a refrigerator? Is this reasonable?

3. Write two equivalent fractions for $\frac{17}{34}$.

4. Josiah and his family go out for dinner and their restaurant bill is $126. If they want to leave a 15% tip, how much should they leave?

5. You are approved for a $219,000 mortgage from your bank. If you have saved up an additional $16,000 for a down payment, how much can you afford to spend on a house?

Part B: Additional Cost Calculations

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Calculate the land transfer tax on a home with a purchase price of $185,000.

continued

Learning Activity 1.3 (continued)

2. Ken Baron has just purchased a new home. The possession date of his new home is November 1. Annual property taxes on his new home are $1670. The due date for property taxes is June 30. Ken's home insurance is renewed April 1 of each year. He has to increase his home insurance from $285 to $326 per year and pay the difference for the extra months.
   a) Calculate Ken's property tax adjustment (i.e., the amount he must repay the seller).
   b) Calculate Ken's home insurance adjustment.

3. The Desrochers family has just purchased a new home in Winnipeg. The possession date of their new home is April 15.

   Annual property taxes on their new home are $2495. The due date for property taxes in Winnipeg is June 30. The family's home insurance is renewed October 1 of each year. The family has to increase its home insurance from $352 to $448 per year and pay the difference for the extra months.
   a) Calculate the family's property tax adjustment (i.e., the amount the seller owes them).
   b) Calculate the family's home insurance adjustment.

4. The Wiebe family purchases a three-bedroom bungalow for $188,500. Before finalizing their offer on the bungalow, the Wiebes have a professional building inspector inspect the house. The inspector assures the Wiebes that the house is structurally sound. The inspection costs $275. The Wiebes need to take out a mortgage at a financial institution. They are charged a mortgage application fee of $65 and an appraisal fee of $40.

   The Wiebes retain a lawyer to act for them in the purchase of their home. They do not need a property survey done of their new property. Other legal disbursements cost $124.86. Their lawyer's fee is $350.

   The Wiebes' possession date is October 1. The amount of interest owing to the seller is $322.85. Property taxes for the year are $1583. The due date for property taxes is June 30. Their home insurance is renewed May 1 of each year. The family has to increase their home insurance from $336 to $382 per year and pay the difference for the extra months.

continued

The cost to hook up the phone is $60. The cost to activate the natural gas is $45. The Wiebes hire movers to move their furniture and appliances to their new home. The movers charge $380. Before they move in, the family purchases a new dishwasher for $490.50. They have the hardwood floors refinished at a cost of $1700. They paint the bedrooms themselves. The cost of the paint and brushes is $138.70.

Use the form provided at the end of this lesson or create your own spreadsheet to calculate the Wiebe family's total closing costs and extras to purchase their new home.

5. Refer to Question 4. Determine the Wiebe family's total closing costs and extras as a percentage of the total purchase price of their new home.

6. Lauren Johansson has received a promotion from her company and is relocating in Winnipeg. She has just purchased a bungalow for $282,500. Before finalizing her offer, she has a professional building inspector inspect the house. The inspection fee costs her $300. The mortgage application fee costs $75. An appraisal fee costs $40.

   She retains a lawyer to act for her in the purchase of her home. Her lawyer's fee is $300. She needs a property survey of her new property. The cost of this survey is $325. Other legal disbursements cost her $105.20.

   The possession date of Lauren's new home is March 1. The amount of interest owing to the seller is $242.75. Property taxes for the year are $1680. The due date for property taxes in Winnipeg is June 30. (Because Lauren will be paying the taxes for the whole year, the seller must pay her for the taxes for January and February. This will be shown as a credit on the chart.) Home insurance for the year will cost her $314.

   The cost to hook up the phone is $55. The cost to activate the natural gas is $45. Lauren hires a moving company to move her possessions to her new home. Her employer pays the cost of the moving company. Before she moves in, Lauren purchases a new washing machine and dryer at a cost of $499.99 and $349.99, respectively. She has the kitchen cabinets, counters, and flooring replaced at a cost of $14,150. She also has an alarm system installed at a cost of $600. She has her new house painted at a cost of $1590.

   Use the form provided at the end of this lesson to calculate Lauren's total closing costs and extras to purchase her new home.

7. Refer to Question 6. Determine Lauren's total closing costs and extras as a percentage of the total purchase price of her new home.

Lesson Summary

In this lesson, you explored the first steps of buying a house, and the calculations that accompany these steps. You learned that Gross Debt Service Ratio formula can be used to determine the affordability of a house, and that there are many additional costs that you have to consider when you buy a house. This material is included in the assignment at the end of Lesson 2, so be sure that you understand these concepts before moving on.

The next lesson looks at mortgage calculations.

Notes

Total Closing Costs		
Initial Fees		
Inspection Fee	$	
Mortgage Application Fee	$	
Appraisal Fee	$	
Total Initial Fees		$
Lawyer's Disbursement and Fees		
Land Transfer Tax	$	
Property Survey	$	
Other Legal Disbursements	$	
Legal Fees	$	
Total Lawyer's Disbursement and Fees		$
Adjustments		
Interest Adjustment	$	
Property Tax Adjustment	$	
Home Insurance Adjustment	$	
Total Adjustments		$
Other Additional Costs		
Service Charges	$	
Moving Expenses	$	
Immediate Repairs	$	
Appliances	$	
Decorating Costs	$	
Total Other Additional Costs		$
Total Closing Costs and Extras		$

Total Closing Costs		
Initial Fees		
Inspection Fee	$	
Mortgage Application Fee	$	
Appraisal Fee	$	
Total Initial Fees		$
Lawyer's Disbursement and Fees		
Land Transfer Tax	$	
Property Survey	$	
Other Legal Disbursements	$	
Legal Fees	$	
Total Lawyer's Disbursement and Fees		$
Adjustments		
Interest Adjustment	$	
Property Tax Adjustment	$	
Home Insurance Adjustment	$	
Total Adjustments		$
Other Additional Costs		
Service Charges	$	
Moving Expenses	$	
Immediate Repairs	$	
Appliances	$	
Decorating Costs	$	
Total Other Additional Costs		$
Total Closing Costs and Extras		$

Lesson 2: Mortgages

Lesson Focus

In this lesson, you will

- ❑ learn the terminology related to mortgages
- ❑ calculate mortgage payment amounts, and the amount of interest paid when buying a house

Lesson Introduction

Buying a home is the largest purchase most consumers make in their lifetime. Because it is such a large purchase, most consumers cannot afford to pay for a home outright. They pay a portion of the purchase price for the home and obtain a loan for the balance from a financial institution. The portion of the purchase price the consumer pays is called the down payment, while the loan obtained from the financial institution is called the mortgage.

What is a Mortgage?

Mortgage Basics

The following terms are used in the description of mortgages and in the assignment questions that follow. If you need further clarification, ask your learning partner or tutor/marker. You may also include these terms on your Module 1 Resource Sheet.

- **Principal**—the amount of money you borrow from the financial institution (usually the difference between the selling price and the down payment)
- **Interest**—the amount the financial institution charges you for borrowing money
- **Mortgage payment**—the amount you pay regularly, which includes principal and interest, to the financial institution where you have your mortgage
- **Amortization period**—the number of years you have to repay the entire mortgage (usually between 15 and 30 years)
- **Term**—the length of time covered by a specific mortgage agreement, usually between 6 months and 5 years

- **Equity**—the value of the property you actually own calculated as the difference between the market value of the property and the outstanding amount owed on the mortgage(s) related to the property

You may have noticed that **amortization period** and **term** both relate to time. It is important to understand that these are not the same. The *term* designates the amount of time that the conditions of the mortgage are in effect (for example, the interest rate and payment size). This means that if you have not paid off your entire mortgage by the end of the term, you must renegotiate the conditions of the mortgage for another term. On the other hand, the *amortization period* is the total amount of time you expect to take to repay the mortgage.

Interest rates

Another term that you should take special note of is *interest*. **Interest rates** are a percentage of the loan that the financial institution charges you for lending you money. When choosing a mortgage, you can decide between two interest rate options.

- **Fixed-rate mortgage:** The more secure, or safer, mortgage is the fixed-rate mortgage. As the name implies, the interest rate is locked in for the term of the mortgage. The payments for this type of mortgage are set at the beginning of the term, which allows the buyer to know how much they must pay each period (typically a month). Both open and closed mortgages can have a fixed rate. (You will read about these types of mortgages in the next section of this lesson).

- **Variable-rate mortgage:** The alternative to the fixed-rate mortgage is the variable-rate mortgage. It is less secure because, as you may have guessed, the interest rate for this type of mortgage is flexible, and changes with the market. What you may not have guessed is that the payments are actually fixed for this type of mortgage, just like the fixed-rate mortgage. The difference is that, because the buyer will pay the same amount each month no matter what the interest rate, when the interest rate goes down, more of the payment is applied to the principal; when the interest rate goes up, more of the payment is applied to the interest. Again, this type of mortgage can be open or closed.

Types of Mortgages

In addition to all the options that you have within a mortgage, there are also different types of mortgages. You can make a decision on the type of mortgage you want based on its security or flexibility. You should be familiar with the types of mortgages, so it would be helpful to include descriptions of each on your resource sheet.

Closed Mortgages

This type of mortgage usually has a fixed interest rate and fixed payments for the full term of the mortgage. The interest rates for closed mortgages are usually relatively low, and are available for terms from six months to five years (longer terms may be available). Because of this fixed interest rate, if you want to renegotiate the interest rate, you must pay a **breakage cost** to the financial institution. This fee must also be paid if you decide to pay off the balance of the mortgage before the end of the term.

Typically, the people that should choose a closed mortgage are people who expect the interest rates to increase, and people who do not plan to move in the near future. Also, first-time home buyers often choose this type of mortgage *in the early years* as they are more secure knowing exactly how much their mortgage payments will be over the time of the term.

Open Mortgages

Open mortgages are more flexible than closed mortgages in the sense that they can be repaid in part or in full at any time without having to pay the breakage costs. Generally, the interest rate for this type of mortgage is a little higher than a closed mortgage because of the added flexibility. The terms available are also different, ranging from six months to one year.

People who choose open mortgages are usually people who are planning to move in the immediate future or who believe that interest rates will be going down.

Convertible Mortgages

This third type of mortgage is a compromise between security and flexibility. At first glance, the convertible mortgage is similar to the closed mortgage, but there are some key differences.

- You can pay off your mortgage at any time without having to pay breakage costs.
- You can change your mortgage from a convertible mortgage to a longer closed mortgage at any time without any penalties. This allows you to lock in an interest rate at whatever point you choose.

People choose to have a convertible mortgage for a variety of reasons, ranging from anticipating the ability to pay off the mortgage before the end of the term or expecting interest rates to change. These people would choose a convertible mortgage over an open mortgage as it offers a higher degree of security. Alternately, this type of mortgage offers a higher degree of flexibility than a closed mortgage.

Minimizing Mortgage Costs

Now that you have read about the different types of mortgages, you should also know about several other characteristics of a mortgage. These other characteristics play a role in determining the cost of a mortgage, both monthly and over the *life* of the mortgage.

Interest Rates

We are revisiting the interest rate because interest rates are an important part of mortgages. You may remember from Grade 11 Essential Mathematics that you pay less interest if the interest rate is lower, and more if the interest rate is higher. The table below shows the monthly payments on a $180,000 mortgage, amortized over 25 years. Take note of how the interest rate affects the monthly payment.

Interest Rate	Monthly Payment
3.0%	$851
4.0%	$947
5.0%	$1048

You should have noticed the following:

- A 1% increase in the interest rate increased the monthly payment by about $100 for a $180,000 mortgage.

In general, we can conclude that the higher the interest rate, the higher the monthly payment.

Terms

As you probably discovered while reading about the different types of mortgages, you have a range of choices when deciding the length of your mortgage term, from 6 months to 5 years (or longer)! Usually, financial institutions will provide a lower interest rate for a shorter term, and a higher interest rate for a longer term.

Because you pay more with a higher interest rate, you might be thinking, *"Why would anyone choose to have a longer term for their mortgage? Don't you want the lowest rate?"* These are good questions, but remember that you also want to protect yourself from fluctuations in interest rates. For this reason, deciding on a mortgage term depends on your personal situation, your forecast of interest rates, and the degree of risk you are willing to take. A few reasons for choosing a particular mortgage term are shown below:

- If you plan to sell your house soon without buying another, choosing a short-term mortgage may be your best option.
- If you think that interest rates are low and will not go down, you may lock them in with a long-term mortgage. If interest rates seem high right now, you may choose a shorter term in hopes that the rates will drop by the end of the term.
- If you are a first-time home buyer, you may choose a long-term mortgage because of the security. This would also help you budget and manage monthly expenses.

How To Choose

The following questionnaire is very helpful when deciding which mortgage to choose.

If my/our mortgage payments were to increase by 20% on my/our next renewal, it would be a . . .				
1 (serious problem)	2	3 (concern)	4	5 (no problem)
I/we worry about interest rates . . .				
1 (often)	2	3 (sometimes)	4	5 (never)
I/we expect that interest rates will . . .				
1 (rise a lot)	2	3 (rise a bit)	4	5 (same/ decrease)
I/we normally check interest rates . . .				
1 (seldom)	2	3 (sometimes)	4	5 (frequently)

Source: RBC Royal Bank. *Home Financing: Buying a Home*. Canada, 2002.

Once the questionnaire has been completed, find the sum of the circled numbers to determine your category.

If you scored…

4–8 Consider a fixed-rate mortgage with a longer term (4 to 25 years)
- Protection from increases in interest rates for a longer period
- Security of fixed, regular payments for a longer period of time

9–12 Consider a fixed-rate mortgage with a medium term (1 to 3 years)
- Protection from increases in interest rates over the short term
- Fixed, regular payments for a few years
- Flexibility to take advantage of any future rate declines because you are not locked in for too long

13–16 Consider a 6-month convertible or open mortgage
- Flexibility to take advantage of further rate declines
- Flexibility to fix your rate and regular payments if rates begin to rise

17–20 Consider a variable-rate mortgage
- Flexibility to take advantage of further reductions in rates
- Flexibility to switch to a fixed-rate mortgage if rates start to rise

Amortization Periods

Unlike terms, amortization periods are usually 15, 20, or 25 years (or anywhere in between). New homeowners often choose to amortize their mortgage for 25 years because it keeps the monthly costs as low as possible. In the following table, all calculations are based on a $200,000 mortgage. Compare the total interest costs and the total amounts repaid to the financial institution. What do you observe?

Interest Rate	Monthly Payment	Total Interest Cost	Total Repaid
25-year amortization			
2.00%	$847.71	$54,313	$254,313
3.00%	$948.42	$84,527	$284,527
5.00%	$1169.18	$150,754	$350,754
20-year amortization			
2.00%	$1011.77	$42,824	$242,824
3.00%	$1109.20	$66,208	$266,208
5.00%	$1319.91	$116,778	$316,778
15-year amortization			
2.00%	$1287.02	$31,663	$231,663
3.00%	$1381.16	$48,609	$248,609
5.00%	$1581.59	$84,686	$284,686

Looking in the last column, you can see that you pay a lot more than the $200,000 borrowed over the life of the mortgage. The longer the amortization period, the more you will pay.

Other Options

In addition to the options listed above, there are several other options that you have if you would like to minimize the cost of your mortgage.

1. **Adding an extra payment each year.** Most mortgages provide an option of *pre-paying* a certain amount (usually 10% to 15% of the original loan each year). This is especially important in the early years because it reduces the amount of money you still owe the bank by a large amount. By doing this, you are charged a lot less interest over the life of the mortgage.

   For example, if you are charged 6.5% annual interest on $115,000, you would pay $622.92 in interest the first month. If you can prepay 10% of this amount or $11,500, you are charged the same interest rate on only 90% of the original amount (0.9 × 115,000 = $103,500), you would pay only $560.63 in interest the first month.

2. **Making bi-weekly payments.** Although we only perform calculations involving monthly payments in this course, banks offer the option to make payments every two weeks instead of just monthly. This means that instead of making 12 payments toward your mortgage in one year, you make 26 payments (52 weeks ÷ 2 = 26 bi-weekly periods). Also, by paying more frequently, you reduce the amount of interest that you will be charged.

Mortgage Calculations

For this course, you are only responsible for calculations related to fixed-rate mortgages that are repaid on a monthly basis. Although there are many other types of mortgages (as you have read), calculating this type of mortgage will help you understand how all mortgages are calculated.

Example 1

Conrad Wiebe purchases a home for $220,000. He makes a down payment of $40,000 and takes out a fixed-rate mortgage at 2.5% for the balance of the purchase price. The mortgage is to be amortized over 20 years.

a) Determine Conrad's monthly mortgage payment.

b) Calculate the amount of interest Conrad pays during the 20-year amortization period.

Solution

a) Balance owing = purchase price − down payment
= $220,000 − $40,000
= $180,000

Use the amortization table at the end of this lesson to determine the monthly mortgage payment. Find the amortization period for 20 years and go down the rate column until you locate 2.5%. The monthly payment on a $1000 mortgage is $5.29. Since the loan Conrad requires is for $180,000, the value of $5.29 must be multiplied by 180 (180,000 ÷ 1000 = 180).

Conrad's monthly payment = $5.29 × $180,000 = $952.20

b) Since Conrad is amortizing the mortgage over a 20-year period, and there are 12 months in a year, he makes a total of 20 × 12 = 240 payments. The total mortgage payments over the amortization period

= $952.20 × 240
= $228,528

The total interest Conrad pays during the 20-year amortization period

= $228,528 − $180,000
= $48,528

You can gain a better understanding of mortgage payments and interest costs by examining how each monthly payment affects the mortgage. This can be done with a **schedule of mortgage payments chart**. This chart divides each mortgage payment into the amount that goes to pay interest and the amount that goes to pay down the principal.

Example 2

Complete a schedule of mortgage payments chart for the first six months of Conrad Wiebe's mortgage.

Payment #	Payment	Interest	Principal	Unpaid Balance	Owner's Equity
1					
2					
3					
4					
5					
6					

Solution

Method 1: Completing calculations by hand

Complete the first row of the chart as follows:

Fill in only the Unpaid Balance and the Owner's Equity. In the first row, the Unpaid Balance is the amount of the mortgage and the Owner's Equity is the amount of the down payment.

Payment #	Payment	Interest	Principal	Unpaid Balance	Owner's Equity
				$180,000.00	$40,000.00
1					
2					
3					
4					
5					
6					

Complete the second row of the chart (Payment # 1) as follows:

Total Payment

Refer to Example 1. The total monthly mortgage payment is $952.20.

Interest

Recall from Grade 11 Essential Mathematics the formula for simple interest ($I = Prt$). Include this formula on your resource sheet.

Note that P = the previous unpaid balance

Note that $r = 2.5\% = 0.025$

Note that $t = \frac{1}{12}$ because time in the formula is always expressed in years.

Therefore, one month is equal to $\frac{1}{12}$ of a year.

$I = Prt$ where $P = \$180{,}000$, $r = 0.025$, and $t = \frac{1}{12}$

$= \$180{,}000 \times 0.025 \times \frac{1}{12}$

$= \$375$

Principal

Principal = Total Payment – **Interest**

$= \$952.20 - \$375.00$

$= \$577.20$

Unpaid Balance

Unpaid Balance = Previous **Unpaid Balance** − **Principal**

$= \$180{,}000.00 - \$577.20$

$= \$179{,}422.80$

Owner's Equity

Owner's Equity = Previous **Owner's Equity** + **Principal**

$= \$40{,}000.00 + \$577.20$

$= \$40{,}577.20$

Note: The owner's equity is calculated with the assumption that the house will be sold for exactly the same amount as what you paid for it. This is not usually the case because the housing market varies—you may sell for more or for less. Actual Equity is a much more complicated calculation.

After performing these calculations, your schedule of mortgage payments should look like this:

Payment #	Payment	Interest	Principal	Unpaid Balance	Owner's Equity
				$180,000.00	$40,000.00
1	$952.20	$375.00	$577.20	$179,422.80	$40,577.20
2					
3					
4					
5					
6					

The same process is followed for the following rows. Include the formulas for each column on your resource sheet.

Complete the third row of the chart as follows:

Payment

The total monthly mortgage payment is $952.20.

Interest

$I = Prt$ where $P = \$179{,}422.80$, $r = 0.025$, and $t = \frac{1}{12}$

$$= \$179{,}422.80 \times 0.025 \times \frac{1}{12}$$

$$= \$373.80$$

Note that P is the previous **Unpaid Balance**.

Principal

Principal = **Payment** − **Interest**

$$= \$952.20 - \$373.80$$

$$= \$578.40$$

Unpaid Balance

Unpaid Balance = Previous **Unpaid Balance** − **Principal**

$$= \$179{,}422.80 - \$578.40$$

$$= \$178{,}844.40$$

Owner's Equity

Owner's Equity = Previous **Owner's Equity** + **Principal**

$$= \$40{,}577.20 + \$578.40$$

$$= \$41{,}155.60$$

The third row of the schedule of mortgage payments chart can be filled in as follows:

Payment #	Payment	Interest	Principal	Unpaid Balance	Owner's Equity
				$180,000.00	$40,000.00
1	$952.20	$375.00	$577.20	$179,422.80	$40,577.20
2	$952.20	$373.80	$578.40	$178,844.40	$41,155,60
3					
4					
5					
6					

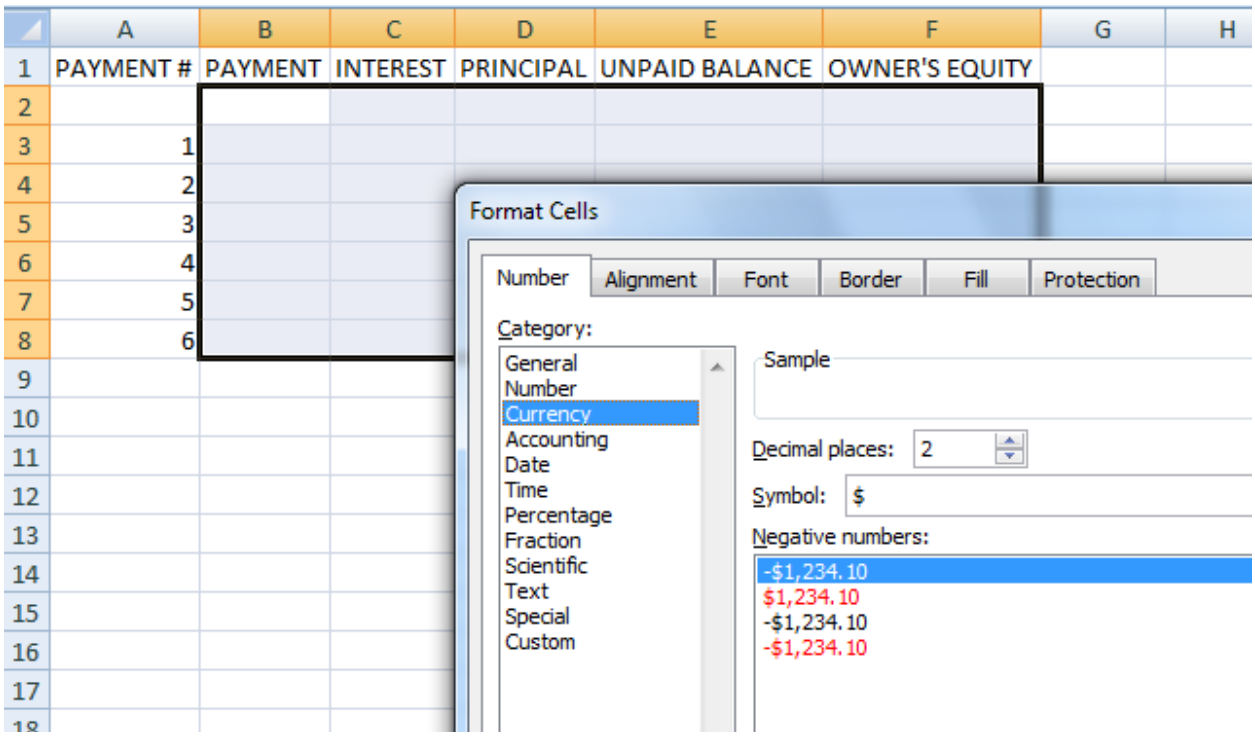
You continue the calculations using the same processes as shown for the second and third rows of the table in order to complete the table. Your final answer should look like this:

Payment #	Payment	Interest	Principal	Unpaid Balance	Owner's Equity
				$180,000.00	$40,000.00
1	$952.20	$375.00	$577.20	$179,422.80	$40,577.20
2	$952.20	$373.80	$578.40	$178,844.40	$41,155,60
3	$952.20	$372.59	$579.61	$178,264.79	$41,735.21
4	$952.20	$371.38	$580.82	$177,683.97	$42,316.03
5	$952.20	$370.17	$582.03	$177,101.95	$42,898.05
6	$952.20	$368.96	$583.24	$176,518.71	$43,481.29

You may also complete a schedule of mortgage payments chart using a spreadsheet program on the computer.

Method 2: Using a Spreadsheet

Before you enter any values or formulas, be sure to enter the correct headings. Also, you may want to format all of the data cells so that they automatically add the dollar sign and comma (recall that the formulas will not work if you enter the dollar signs manually).



Once you have done this, enter the mortgage amount ($180,000.00) and the down payment ($40,000.00) under unpaid balance and owner's equity, respectively.

	A	B	C	D	E	F
1	PAYMENT #	PAYMENT	INTEREST	PRINCIPAL	UNPAID BALANCE	OWNER'S EQUITY
2					$180,000.00	$40,000.00
3	1					
4	2					
5	3					
6	4					
7	5					
8	6					

For the second row, beside payment #1, take the payment amount from Part (a) of Example 1 ($952.20). The formula to calculate interest is $I = Prt$. In this calculation, P is the previous unpaid balance (for payment #1 the previous unpaid balance is in cell E2). In the interest cell, enter the formula to calculate the amount of interest, **=E2*0.025/12** ($r = 0.025$ is the interest rate and $t = \frac{1}{12}$ because the payments are made monthly).

	A	B	C	D	E	F
1	PAYMENT #	PAYMENT	INTEREST	PRINCIPAL	UNPAID BALANCE	OWNER'S EQUITY
2					$180,000.00	$40,000.00
3	1	$952.20	=E2*0.025/12			
4	2					

This turns out to be:

	A	B	C	D	E	F
1	PAYMENT #	PAYMENT	INTEREST	PRINCIPAL	UNPAID BALANCE	OWNER'S EQUITY
2					$180,000.00	$40,000.00
3	1	$952.20	$375.00			
4	2					

To calculate the *principal*, you subtract the *interest* from the *payment*, so the formula will be **=B3-C3**, which equals $577.20.

	A	B	C	D	E	F
1	PAYMENT #	PAYMENT	INTEREST	PRINCIPAL	UNPAID BALANCE	OWNER'S EQUITY
2					$180,000.00	$40,000.00
3	1	$952.20	$375.00	=B3-C3		
4	2					

	A	B	C	D	E	F
1	PAYMENT #	PAYMENT	INTEREST	PRINCIPAL	UNPAID BALANCE	OWNER'S EQUITY
2					$180,000.00	$40,000.00
3	1	$952.20	$375.00	$577.20		
4	2					

The new *unpaid balance* is equal to the *previous unpaid balance* (cell E2) minus the *principal* (cell D3), so the formula will be **=E2–D3**.

	A	B	C	D	E	F
1	PAYMENT #	PAYMENT	INTEREST	PRINCIPAL	UNPAID BALANCE	OWNER'S EQUITY
2					$180,000.00	$40,000.00
3	1	$952.20	$375.00	$577.20	=E2-D3	
4	2					

	A	B	C	D	E	F
1	PAYMENT #	PAYMENT	INTEREST	PRINCIPAL	UNPAID BALANCE	OWNER'S EQUITY
2					$180,000.00	$40,000.00
3	1	$952.20	$375.00	$577.20	$179,422.80	
4	2					

The *owner's equity* is equal to the *previous owner's equity* (cell F2) plus the *principal* (cell D3), so the formula will be _____.

	A	B	C	D	E	F
1	PAYMENT #	PAYMENT	INTEREST	PRINCIPAL	UNPAID BALANCE	OWNER'S EQUITY
2					$180,000.00	$40,000.00
3	1	$952.20	$375.00	$577.20	$179,422.80	=F2+D3
4	2					

	A	B	C	D	E	F
1	PAYMENT #	PAYMENT	INTEREST	PRINCIPAL	UNPAID BALANCE	OWNER'S EQUITY
2					$180,000.00	$40,000.00
3	1	$952.20	$375.00	$577.20	$179,422.80	$40,577.20
4	2					

This completes the second row of the table. When you calculated this using pen and paper, you would have to repeat the same calculations for each row. With the spreadsheet, you can complete the table a lot faster. By selecting cell B3 ($952.20) and clicking on the bottom right corner, you can copy the cell by dragging downward.

	A	B	C
1	PAYMENT #	PAYMENT	INTEREST
2			
3	1	$952.20	$375.00
4	2		
5	3		
6	4		
7	5		
8	6		

	A	B	C
1	PAYMENT #	PAYMENT	INTEREST
2			
3	1	$952.20	$375.00
4	2	$952.20	
5	3	$952.20	
6	4	$952.20	
7	5	$952.20	
8	6	$952.20	

You can do the same for all the columns.

	A	B	C	D	E	F
1	PAYMENT #	PAYMENT	INTEREST	PRINCIPAL	UNPAID BALANCE	OWNER'S EQUITY
2					$180,000.00	$40,000.00
3	1	$952.20	$375.00	$577.20	$179,422.80	$40,577.20
4	2	$952.20	$373.80	$578.40	$178,844.40	$41,155.60
5	3	$952.20	$372.59	$579.61	$178,264.79	$41,735.21
6	4	$952.20	$371.38	$580.82	$177,683.97	$42,316.03
7	5	$952.20	$370.17	$582.03	$177,101.95	$42,898.05
8	6	$952.20	$368.96	$583.24	$176,518.71	$43,481.29

From the schedule of mortgage payments chart, you can see that the majority of the first mortgage payments go to pay interest and very little goes to pay down the principal. This is because you owe your financial institution the greatest amount of money at the beginning of your mortgage. As you continue to make mortgage payments, you owe your financial institution less money and, therefore, less money goes to pay interest and more goes to pay down the principal.

You need to know how to complete the above table with pencil, paper, and calculator, as well as with a spreadsheet. You will very quickly discover the advantages of using a spreadsheet—it is much quicker, and you are less likely to make mistakes. It may help you to use a spreadsheet to complete some of the assignments in this module, but when you write your midterm examination, you need to know how to complete a few lines of the table without the use of a spreadsheet.

If you have access to the Internet, it is recommended that you take some time to investigate mortgage payments using the available online calculators. These calculators perform the calculations much faster than you can by hand. Several financial institutions have these calculators on their websites, and a search of the Internet using the words "mortgage calculator" will direct you to those websites. When you are using the online calculators, adjust the number of payments per year and the amortization period, and you will gain a better understanding of how these two factors affect a mortgage.

Example 3

This example is based on Example 2.

a) Calculate the total amount Conrad pays in the first six months.

b) Calculate the total amount of interest paid in the first six months.

c) Calculate the total amount by which the unpaid balance (i.e., the mortgage) is reduced in the first six months.

Solution

a) If you are completing this question without a spreadsheet, you must add the payments for the six months ($6 \times \$952.20 = \$5713.20$).

   Using a spreadsheet, you would add another row to your table. Under **PAYMENT#** you should title this row **TOTAL**. In the column for **PAYMENT**, instead of entering the same amount, enter the formula **=SUM(B3:B8)**.

b) Since the interest amount changes each month, you need to add the six numbers in the Interest column. The total interest is $2231.91. Alternatively, you could use a spreadsheet and repeat the same steps for the Interest column. The formula is **=SUM(C3:C8)**.

c) Repeat the same steps from the Principal column. The formula is **=SUM(D3:D8)**. Alternatively, you could subtract the final unpaid balance from $180,000.00. The total principal paid is $3481.29.

Complete the following learning activity to practice calculating mortgages. Be sure to check your answers so that you know that you understand the material, or discover what you need to revisit it.

Learning Activity 1.4

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Tyla purchases a home for $207,000 with no down payment. She has calculated that she will spend $278,187 paying for the house during the 25-year amortization period. How much money in interest will she pay during this 25-year period?
2. Tyla wants to purchase a television for her new home. One television is on sale for 10% off the purchase price of $750. Another television is on sale for 15% off the purchase price of $800. Which television is the least expensive?
3. Solve for g: $2g - 11 = 7$
4. Convert this percent to a fraction in lowest terms: 66%.
5. Complete the pattern: 1, 2, 4, 7, _____ , _____ , _____ .

continued

Learning Activity 1.4 (continued)

Part B: Mortgage Calculations

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

Use the amortization table at the end of this lesson to complete this learning activity.

1. What interest rates are financial institutions now charging for a five-year mortgage? The interest rate can be found by consulting a financial institution, the Saturday *Winnipeg Free Press*, or the Internet.
2. Calculate the monthly payments for each of the following fixed-rate mortgages.
   a) $150,000 mortgage at 2.25% amortized over 15 years.
   b) $235,000 mortgage at 3.5% amortized over 25 years.
   c) $170,000 mortgage at 4% amortized over 20 years.
3. Moira Diaz purchases a home for $190,000. She makes a down payment of $20,000 and takes out a fixed-rate mortgage at 2.25% for the balance of the purchase price. The mortgage is to be amortized over 10 years.
   a) Determine Moira's monthly mortgage payments.
   b) Calculate the amount of interest Moira pays during the 10-year amortization period.
4. Refer to Question 3. Suppose Moira chooses to amortize her mortgage over 25 years rather than 10 years. Suppose the interest rate remains fixed at 2.25%.
   a) Determine Moira's monthly mortgage payments.
   b) Calculate the amount of interest Moira pays during the 25-year amortization period.
   c) How would the interest she pays during a 25-year amortization period compare to the interest she pays during a 10-year amortization period?
   d) Why might Moira choose a longer amortization period?

continued

Learning Activity 1.4 (continued)

5. Complete a schedule of mortgage payments chart for the first three months of Question 3.

Payment #	Payment	Interest	Principal	Unpaid Balance	Owner's Equity
				$170,000.00	$20,000.00
1					
2					
3					

6. Refer to the schedule of mortgage payments chart in Question 5.
   a) Calculate the total interest paid in the first three months.
   b) Calculate the total principal paid down in the first three months.
   c) How does the total principal paid down compare to the total interest paid?
7. Use a spreadsheet to complete a schedule of mortgage payments chart for the first 24 months of Question 4. If you don't have a computer, you should complete the first 5 months of the chart.
8. The Rossbrook family is considering buying a bungalow with a purchase price of $245,000. Their gross monthly income is $4960. The family can make a down payment of $40,000 and they expect their financial institution to offer them a fixed-rate mortgage rate of 2.75% over 20 years. The annual taxes on the property are $2544. The annual heating costs of the house are $1680.
   a) What is the monthly mortgage payment?
   b) Calculate the Gross Debt Service Ratio.
   c) Can the Rossbrook family afford this home?

Lesson Summary

In this lesson, you studied mortgages, including what they are and how to perform related calculations. This is an essential knowledge base when buying a home. The majority of people who purchase a home will require a mortgage, and a good understanding of how they work will give you the necessary skills to make the correct decisions during this process.

Following this lesson is your first assignment, focusing on mortgages as well as affordability calculations from Lesson 1.

The following assignment is longer than most, so feel free to take a break and come back to it later. If any material seems challenging to you, be sure to ask your tutor/marker or learning partner for help. Also, make sure your resource sheet is up to date with all definitions and sample solutions for some of the more difficult questions.

Assignment 1.1

Affordability, Initial Costs, and Mortgages

Total: 50 marks

Note to Students: Have you made a resource sheet for this module? Do you have the definitions and formulas on your resource sheet? If so, you should use it now. If not, now would be a good time to make one.

An amortization table is provided at the end of this lesson, and it will be provided on your midterm examination. Also, the information from Chart 1.1: Interest Rate Factor Table will be provided on your midterm examination.

1. Find the Gross Debt Service Ratio for the following situations, and state whether these houses are affordable and why.
   a) The monthly mortgage payment is $805, monthly property taxes are $110, monthly heating costs are $74, and the gross monthly income is $3458. *(2 marks)*

   b) The monthly mortgage payment is $716, monthly property taxes are $120, monthly heating costs are $118, and the gross monthly income is $2280. *(2 marks)*

continued

Assignment 1.1: Affordability, Initial Costs, and Mortgages

2. Mr. and Mrs. Dupont are considering buying a split-level, four-bedroom house with a purchase price of $286,000. The Duponts can make a down payment of $42,000. Mr. Dupont's gross annual income is $63,300. Mrs. Dupont is working part-time while she attends university. Her gross annual income is $19,500. The Duponts are expecting their financial institution to offer them a fixed-rate mortgage rate of 3.5% over 15 years. The annual taxes on the property are $3760. The annual heating costs of the house are $3550.

   a) Calculate the Gross Debt Service Ratio. *(4 marks)*

   b) Can the Duponts afford this house? Explain. *(1 mark)*

   c) If the Duponts decide to amortize their mortgage over a 25-year period, can they afford this house? Justify your answer with calculations. *(3 marks)*

continued

Assignment 1.1: Affordability, Initial Costs, and Mortgages

3. A group of students from rural Manitoba are planning to attend university in Winnipeg. They are considering purchasing an older home rather than living in residence or renting an apartment. After a careful analysis of their finances, the students determine that their gross monthly income will be $3400. The group can afford a down payment of $8000, and can arrange a fixed-rate mortgage at a rate of 3.0% over a 25-year period. The group estimates their monthly property taxes to be about $150 and their heating costs to be about $105.

   Calculate the maximum price the students can pay for a house. Use either the chart below or create your own chart using a spreadsheet program. *(5 marks)*

Maximum Affordable Home Price		
Gross monthly household income		$ _____
Multiply: (GDSR)	_____	
Total affordable household expenses		$ _____
Subtract:		
Monthly property taxes	$ _____	
Monthly heating costs	$ _____	
One-half of condo/strata fees (if applicable)	$ _____	
Monthly affordable mortgage payment		$ _____
Divide: Interest factor (from Chart 1.1)	_____	
Amount of affordable mortgage		$ _____
Add: Cash down payment	$ _____	
Maximum affordable home price		$ _____

continued

4. The Kowaluks are a retired couple who would like to purchase a condominium. The Kowaluks have a gross annual pension income of $42,000. The couple has $168,000 cash left from the sale of their family home. A financial institution offers the Kowaluks a fixed-rate mortgage at a rate of 3.5% amortized over 25 years. They estimate their monthly property taxes to be about $120 and their heating costs to be about $45. They expect condo fees to be $525 per month.

   Calculate the maximum price the Kowaluks can afford to pay for a condominium. Use either the chart below or create your own chart using a spreadsheet program. *(5 marks)*

Maximum Affordable Home Price		
Gross monthly household income		$ _____
Multiply: (GDSR)	_____	
Total affordable household expenses		$ _____
Subtract:		
Monthly property taxes	$ _____	
Monthly heating costs	$ _____	
One-half of condo/strata fees (if applicable)	$ _____	
Monthly affordable mortgage payment		$ _____
Divide: Interest factor (from Chart 1.1)	_____	
Amount of affordable mortgage		$ _____
Add: Cash down payment	$ _____	
Maximum affordable home price		$ _____

5. Calculate the land transfer tax on a home with a purchase price of $220,000. *(2 marks)*

continued

6. Joani Michelle has just purchased a new home. The possession date of her new home is September 1. Annual property taxes on her new home are $1800. The due date for property taxes is June 30. Joani's home insurance is renewed April 1 of each year. She has to increase her home insurance from $250 to $330 per year and pay the difference for the extra months.

   a) Does the seller owe Joani money for the property tax adjustment, or does Joani owe the seller money? *(1 mark)*

   b) Calculate Joani's property tax adjustment. *(2 marks)*

   c) Calculate Joani's home insurance adjustment. *(2 marks)*

continued

Assignment 1.1: Affordability, Initial Costs, and Mortgages

7. The Klaussen family has just purchased a home for $229,000. Before finalizing their offer on the home, they have a professional building inspector inspect the house. The inspector assures the Klaussens that the house is structurally sound. The inspection fee is $325. The Klaussens retain a lawyer to act for them in the purchase of their home. They need a property survey done of their new property. The cost of the property survey is $300. Other legal disbursements are $156.74. Their lawyer's fee is $375. The Klaussens will need to take out a mortgage at a financial institution. The mortgage application fee is $75. Their financial institution charges them an appraisal fee of $45. The Klaussens' possession date is April 15. The amount of mortgage interest owing to the seller is $503. Property taxes for the year are $3296. The due date for property taxes is June 30. Their home insurance is renewed December 1 of each year. The family has to increase their home insurance from $482 to $624 per year and pay the difference for the extra months. The cost to hook up the phone lines is $75. The cost to activate the natural gas is $45. The Klaussens hire movers to move their furniture and appliances to their new home. The mover charges them $480. Before they move in, the family wants a new roof for their home. The new roof costs $4200. They also decide to build a fence around their property at a cost of $1600.

   Use either the chart provided or create your own spreadsheet to calculate the Klaussen family's total closing costs and extras to purchase their new home. Include a copy of your spreadsheet with this assignment if you perform this calculation using technology. *(7 marks)*

continued

Assignment 1.1: Affordability, Initial Costs, and Mortgages

Total Closing Costs		
Initial Fees		
Inspection Fee	$	
Mortgage Application Fee	$	
Appraisal Fee	$	
Total Initial Fees		$
Lawyer's Disbursement and Fees		
Land Transfer Tax	$	
Property Survey	$	
Other Legal Disbursements	$	
Legal Fees	$	
Total Lawyer's Disbursement and Fees		$
Adjustments		
Interest Adjustment	$	
Property Tax Adjustment	$	
Home Insurance Adjustment	$	
Total Adjustments		$
Other Additional Costs		
Service Charges	$	
Moving Expenses	$	
Immediate Repairs	$	
Appliances	$	
Decorating Costs	$	
Total Other Additional Costs		$
Total Closing Costs and Extras		$

continued

Assignment 1.1: Affordability, Initial Costs, and Mortgages

8. Refer to Assignment Question #7. Determine the Klaussen family's total closing costs and extras as a percentage of the purchase price of their new home. *(1 mark)*

9. Discuss how each of the following mortgage features affects the cost of a mortgage. *(2 marks)*
   a) interest rate

   b) payment frequency

10. Find the monthly payments for each of the following fixed-rate mortgages.
    a) $15,000 mortgage at 6.25% amortized over five years. *(1 mark)*

    b) $100,000 mortgage at 4.75% amortized over 25 years. *(1 mark)*

continued

Assignment 1.1: Affordability, Initial Costs, and Mortgages

11. Robert and Lynne Coyne purchase a home for $215,000. They are able to make a down payment of $22,000 on the home and take out a fixed-rate mortgage at 2.5% for the balance of the purchase price. The mortgage is to be amortized over 20 years.

    a) Determine the Coynes' monthly mortgage payments. *(2 marks)*

    b) Calculate the amount of interest the Coynes pay during the 20-year amortization period. *(2 marks)*

12. Refer to Assignment Question #11. Suppose the Coynes were able to make a $35,000 down payment on their home. Suppose their mortgage is still at a fixed interest rate of 2.5% and is amortized over 20 years.

    a) Determine the Coynes' monthly mortgage payments. *(2 marks)*

    b) Calculate the amount of interest the Coynes would pay during the 20-year amortization period. *(2 marks)*

    c) Calculate the amount the Coynes save by making the larger down payment. *(1 mark)*

continued

Notes

Amortization Table					
Amortization Period of Mortgage Loan (Blended payment of principal and interest per $1,000 of loan)					
Interest Rate	**5 years**	**10 years**	**15 years**	**20 years**	25 years
1.50%	$17.31	$8.98	$6.21	$4.82	$4.00
1.75%	17.42	9.09	6.32	4.94	4.11
2.00%	17.52	9.20	6.43	5.05	4.23
2.25%	17.63	9.31	6.55	5.17	4.36
2.50%	17.74	9.42	6.66	5.29	4.48
2.75%	17.85	9.53	6.78	5.41	4.61
3.00%	17.96	9.65	6.90	5.54	4.73
3.25%	18.07	9.76	7.02	5.66	4.86
3.50%	18.18	9.88	7.14	5.79	4.99
3.75%	18.29	9.99	7.26	5.91	5.13
4.00%	18.40	10.11	7.38	6.04	5.26
4.25%	18.51	10.23	7.50	6.17	5.40
4.50%	18.62	10.34	7.63	6.30	5.53
4.75%	18.74	10.46	7.75	6.44	5.67
5.00%	18.85	10.58	7.88	6.57	5.82
5.25%	18.96	10.70	8.01	6.71	5.96
5.50%	19.07	10.82	8.14	6.84	6.10
5.75%	19.19	10.94	8.27	6.98	6.25
6.00%	19.30	11.07	8.40	7.12	6.40
6.25%	19.41	11.19	8.53	7.26	6.55
6.50%	19.53	11.31	8.66	7.41	6.70
6.75%	19.64	11.43	8.80	7.55	6.85
7.00%	19.75	11.56	8.93	7.70	7.00
7.25%	19.87	11.68	9.07	7.84	7.16
7.50%	19.98	11.81	9.21	7.99	7.32
7.75%	20.10	11.94	9.34	8.13	7.47
8.00%	20.21	12.06	9.48	8.28	7.63
8.25%	20.33	12.19	9.62	8.43	7.79
8.50%	20.45	12.32	9.76	8.59	7.95
8.75%	20.56	12.45	9.90	8.74	8.12
9.00%	20.68	12.58	10.05	8.89	8.28
9.25%	20.80	12.71	10.19	9.05	8.44
9.50%	20.91	12.84	10.33	9.20	8.61
9.75%	21.03	12.97	10.48	9.36	8.78
10.00%	21.15	13.10	10.62	9.52	8.94
10.25%	21.27	13.24	10.77	9.68	9.11
10.50%	21.38	13.37	10.92	9.84	9.28
10.75%	21.50	13.50	11.06	9.99	9.45
11.00%	21.62	13.64	11.21	10.16	9.63

*Interest compounded semi-annually. Actual payment amount may differ slightly.

Note: This chart will be available on the midterm examination.

Lesson 3: Home Insurance and Property Tax

Lesson Focus

In this lesson, you will

- ❑ explore some of the facts a homeowner should know about property insurance and property taxes
- ❑ calculate homeowner's insurance premiums
- ❑ calculate tenant's insurance premiums
- ❑ determine the property tax of a house

Lesson Introduction

In this module, you have calculated how much, based on income, a home buyer can afford to pay for a house, as well as the extra costs one can expect to pay when buying a house. You calculated the amounts of monthly mortgage payments, and what you need to do to save money by paying less interest. You explored some of the calculations and other services normally done by lawyers.

In this lesson, you will study two more costs of home ownership: property insurance and property taxes.

Buying Home Insurance

Home insurance is not a requirement when you own a home; you do not need to purchase it in order to gain possession. Although it is not required, it is highly recommended because you never know what might happen. For example, if you accidentally put the wrong soap in your dishwasher and the dishwasher floods your kitchen, you want to have insurance to pay for damage that would result from that. Because you cannot guarantee that your house will never be damaged, most financial institutions will not grant you a mortgage if you do not have adequate insurance.

Home insurance protects you against mishaps that are generally hard to predict and prevent. There are insurance policies for homeowners, apartment dwellers, condominium owners, and mobile home owners. Homeowner's insurance protects a homeowner against damage and/or loss to both the

building and its contents. Tenant's insurance protects a renter against damage and/or loss to personal possessions. As well, tenant's insurance protects renters against damage they may inadvertently cause to the building or other renters. Insurance policies are also available for condominium owners but condominium and mobile home insurance are beyond the scope of this course. The examples in this lesson will be restricted to homeowner's and tenant's insurance.

In Manitoba, you purchase home insurance through an insurance company broker or agent. There are many insurance brokers in Manitoba representing different insurance companies. Because coverage varies significantly from company to company, it is important that your broker chooses the best company for you. As an astute consumer, you should check with more than one insurance broker before purchasing home insurance.

In addition to the company you choose, home insurance premiums depend on five factors. As you read about these five factors, you should include them and some key points about them on your resource sheet.

1. **Replacement cost of home**

   In order to calculate how much homeowner's insurance you require, your insurance agent determines the replacement cost of your home and/or contents using a program called Boeckh EvaluRate. **The replacement cost of your home is the amount it would cost to replace your home (and its contents) if it burned to the ground.** Note that replacement cost of your home is not the same as its resale value. In the case of an older home, the replacement cost can be significantly greater than its resale value.

   In general, homeowner's insurance offers the following coverage:

   - Building—replacement cost
   - Contents—up to 70% of replacement cost
   - Outbuildings (for example, a shed or detached garage)
     - up to 10% of replacement cost
     - more coverage can be purchased
   - Additional living expenses—while your home is being rebuilt
     - up to 20% of replacement cost
   - Third-party liability—protection against another person injured on your property; at least $1,000,000 is recommended

2. **Location of home**

Manitoba is divided into different areas for homeowner's insurance. The division varies from one insurance company to another. For the purposes of this course, Manitoba will be divided into the following four areas:

- **Area 1:** Metro Winnipeg—homes located within the City of Winnipeg Perimeter Highway; homes located outside the perimeter highway whose property taxes are paid to the City of Winnipeg
- **Area 2:** Protected—homes located outside Metro Winnipeg but within 1000 feet of a fire hydrant
- **Area 3:** Semi-protected—homes located outside the areas designated in areas 1 and 2, but within eight miles of a fire hall
- **Area 4:** Unprotected—homes located more than eight miles from a fire hall

It may be helpful to add the description of these areas to your resource sheet.

3. **Type of coverage**

There are two basic types of home insurance:

- Standard or broad
- Comprehensive

Both types of insurance offer the same protection for your building. They differ in terms of the coverage for the contents of your home. With standard form insurance, the contents are covered only for specified perils. With comprehensive form insurance, the contents are covered for more perils.

One peril covered by comprehensive insurance and not covered by standard insurance is "mysterious disappearance." For example, if you lose a piece of jewelry, it will be covered by a comprehensive policy but not a standard policy. Another peril covered by comprehensive insurance and not covered by standard insurance is "accidental mishap." For example, if you damage your sofa by spilling juice on it, the damage will be covered under comprehensive insurance but not by standard insurance.

Standard and comprehensive insurance may have different limits on valuable personal articles such as jewelry and silverware. They can also differ in terms of sewer back-up insurance. Because comprehensive insurance offers more protection than standard insurance, it is more expensive.

The following is a list of some of the perils against which one insurance company insures homeowners. Since coverage varies significantly between companies, you have to carefully check your insurance policy to find out which perils it covers.

	Standard Coverage		Comprehensive Coverage	
Homeowners	**Building**	**Contents**	**Building**	**Contents**
Collapse	✓	✓	✓	✓
Collapse caused by weight of ice, snow, sleet	✓	✓	✓	✓
Debris removal	✓	✓	✓	✓
Escape of fuel oil	✓	✓	✓	✓
Explosion	✓	✓	✓	✓
Falling objects striking exterior of building	✓	✓	✓	✓
Falling objects in interior of building		N/C	✓	✓
Fire	✓	✓	✓	✓
Fire department charges	✓	N/C	✓	N/C
Food freezer contents	N/C	✓	N/C	✓
Freezing of heating, plumbing, or air conditioning systems	✓	✓	✓	✓
Glass breakage—$25 ded.	✓	✓	✓	✓
Hail damage	✓	✓	✓	✓
Impact of aircraft or land vehicle—including insured's own vehicle	✓	✓	✓	✓
Lawns, shrubs, trees, and plants	✓	N/C	✓	N/C
Lightning	✓	✓	✓	✓
Melting of snow and ice on roof	✓	N/C	✓	✓
Mortgage rate protection	✓	N/C	✓	N/C
Moving to a new home	N/C	✓	N/C	✓
Mysterious disappearance	N/C	N/C	N/C	✓
Riot	✓	✓	✓	✓
Rupture of heating, plumbing, or air conditioning systems	✓	✓	✓	✓
Sewer back-up—$5,000	N/C	N/C	✓	✓
Smoke damage—incl. smoke from a fireplace	✓	✓	✓	✓
Theft from the principal dwelling	✓	✓	✓	✓
Theft of contents away from principal dwelling	✓	✓	✓	✓
Theft from an unlocked car	N/C	✓	N/C	✓
Transportation—excluding watercraft and outboard motors	N/C	✓	N/C	✓
Vandalism or malicious acts	✓	✓	✓	✓
Water escape—including waterbeds	✓	✓	✓	✓
Windstorm	✓	✓	✓	✓
N/C—not covered				

4. Amount of deductible

The amount of deductible is the amount you must pay before the insurance company pays anything when you make a claim. Most home insurance policies have a $500 deductible clause. A $500 deductible means you are responsible for paying the first $500 of any insurance claim you make. Some insurance companies allow you to decrease or increase your deductible by adjusting the cost of your insurance policy.

In this course, we will assume that the premiums of all insurance policies have deductible amounts of $500. If you wish to decrease the deductible amounts to $200, you will have to increase the premiums by 10%. Include this in your resource sheet as a reminder for yourself.

5. Available discounts

Some companies allow discounts for the following conditions:

- burglar alarm
- claim-free for three years
- new home
- client is over 50 years of age

You have now read about the factors that affect home insurance costs. The following examples will show you how to use the information related to these factors to calculate the home insurance for various situations.

In order to solve the following examples, you will have to refer to the *Manitoba Homeowner's Insurance Rates* table and the *Manitoba Tenant's Insurance Rates* table. **You can find these tables at the end of the lesson. The tables will also be provided on the midterm** examination**.** Note that the tables are just two hypothetical examples of home insurance rates in Manitoba. Different companies offer different rates and many of them are more complex. Manitoba tenant's insurance rates in particular can be more complex as they can depend on location, number of apartments in the building, and the construction of the building.

Example 1

The Tam family owns a home with a Boeckh replacement value of $185,000. The home is in Winnipeg. The family chooses comprehensive insurance with a deductible of $500. Calculate the Tam family's annual insurance premium.

Solution

Refer to the *Manitoba Homeowner's Insurance Rates* table.

Find the amount of $185,000 under the Boeckh calculator amount and go across until you locate the comprehensive premium for Metro Winnipeg. The annual premium for $185,000 of comprehensive insurance, with a $500 deductible, in Metro Winnipeg is $702.

Example 2

The Sampson-Grant family owns a home with a Boeckh replacement value of $220,000. The home is located outside Metro Winnipeg but within 1000 feet of a fire hydrant. The family chooses standard insurance with a deductible of $500. Calculate the Sampson-Grant family's annual insurance premium.

Solution

Refer to the *Manitoba Homeowner's Insurance Rates* table. The Boeckh Calculator amount in the table only indicates replacement costs up to $200,000. In order to locate a replacement cost greater than $200,000, first find $200,000 under the Boeckh calculator amount and move across until you locate the broad premium for Area 2. The annual premium for $200,000 of standard insurance, with a $500 deductible, in Area 2 is $519.

According to the table, for replacement costs for broad insurance in Area 2 that are greater than $200,000, there is a cost of $2.75 for each additional $1000 worth of coverage.

Amount of additional coverage required = $220,000 − $200,000 = $20,000

$$\text{Cost of additional coverage} = \frac{\$20,000 \times \$2.75}{\$1000} = \$55.00$$

Total annual insurance premium = $519.00 + $55.00 = $574.00

Example 3

Marilyn Davis rents an apartment in Brandon. Her personal possessions have a Boeckh replacement value of $30,000. Marilyn chooses comprehensive tenant's insurance with a deductible of $200. Calculate her annual insurance premium.

Solution

Refer to the *Manitoba Tenant's Insurance Rates* table. Find the amount of $30,000 under the coverage amount and move across until you locate the comprehensive premium. The annual premium for $30,000 of comprehensive tenant's insurance with a $500 deductible is $226. In order to decrease the deductible to $200, you have to add an additional amount of 10% to her premium.

10% of $226 or 10% × $226 = $22.60

Marilyn's total insurance premium = $226.00 + 22.60 = $248.60

Now that you have seen some examples of how to calculate home insurance, it's your turn to try. Complete the following learning activity to find out approximately how much you could be paying for home insurance where you live. There are also some sample questions that will help you check your understanding of the examples. After you have finished these questions, be sure to check your answers.

Learning Activity 1.5

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Sharlee is covered for 70% of the replacement cost of the contents in her home. If the contents of her home are worth $150,000, how much money will Sharlee receive in the event of a house fire?
2. Evaluate for $t = 5$: $3t - 8$
3. Carly is three times as old as Marla. Marla is one-fourth as old as Pauly. If Pauly is 20, how old are Carly and Marla?
4. If 17 × 18 is 306, what is 17 × 20?
5. Evaluate: $\frac{1}{5} + \frac{2}{3}$

continued

Learning Activity 1.5 (continued)

Part B: Home Insurance

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. a) Find out how much the replacement value is for where you live. You can probably get this information from a parent or guardian.
   b) Use the descriptions of the four types of areas that Manitoba is divided into to determine which area you live in.
   c) What type of coverage would you choose to have for your house? Use either the *standard* or *comprehensive coverage* and the table describing them in detail to make this decision.
   d) Decide whether you would want a $200 deductible or a $500 deductible. Explain why you chose one or the other.
   e) Using the information you gathered and the choices you made in parts (a) to (d), calculate your possible home insurance costs. If you have an alarm system, deduct $15.

2. a) Why is it important to have homeowner's insurance?
   b) Why is it important to have tenant's insurance?

3. a) Explain the difference between the replacement cost of a home and its resale value.
   b) On which value is homeowner's insurance based?

4. Jay Wallace owns a home with a Boeckh replacement value of $175,000. The home is in an unprotected area of Manitoba. Jay chooses standard insurance with a deductible of $500. Determine Jay's annual insurance premium.

5. Joy Lewicki rents an apartment in Altona. Her personal possessions have a Boeckh replacement value of $40,000. Joy chooses comprehensive tenant's insurance with a deductible of $200. Calculate her annual insurance premium.

6. Al McMillan owns a home with a Boeckh replacement value of $190,000. His home is located outside Winnipeg in a semi-protected area. He is interested in an insurance policy with $500 deductible. If Al chooses comprehensive insurance rather than standard insurance, how much more would his annual premium be?

continued

Learning Activity 1.5 (continued)

7. Martin Humboldt owns a home with a Boeckh replacement value of $190,000. The home is located in Metro Winnipeg. He chooses comprehensive homeowner's insurance with a deductible of $200. In addition to the $5000 of sewer back-up coverage he has with his policy, he opts to pay another $120 for $15,000 of additional sewer back-up coverage. Calculate his annual insurance premium.

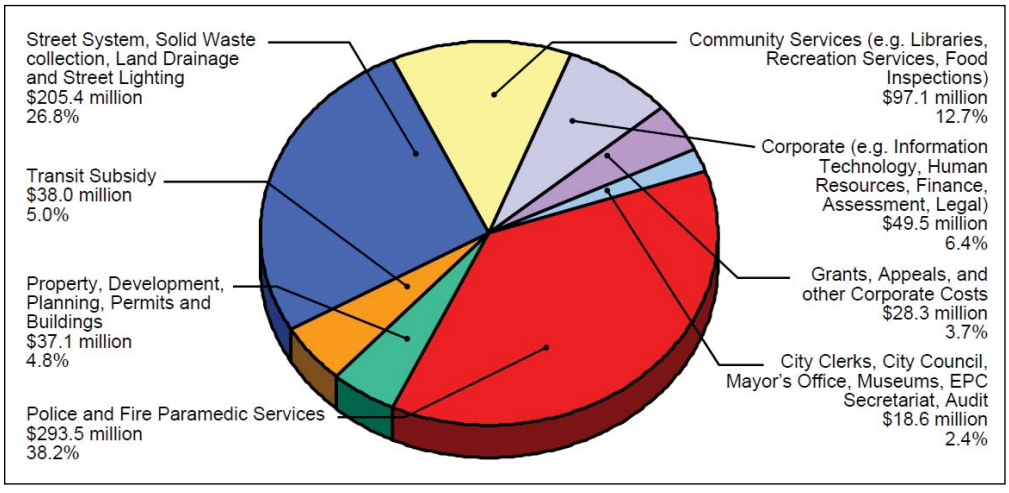
Property Taxes

As a homeowner, you may or may not have a mortgage or property insurance. You will, however, most certainly have to pay property taxes. These taxes are assessed by the municipal government (a municipality is a city, town, or district with a degree of self-governance), so they vary from place to place within the province. In this lesson, we will focus on Winnipeg's property taxes, but if you do not live within the city limits, the procedures are very similar.

Property Tax Rates

One of the main sources of revenue for municipal governments in Manitoba is property tax. In order for a municipality to determine the amount of property tax its taxpayers must pay each year, it first determines the total revenue it requires, and then it subtracts all other sources of revenue.

The following graph shows how the City of Winnipeg spent its operating budget (made up of the taxes collected) in 2008.



Source: http://winnipeg.ca/Finance/files/2008_adopted_operating_budget_service_based_view(aug5).pdf

How is property in Manitoba assessed? Provincial legislation requires all property in Manitoba to be assessed using the market value system, so the assessed value should be approximately the same as the market value of the property. Market value assessments may vary based on geographical location, building style, and size of the property. In Manitoba we classify properties to ensure that all properties within the same classification are assessed in the same way.

Property Classification Codes in Manitoba

10	Residential 1—fewer than 5 dwelling units
20	Residential 2—5 or more dwelling units
30	Farm
40	Institutional
51	Statutory—pipeline
52	Statutory—railway
60	Other
70	Golf Course
80	Residential 3—Owner-occupied condominiums and co-op housing

A *portion percentage* is assigned to each type of property, which is used to calculate the portioned assessment of a property (which is rounded to the nearest $10).

Portioned Assessment = Portion Percentage × Market Value Assessment

The *property tax rate* is then calculated using the following formula.

$$\text{Property tax rate (mills)} = \frac{\text{total revenue required}}{\text{total portioned assessment}} \times 1000$$

You are not required to know how property tax rates are calculated for this course. You do need to know how to use the rates to calculate the value of someone's property tax.

Calculating Property Tax

Property tax is composed of two subdivisions—municipal taxes and education taxes. In order to calculate property taxes, you use the portioned assessments and mill rates you were introduced to in the previous section of this lesson. You will not be asked to calculate portioned assessments and mill rates. These values will be provided whenever they are required.

You may be asking, "What is a mill rate?" A **mill** is a metric term, much like a millimetre where a **mill** refers to a unit of one-thousandth. In terms of property tax rates, 1 mill represents a tax of $1 for every $1000 of proportioned assessed value.

Municipal Taxes

Municipal taxes support municipalities. Municipal taxes consist of the general municipal tax and local improvement taxes. The general municipal tax formula is:

$$\text{General municipal tax} = \frac{\text{total portioned assessment}}{1000} \times \text{municipal mill rate}$$

Local improvement taxes are based on the cost of the improvements and your **frontage**. For the purposes of this course, the frontage is taken to be the width of the front of your property. Each local improvement tax is calculated as follows:

Local improvement tax
= frontage × cost of improvement per foot of property frontage

Include these two formulas on your resource sheet.

The costs of local improvements vary from municipality to municipality. The costs of local improvements for the City of Winnipeg for 2012 are included in the table below. For this course, we will use these costs for calculating local improvements in all municipalities.

Local Improvement Costs for Property Tax Credits	
Property Improvement	**Cost per Frontage Foot per Year**
Asphalt surfacing roadways	$ 26.22
Boulevard construction	$ 10.81
Concrete sidewalk	$ 7.86
Concrete street paving	$ 39.32
Granular surface lane	$ 9.01
Land drainage system	$ 8.62
Lane lighting	$ 1.80
Lane oiling	$ 9.00
Lane paving	$ 11.80
Ornamental lighting (lane)	$ 10.82
Ornamental lighting (street)	$ 14.42
Road oiling	$ 8.00
Wastewater sewers	$ 9.98
Water mains	$ 11.54

Source: http://winnipeg.ca/publicworks/Services/LocalImprovements.asp

You may want to photocopy this table or flag it using a sticky note because you will have to refer back to it in order to complete the learning activity and assignment at the end of this lesson.

The total municipal tax is the sum of the general municipal tax and the local improvement taxes. Include this formula in your resource sheet.

Municipal Taxes = General Municipal Tax + Local Improvement Taxes

The following example demonstrates how to use the formulas provided in order to calculate the municipal taxes on a property.

Example 1

Solaimon owns a home with a total portioned assessment of $100,500. The frontage of his home is 50 feet. His annual municipal tax rate is 14.056 mills. He must also pay local improvement taxes for both boulevard construction and lane paving. Calculate Solaimon's total annual municipal taxes.

Solution

$$\text{General municipal tax} = \frac{\text{total portioned assessment}}{1000} \times \text{municipal mill rate}$$

$$= \frac{\$100,500}{1000} \times 14.056$$

$$= \$1412.63$$

Improvement tax (boulevard construction): $50 \times 10.81 = \$540.50$

Improvement tax (lane paving): $50 \times 11.80 = \$590.00$

TOTAL municipal taxes: $1412.63 + 540.50 + 590.00 = \$2543.13$

Education Taxes

Education taxes support the various school divisions in the province of Manitoba. Education taxes are also calculated using portioned assessed property value and mill rate. The mill rate for education taxes is not the same as the mill rate for municipal taxes. You should note this on your resource sheet.

$$\text{Education taxes} = \frac{\text{total portioned assessment}}{1000} \times \text{education mill rate}$$

The education mill rate given in this lesson consists of two education mill rates: the provincial education mill rate and the school division mill rate. The school division mill rate varies from one school division to another.

Example 2

The annual rate of the education tax is 15.668 mills. Use the information about Solaimon found in Example 1 to calculate

a) Solaimon's annual total education tax

b) Solaimon's total property tax

Solution

a) $$\text{Education taxes} = \frac{\text{total portioned assessment}}{1000} \times \text{education mill rate}$$

$$= \frac{\$100,500}{1000} \times 15.668$$

$$= \$1574.63$$

b) Property taxes = municipal taxes + education taxes

$$= \$2543.13 + \$1574.63$$

$$= \$4117.76$$

Example 3

The Adebyo family owns a home with a portioned assessed value of $83,250. The municipal mill rate is 14.056 mills and the education mill rate is 14.285 mills. The property has a frontage of 60 feet. The family is charged local improvement taxes for road oiling and lane lighting.

a) Calculate the total annual municipal taxes for the property.

b) Calculate the total annual education taxes for the property.

c) Calculate the total property tax.

Solution

a) $$\text{General municipal tax} = \frac{\text{total portioned assessment}}{1000} \times \text{municipal mill rate}$$

$$= \frac{\$83,250}{1000} \times 14.056$$

$$= \$1170.16$$

Local improvement tax (lane lighting): $60 \times 1.80 = \$108.00$

Local improvement tax (road oiling): $60 \times 8 = \$480$

Total: $\$1170.16 + \$108.00 + \$480.00 = \$1758.16$

b) $$\text{Education taxes} = \frac{\text{total portioned assessment}}{1000} \times \text{education mill rate}$$

$$= \frac{\$83,250}{1000} \times 14.285$$

$$= \$1189.23$$

c) Property tax: \$1758.16 + \$1189.23 = \$2947.39

You're almost done this lesson! You just need to complete the following learning activity. Check your answers with the answer key at the end of this module. The questions in this learning activity are similar to the questions in the assignment following this lesson.

Learning Activity 1.6

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Evaluate: $\frac{3}{5} \times \frac{10}{7}$
2. Cleavon is buying his lunch at a food court in the mall. He spends \$4.25 on a slice of pizza, \$2.75 on a drink, and \$3.50 on a salad. How much does he spend on his lunch?
3. Convert the following decimal to a percent: 0.006
4. You want to have the following items in your backyard: a shed, a dog run, and a garden. If your backyard is 10 m × 10 m, can you fit a shed that is 4 m × 5 m, a dog run that is 3 m × 10 m and garden that is 5 m × 5 m?
5. You are paid \$10.50 per hour. If you work 30 hours this week and 24 hours next week, how much will you be paid for these two weeks?

continued

Learning Activity 1.6 (continued)

Part B: Property Taxes

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. The Duhamel family owns a home with a total portioned assessment of $90,240. The frontage of the home is 45 feet. The annual municipal rate is 14.132 mills and the annual education rate is 15.732 mills. Assume the family has no local improvement taxes.
   a) Calculate the total annual municipal taxes for the property.
   b) Calculate the total annual education taxes for the property.
   c) Calculate the total annual municipal and education taxes for the property.
2. The Lorenzo family bought a home in Selkirk for $196,400. The total portioned assessment of the building is 45% of the value of the house when it was bought. The home has a 35-foot frontage. The annual municipal rate is 11.256 mills and the annual education rate is 14.395 mills. There is an annual local improvement tax for lane oiling.
   a) What is the total portioned assessment of the property?
   b) Calculate the annual municipal tax on the property.
   c) Calculate the annual education tax on the property.
   d) What are the annual taxes on the property (in total).

Lesson Summary

In this lesson, you studied home insurance and property taxes. Although these two topics might not be the first thing you think about when buying a house, they are very important because you must budget money to pay for home insurance and taxes as well as your mortgage in order to keep your house. The assignment following this lesson focuses on home insurance and property tax calculations, so be sure to ask your learning partner or tutor/marker for help if you have any questions. Also, check that you have added all the formulas from this lesson.

In the next lesson, you will look at other costs of home ownership. It is important to look at these future expenses so that you are aware of these costs when you start to plan the purchase of your first home.

Notes

Manitoba Homeowner's Insurance Rates ($500 deductible)								
Boeckh Calculator	**Metro Winnipeg**		**Area 2**		**Area 3**		**Area 4**	
Amount	**Standard**	**Comprehensive**	**Standard**	**Comprehensive**	**Standard**	**Comprehensive**	**Standard**	**Comprehensive**
$ 50,000	195	214	147	161	196	216	261	287
$ 55,000	216	238	160	176	217	239	289	318
$ 60,000	237	260	173	190	237	261	315	347
$ 65,000	252	277	187	205	255	281	339	373
$ 70,000	266	303	200	220	270	297	359	395
$ 75,000	294	324	210	231	285	314	379	417
$ 80,000	310	323	221	243	302	332	402	438
$ 85,000	318	333	226	249	313	344	416	462
$ 90,000	324	349	231	254	324	356	431	474
$ 95,000	348	370	244	268	345	380	459	505
$100,000	364	393	260	286	361	397	480	528
$105,000	390	417	278	306	378	416	503	553
$110,000	402	441	293	322	393	432	523	575
$115,000	418	464	299	329	409	450	544	598
$120,000	436	487	309	340	424	466	564	620
$125,000	451	510	319	351	444	488	591	650
$130,000	472	543	339	373	466	513	620	682
$135,000	498	557	345	380	477	525	634	697
$140,000	523	580	358	394	496	546	660	726
$145,000	538	596	375	413	508	559	676	744
$150,000	550	604	385	424	520	572	692	761
$155,000	557	613	398	438	551	606	733	806
$160,000	565	622	413	454	569	626	757	833
$165,000	572	629	425	468	589	648	783	861
$170,000	590	647	441	485	609	670	810	891
$175,000	607	668	451	496	624	686	830	913
$180,000	620	686	466	513	648	713	862	948
$185,000	636	702	478	526	667	734	887	976
$190,000	652	717	492	541	705	776	938	1032
$195,000	678	742	504	554	720	792	958	1054
$200,000	692	771	519	571	726	799	966	1063
Additional Amounts per $1000 coverage	Add: $3.15	Add: $3.50	Add: $2.75	Add: $3.03	Add: $3.55	Add: $3.91	Add: $4.72	Add: $5.19

$200 deductible—Increase premium by 10%

Note: This table will be available for your midterm exam.

Tenant's Package Policy ($500 deductible)		
All Areas—Manitoba		
Coverage Amount	**Standard Form**	**Comprehensive Form**
$25,000	158.00	200.00
$30,000	174.00	226.00
$35,000	199.00	252.00
$40,000	212.00	269.00
$45,000	235.00	298.00
$50,000	254.00	324.00
$55,000	272.00	346.00
$60,000	293.00	373.00
$65,000	315.00	400.00
$70,000	337.00	427.00
$75,000	359.00	454.00
Each additional $1000	$4.50	$5.50

$200 deductible—Increase premium by 10%

Assignment 1.2

Insurance and Property Tax

Total: 15 marks

Note to Students: If you haven't updated your resource sheet during this lesson, take a moment to do so before you start this assignment. You can also add to your resource sheet while you are completing the assignment. You may use the tables given in the lessons as an additional resource.

1. Explain the major differences between standard insurance and comprehensive insurance. *(2 marks)*

2. Amanda Rey owns a home with a Boeckh replacement value of $180,000. Her home is located outside Metro Winnipeg, but within 1000 feet of a fire hydrant. Amanda chooses comprehensive insurance. If Amanda chooses a deductible of $200 rather than the $500 deductible, how much more will her annual premium be? *(2 marks)*

continued

Assignment 1.2: Insurance and Property Tax (continued)

3. Shogun owns a home with a Boeckh replacement value of $175,000. The home is in the Metro Winnipeg zone. He chooses to have standard insurance with a deductible of $200. He also chooses to pay an extra $200 for $15,000 of additional coverage for sewer back-up. Calculate his annual insurance premium. *(3 marks)*

4. Using the table for local improvement costs, calculate the total annual tax for the following property improvements. *(2 marks)*

   a) A home with a frontage of 50 feet and a local improvement of granular surface lane.

   b) A home with a frontage of 55 feet and a local improvement of asphalt surfacing roadways.

continued

Assignment 1.2: Insurance and Property Tax (continued)

5. The Poon family owns a home with a total portioned assessment of $75,800. The frontage of the home is 60 feet. The annual municipal rate is 12.435 mills and the annual education rate is 15.278 mills. The Poon family also has to pay for lane lighting and lane oiling. Use the tables for local improvement costs.

   a) Calculate the total annual municipal taxes for the property. *(4 marks)*

   b) Calculate the total annual education taxes for the property. *(1 mark)*

   c) Calculate the total annual property taxes the Poon family has to pay. *(1 mark)*

Notes

Lesson 4: Home Maintenance

Lesson Focus

In this lesson, you will

- ❑ explore some of the daily costs of home maintenance
- ❑ look at some preventative maintenance that can reduce emergency repair costs
- ❑ look at the effect of energy efficiency options on your immediate and long-term housing costs

Lesson Introduction

When you started this module, did you think about what home maintenance costs you would need to consider when buying a home?

You probably thought of the cost of the house and perhaps the taxes, and/or the insurance. Did you know about mortgages? Did you think about maintenance costs? Maybe you did or maybe you didn't. Either way, this lesson will highlight the importance of maintaining your house.

Maintaining Your House

Before we go any further, let's think about what maintenance means.

For our purposes, the word *maintenance* means keeping your house in good condition by checking or repairing regularly. Maintaining your house is important because it helps you protect your financial investment. In addition to this, it also keeps your house looking good and it creates a safe environment. It is recommended that an amount of 1% to 3% of a homeowner's annual income be set aside as available money to cover any maintenance costs that occur.

Daily Maintenance

Daily home maintenance includes tasks that you perform on a regular basis (daily or at least weekly). Some examples of regular maintenance the homeowner should do include:

- repair dripping faucets and showers
- replace light bulbs
- prevent toilets from wasting water
- repair damage to walls
- replace items (e.g., windows) when they break
- repair electrical outlets and switches
- tighten loose stair railings
- adjust locks that are not functioning properly
- clean stove, floors, and kitchen counters
- check smoke alarms and carbon monoxide detectors

Can you think of any other maintenance tasks that should be done on a regular basis? Ask your learning partner for help if you cannot think of anything on your own.

Performing these tasks on a regular basis can actually reduce your insurance premiums in two ways.

- First, daily maintenance can reduce your premiums. If you are familiar with your property, you can predict and correct issues before they become problems that involve the insurance company. This can reduce the amount of coverage that you require, and less coverage means a lower cost.
- Second, insurance companies assess you when you are buying a property to determine if you are a high-risk client. If you can prove that you rarely, if ever, make insurance claims, you are likely to have a lower premium than if you are a high-risk client with a history of making many claims.

Preventative Maintenance

In addition to daily maintenance, there are certain tasks that you can perform on a less frequent basis that can prevent major repair costs later on. These tasks are called **preventative maintenance**, and can include

- keeping window wells and storm drains free of debris
- checking siding for damage and repairing as required
- checking driveway and sidewalk for cracks and repairing as required
- checking fence and gates for damage and repairing as required
- checking trees for damage and trimming them as required
- checking drainage around your house to ensure proper drainage
- checking roof for damage and clearing eavestroughs of all debris
- checking that the chimney and air vents are clear
- checking caulking and weather-stripping on windows and doors, and repairing as necessary
- checking water lines and water heater
- checking basement walls for cracks and condensation
- having furnace checked annually, and replacing all filters regularly
- installing a sewer backup valve to prevent basement flooding

With your learning partner, brainstorm other preventative maintenance tasks that should be done.

When you own your own house, it is a good practice to have a maintenance binder where you keep records of the different maintenance procedures you do or have done to your house. In Learning Activity 1.7, you will create a maintenance log for your house, or for your hypothetical house if you do not wish to make it for your own home.

Emergency Repairs

As the name implies, emergency repairs occur when the system or item that breaks must be fixed immediately. Items that require emergency repairs include:

- heating systems
- hot water tank
- chimneys
- doors and windows
- home foundations
- roofs
- walls
- floors and ceilings
- vents
- plumbing
- electrical systems

Can you or your learning partner think of other potential emergency repairs?

You should note that you can sometimes avoid emergency repairs (and the costs that go with them) by performing preventative maintenance. Typically, preventative maintenance targets areas of the house that, if unattended, could lead to larger problems that are expensive to repair.

Learning Activity 1.7

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Melika is taking a vacation to Hawaii. She wants to know if she can carry her suitcase on the airplane. She needs to pack clothes that weigh 5.4 kg, toiletries that weigh 2.8 kg, and books that weigh 1.2 kg. If the airport has a limit of 10 kg per carry-on bag, can she take her bag with her on the plane?
2. Evaluate: $\frac{3}{7} \times \frac{7}{6}$
3. A canoe is on sale for 35% off the regular price of $300. How much is the canoe on sale for?
4. Continue the pattern: 2, 6, 18, 54, _____ , _____ .
5. If 40 DVDs cost $100, how much does each DVD cost?

Part B: Planning Preventative Maintenance

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Explain the differences between preventative maintenance and emergency repairs.
2. In order to complete this part of the learning activity, you may need to talk to the person in charge of your household or your learning partner in order to get all of the information you need. For this learning activity, you will need:
   - a folder, duotang or binder
   - pieces of paper
   - dividers (optional)

continued

Learning Activity 1.7 (continued)

Part I: Checklists

Create a logbook that includes:

a) a checklist describing items that need to be checked each month

b) lists of items to be checked each season (these lists should be divided into subgroups, such as things to turn off/on, interior tasks, and exterior tasks)

c) an annual checklist (things that need to be done once every year)

To create these checklists, refer back to the list of preventative maintenance provided in this course, as well as the list that you made (with your learning partner). Divide these lists in order to make the checklists outlined above.

Part II: Dividers (optional)

After creating your checklists, you should include dividers titled *interior*, *exterior*, *basement*, *attic*, *garage*, and *systems*. Within each of these sections you will be able to keep receipts and warranties.

Although this section is optional within this learning assignment, it is not optional if you are using it for your own home because it is important that you keep all of this information (for yourself, the insurance company, and for the future homeowner).

Energy Efficiency

Did you know that Canada is one of the highest energy-consuming countries in the world? In fact, according to the WWF (World Wildlife Federation) *Living Planet Report* (2012), we have the eighth-largest **ecological footprint** in the world! (The ecological footprint measures how large an impact we have on our environment.) What does this mean for you? It means that we use a *lot* of energy.

As a homeowner, you have to pay for the energy you use. This includes electricity and heating. Most people want to pay as little as possible for energy. The question is, how do you maximize the efficiency of the energy you use in your house so that you can minimize the cost? (*Efficiency* means to work productively with minimum wasted effort or expense.)

Electricity

In Manitoba, we are lucky enough to have an abundance of electricity. Our electricity comes from hydro power plants (water-operated turbines) operated by Manitoba Hydro. Our electrical bills are paid to Manitoba Hydro. Costs for electricity are relatively low in Manitoba due to the abundance of water in the province. In fact, Manitoba Hydro exports some of its energy. We should still make an effort, however, to use electricity efficiently to avoid paying excessive electricity bills and to avoid adding stress to our environment.

Here are some tips to follow to reduce your electricity consumption:

- **Refrigerators** use up to 11% of your household energy consumption. Buying an energy-efficient refrigerator may cost more upfront but will save you large amounts of money in the long run. Old refrigerators use a lot more energy than new models.
- **Washing machines** also use a lot of energy. Front-loading machines are typically more energy efficient than top-loading machines because they require less water.
- **Dryers** with built-in sensors can save energy, as the dryer will turn off once the clothes are dry instead of continuing until the cycle is done.
- **Chest freezers** use less energy to stay cold than upright freezers. Also, if your freezer is too big, you could be wasting a lot of money just to keep the freezer itself cold.
- **Dishwashers** are actually energy efficient. You can waste a lot of water by pre-washing dishes. Also, new dishwashers are more energy efficient than older dishwashers.
- **Ovens** with a self-cleaning feature are typically more energy efficient because they have more insulation. Also, you are saving energy by turning on the interior light instead of opening the oven door. This may seem wrong, but it takes more energy to keep the oven heated at 450° than it does to turn on a light bulb.
- Turn off the lights when you leave a room.
- Do not leave the TV or radio on when you go to bed.

Can you think of any other steps to take to reduce your use of electricity?

Heating

Homes in Manitoba are heated in a number of ways:

- Natural gas heating—most common, especially in newer homes.
- Electricity—most common in apartments and condominiums.
- Propane heating—most common in country homes.
- Oil furnaces—most common in country homes.
- Geothermal heating—uncommon but increasingly more common for those who are environmentally conscious. These houses have pipes that extend into the ground and use the heat from the earth to heat (and cool) the house.

Which type of heating is used in your home?

If you were to give someone tips for improving heating efficiency, what would they be?

Some tips could include:

- Turn off the heat or air conditioning when you have the windows open in your house.
- Check for drafts around exterior doors and windows, and then replace the weather stripping and caulking to prevent heat from escaping. Also, look for condensation around these areas.
- Heat recovery ventilators use the heat of expelled, indoor air to preheat incoming air from outside.
- Unlike wood fireplaces, gas fireplaces can be well sealed so they prevent a large amount of heat loss. Don't forget to turn off the pilot light in the summer—it gives off heat!
- Programmable thermostats help you to conserve heat energy because you can set them to automatically lower the temperature at night or when you are not in the house.
- Replace the furnace filter every three to six months, or as needed.

The following learning activity is designed to help you learn more about energy efficiency, instead of just reading the information listed above. There are many options to choose from, but the information that should be included is the same.

Learning Activity 1.8

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Evaluate: 2^6
2. If Myla takes 14 minutes to play one hole of golf, how long will it take her to play 9 holes of golf?
3. Zahra arrived at work at 8:15 A.M. and left work at 6:15 P.M. If Zahra gets paid $10 an hour, and time-and-a-half for any hours worked over 8 hours in one day, how much did Zahra earn this day?
4. Write $2\frac{1}{3}$ as an improper fraction.
5. What number satisfies the following equation? $\frac{6}{42} = \frac{x}{7}$

Part B: Energy Awareness

In this learning activity, you will create some form of media that can be used to spread awareness about energy efficiency around the house. You can make

- a pamphlet
- a PowerPoint presentation
- a flyer
- a poster
- an essay
- a video/commercial

continued

Learning Activity 1.8 (continued)

Regardless of which form you choose, you must include the following information:

- major sources of energy waste in a home (you can use your home as an example)
- different types of energy that you use in your home
- suggestions of how to improve energy efficiency around your house
- one example of modern technology created to help improve energy efficiency (e.g., Geothermal heating or grey water systems)

Lesson Summary

In this lesson you learned about different tasks and costs you may encounter when you own a house. You looked at ways of maintaining the value and safety of your home by doing repairs as needed. You observed how you can minimize the costs of expensive repairs by performing preventative maintenance, and also how you can save money by choosing energy-efficient options.

Up to this point in this module, you have learned about many of the details involved in buying and owning a house. In the next lesson, you will compare the costs of buying a home with the costs of renting a home.

Lesson 5: Buying Compared to Renting a Home

Lesson Focus

In this lesson, you will

- ❑ compare the costs of renting vs. buying a house
- ❑ learn how to decide when it is better to rent, and when it is better to buy a home

Lesson Introduction

The previous lessons in this module exposed you to a number of the costs associated with buying and owning a home. Probably the single most important decision a person must make when gaining independence is the decision regarding accommodation. "To buy or to rent?" That question is the focus of this lesson. It is a decision that you will have to make when you start living on your own, and it is important that you make an informed decision.

Comparing Buying and Renting

There are certain factors in the decision-making process of choosing accommodation that are unaffected by whether you rent or buy a home. Location, for example, has no bearing on whether you rent or buy, unless there are a limited number of homes to rent or buy in the area where you wish to live. Utility costs such as telephone and television are probably the same in either option. It is, however, important to pay attention to the financial consequences of renting or buying, especially the long-term consequences.

Renting

There are financial factors that you must consider when renting a house:

1. How much are the rental payments and what is the payment schedule? Rental payments are usually monthly and in advance. This is suitable for most working people because they usually receive a paycheque at least once a month.
2. What is included in the rental payment? Does it include utility costs such as heat, hydro, and water? If not, these will be extra costs you will need to pay out. Is the house furnished or partly furnished? If so, it could reduce your costs of starting out on your own.
3. Does the rental payment include insurance on your personal belongings? Most often it does not, so any insurance would be an additional cost to the renter.
4. Due to costs that are less than when buying a house, does renting free up any money that you may invest? If so, these investments will create income for you at some time in the future. Rental payments, however, are not an investment and will not create any assets.

The following are other non-financial factors that may affect whether or not you decide to rent:

1. Restrictions on your living style, such as use of the yard and permission to have pets.
2. Privacy issues may be a consideration when renting.
3. Regular upkeep of the property is not usually the responsibility of the renter. This can be appealing to people who don't have the expertise and/or the time to do this kind of task.
4. When you rent a home, any money you have available for a down payment for a future purchase can be invested to create an increasing asset. Rental payments do not create assets.

Example 1A

You have the opportunity to purchase a home valued at $195,000 with a down payment of $25,000, or to rent a similar home for $975 per month.

a) If you decide to rent a house for the $975, how much money will you have spent on housing after one year?

b) Determine the total amount paid for rent in 20 years if the rental charge increases at the rate of 2% per year.

c) While renting, you invest the $25,000 that you would have used as a down payment, and invest it at a rate of 5%, compounded annually. Calculate the value of the investment after 20 years.

Solution

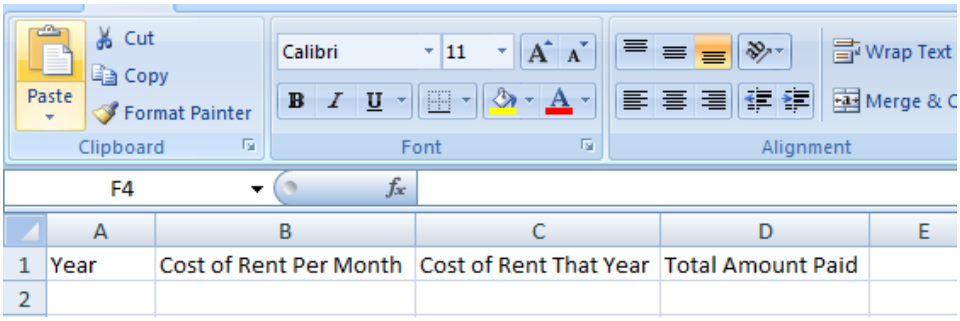
a) Cost per month = $975

Cost per year = 975 × 12 = $11,700

b) **Note:** It is possible to complete these calculations by hand, but it is a lot of work and it is easy to make mistakes. Using a spreadsheet to calculate the answer will save you a lot of time. It is recommended, therefore, if you have a computer, that you use a spreadsheet to calculate this answer.

Note, however, that you will need to know how to perform these calculations by hand for the midterm examination, but the questions will be shorter (no more than two or three rows).

Start by creating headings for your table. (You may want to name this tab **Renting**.)



	A	B	C	D	E
1	Year	Cost of Rent Per Month	Cost of Rent That Year	Total Amount Paid	
2					

You can enter the year number and the original cost of rent.

	A	B	C	D
1	Year	Cost of Rent Per Month	Cost of Rent That Year	Total Amount Paid
2	1	975		
3	2			
4	3			

The formula for calculating the cost of rent in a year for year 1 will be **=B2*12**. Enter this in cell C2, then drag it down the column by clicking the box (cell C2) in the bottom right corner of the cell once it is selected. This indicates that after 12 monthly payments of $975, you will have paid $11,700 in rent.

	A	B	C	D
1	Year	Cost of Rent Per Month	Cost of Rent That Year	Total Amount Paid
2	1	975	=B2*12	
3	2			

	A	B	C	D
1	Year	Cost of Rent Per Month	Cost of Rent That Year	Total Amount Paid
2	1	975	11700	
3	2			
4	3			
5	4			
6	5			
7	6			

For now, zeros will appear in the cells below 11700, but that is not a problem. The numbers will change once we put a value in the **cost of rent per month** column beside them. We know that the cost of rent increases by 2% every year, so the formula for the cost of rent per month (cell B3) is **=B2*1.02**. Again, we can drag this formula down to fill 20 years (to cell B21). This indicates that the cost of rent increases by 2% each year from the previous year's rent amount.

	A	B	C	D
1	Year	Cost of Rent Per Month	Cost of Rent That Year	Total Amount Paid
2	1	975	11700	
3	2	=B2*1.02	0	
4	3		0	

	A	B	C	D
1	Year	Cost of Rent Per Month	Cost of Rent That Year	Total Amount Paid
2	1	975	11700	
3	2	994.5	11934	
4	3	1014.39	12172.68	
5	4	1034.6778	12416.1336	
6	5	1055.371356	12664.45627	
7	6	1076.478783	12917.7454	
8	7	1098.008359	13176.10031	

As you can see, we have several decimal places. To correct this (since money is usually measured to two decimal places), you must highlight all the cells that have dollar values in them, right-click, select **format cells**, and then under the number tab select **currency**. Press OK and your table should now look like this.

	A	B	C	D
1	Year	Cost of Rent Per Month	Cost of Rent That Year	Total Amount Paid
2	1	$975.00	$11,700.00	
3	2	$994.50	$11,934.00	
4	3	$1,014.39	$12,172.68	
5	4	$1,034.68	$12,416.13	
6	5	$1,055.37	$12,664.46	

To find the total amount paid after each year, you must enter a new formula. The cell for the first year (D2) will be the same as the total cost of rent that year, so you can enter **=C2**.

	A	B	C	D	E
1	Year	Cost of Rent Per Month	Cost of Rent That Year	Total Amount Paid	
2	1	$975.00	$11,700.00	$11,700.00	
3	2	$994.50	$11,934.00		

For the second year, the formula in cell D3 should be **=D2+C3**. Again, you can drag this down the rest of the column. This indicates the total amount paid for rent after each year.

	A	B	C	D
1	Year	Cost of Rent Per Month	Cost of Rent That Year	Total Amount Paid
2	1	$975.00	$11,700.00	$11,700.00
3	2	$994.50	$11,934.00	=D2+C3
4	3	$1,014.39	$12,172.68	

	A	B	C	D	E
1	Year	Cost of Rent Per Month	Cost of Rent That Year	Total Amount Paid	
2	1	$975.00	$11,700.00	$11,700.00	
3	2	$994.50	$11,934.00	$23,634.00	
4	3	$1,014.39	$12,172.68	$35,806.68	
5	4	$1,034.68	$12,416.13	$48,222.81	
6	5	$1,055.37	$12,664.46	$60,887.27	

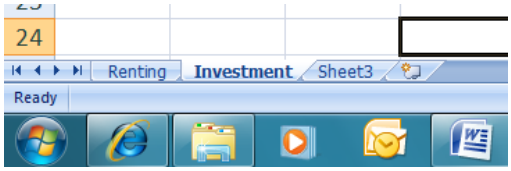
	A	B	C	D
1	Year	Cost of Rent Per Month	Cost of Rent That Year	Total Amount Paid
2	1	$975.00	$11,700.00	$11,700.00
3	2	$994.50	$11,934.00	$23,634.00
4	3	$1,014.39	$12,172.68	$35,806.68
5	4	$1,034.68	$12,416.13	$48,222.81
6	5	$1,055.37	$12,664.46	$60,887.27
7	6	$1,076.48	$12,917.75	$73,805.02
8	7	$1,098.01	$13,176.10	$86,981.12
9	8	$1,119.97	$13,439.62	$100,420.74
10	9	$1,142.37	$13,708.41	$114,129.15
11	10	$1,165.22	$13,982.58	$128,111.74
12	11	$1,188.52	$14,262.23	$142,373.97
13	12	$1,212.29	$14,547.48	$156,921.45
14	13	$1,236.54	$14,838.43	$171,759.88
15	14	$1,261.27	$15,135.20	$186,895.08
16	15	$1,286.49	$15,437.90	$202,332.98
17	16	$1,312.22	$15,746.66	$218,079.64
18	17	$1,338.47	$16,061.59	$234,141.23
19	18	$1,365.24	$16,382.82	$250,524.05
20	19	$1,392.54	$16,710.48	$267,234.54
21	20	$1,420.39	$17,044.69	$284,279.23

Thus, after 20 years, you will have paid $284,279.23 in rent.

Note: You can use this spreadsheet to find the total amount of rent paid in any number of years by using the **fill-down** feature.

c) Again, it is possible to complete these calculations by hand. However, creating a spreadsheet can save time and reduce the possibility of mistakes when doing multiple calculations. Therefore, use a spreadsheet to solve this problem if you have a computer available.

Under a new tab in your spreadsheet (you may want to name this tab **Investment**), create headings for your table.



	A	B	C
1	Year	Value of Investment	
2			

You can add the number of years (up to 20 years) in the **Year** column, and the original investment amount as the **Investment** in year 1 (cell B2).

	A	B
1	Year	Value of Investment
2	1	25000
3	2	
4	3	
5	4	

Beside your table, label a cell as the **Interest Rate**, and in the cell beside it enter the interest rate percentage.

	A	B	C	D	E
1	Year	Value of Investment			
2	1	25000		Interest Rate	1.05
3	2				
4	3				

Note: The interest rate is entered as 1.05 because the interest is added to the previous value of the investment. For example, \$25000 × 1.05 = \$26,250, which is the value of the investment after one year, or the value of the investment at the beginning of year two.

The formula for cell B3 (calculating the value of the investment) will then be **=B2*E2**. The dollar signs are inserted in front of the E and the 2 to ensure that when you use the **Fill-Down** feature later, the **E2** part of the formula remains fixed (i.e., it does not change to **E3**, **E4**, etc.).

	A	B	C	D	E
1	Year	Value of Investment			
2	1	25000		Interest Rate	1.05
3	2	26250			
4	3				

You can then drag the formula from this box down to the other cells in the column.

B6 f_x =B5*E2

	A	B	C	D	E
1	Year	Value of Investment			
2	1	25000		Interest Rate	1.05
3	2	26250			
4	3	27562.5			
5	4	28940.625			
6	5	30387.65625			
7	6	31907.03906			

Note: The formula for cell B5 still refers to cell E2.

Again, you can see that there are more than two decimal places, so you should reformat these cells as Currency cells.

	A	B	C	D	E
1	Year	Value of Investment			
2	1	$25,000.00		Interest Rate	1.05
3	2	$26,250.00			
4	3	$27,562.50			
5	4	$28,940.63			
6	5	$30,387.66			

	A	B	C	D	E
1	Year	Value of Investment			
2	1	$25,000.00		Interest Rate	1.05
3	2	$26,250.00			
4	3	$27,562.50			
5	4	$28,940.63			
6	5	$30,387.66			
7	6	$31,907.04			
8	7	$33,502.39			
9	8	$35,177.51			
10	9	$36,936.39			
11	10	$38,783.21			
12	11	$40,722.37			
13	12	$42,758.48			
14	13	$44,896.41			
15	14	$47,141.23			
16	15	$49,498.29			
17	16	$51,973.20			
18	17	$54,571.86			
19	18	$57,300.46			
20	19	$60,165.48			
21	20	$63,173.75			

Thus, after 20 years, the investment is worth $63,173.75.

Note: You can use this spreadsheet to find the value of the investment in any number of years by dragging the formulas used in each column down further.

Note also: You can use this spreadsheet to find the final value of the investment for any interest rate. If you change the value of cell E2 to 1.07, the spreadsheet automatically calculates the value of the investment for 20 years at 7%.

The result from part (b) shows that you will have paid $284,279.20 for 20 years of rent, and from part (c) it shows that your savings will have grown to $63,173.75. The advantage of buying is that, after 20 years, you will gain a house that will be worth much more than the savings shown here.

Buying

When you are considering the purchase of a home, the most important question is "What is the price of a home that you can afford?" Banks and other lending institutions have developed a formula that allows you to calculate the maximum price of a house that you can afford. You learned how to do this in Lesson 1 of this module.

Example 1B

Refer to Example 1A. You have decided to buy the house.

a) Use the amortization table from Lesson 2 to calculate the monthly payment for the mortgage if you decide to take out a mortgage for 20 years at 3.5%.

b) Use a spreadsheet to create a payment schedule for the first year of ownership.

c) The total portioned assessment of the home is $98,000. The municipal mill rate is 14.945 and the education tax mill rate is 15.492. Calculate the property taxes if there are no local improvement costs.

d) Using your calculations in parts (b) and (c), how much will you spend in the first year (including the $25,000 down payment)?

e) Using the payment schedule you created in part (b), find the amount of outstanding balance left on the mortgage after one year of payments.

f) If the house increases in value at a rate of 4% per year, what is the value of the home after one year?

Solution

a) Mortgage = $195,000 − $25,000 = $170,000

$$\frac{\text{Mortgage}}{\$1000} \text{ at } 3.5\% \text{ for 20 years} = \$5.79$$

$$\text{Monthly payment} = \frac{\$170,000}{1000} \times 5.79 = \$984.30$$

b) Your payment schedule should look like the following chart. This spreadsheet is similar to the one in Lesson 2, with some additional entries. Name this tab **Mortgage Payment Schedule.** If you don't have a computer, calculate the first 3 months using your calculator and create a chart like the one below.

Note the following formulas and instructions:

- cell C3: **=E2∗I2∗(1/12)** using $I = PRT$ where time is one month or $\frac{1}{12}$ years
- cell D3: **=B3–C3**
- cell E3: **=E2-D3**
- cell F3: **=F2+D3**
- cell G3: **=G2+B3**
- cell I2: annual interest rate in formula $I = PRT$ must be written in decimal form

	A	B	C	D	E	F	G	H	I
1	Pmt#	Payment	Interest	Principal	Unpaid Bal	Equity	Total Paid		
2					$170,000.00	$25,000.00	$25,000.00	Annual Interest Rate	0.0350
3	1	$984.30	$495.83	$488.47	$169,511.53	$25,488.47	$25,984.30		
4	2	$984.30	$494.41	$489.89	$169,021.64	$25,978.36	$26,968.60		
5	3	$984.30	$492.98	$491.32	$168,530.32	$26,469.68	$27,952.90		
6	4	$984.30	$491.55	$492.75	$168,037.57	$26,962.43	$28,937.20		
7	5	$984.30	$490.11	$494.19	$167,543.38	$27,456.62	$29,921.50		
8	6	$984.30	$488.67	$495.63	$167,047.75	$27,952.25	$30,905.80		
9	7	$984.30	$487.22	$497.08	$166,550.67	$28,449.33	$31,890.10		
10	8	$984.30	$485.77	$498.53	$166,052.14	$28,947.86	$32,874.40		
11	9	$984.30	$484.32	$499.98	$165,552.16	$29,447.84	$33,858.70		
12	10	$984.30	$482.86	$501.44	$165,050.72	$29,949.28	$34,843.00		
13	11	$984.30	$481.40	$502.90	$164,547.82	$30,452.18	$35,827.30		
14	12	$984.30	$479.93	$504.37	$164,043.45	$30,956.55	$36,811.60		

c) $$\text{General municipal tax} = \frac{\text{total portioned assessment}}{1000} \times \text{municipal mill rate}$$

$$= \frac{\$98,000}{1000} \times 14.945$$

$$= \$1464.61$$

$$\text{Education taxes} = \frac{\text{total portioned assessment}}{1000} \times \text{education mill rate}$$

$$= \frac{\$98,000}{1000} \times 15.492$$

$$= \$1518.22$$

Total: $1464.61 + $1518.22 = $2982.83

d) Total paid in first year

= amount paid on the house (cell G14) + property taxes

= $36,811.60 + $2982.83

= $39,794.43

e) Amount still owed on mortgage = $164,043.45

f) Value of the property after one year = $195,000 × 1.04 = $202,800

Comparing: Renting vs. Buying

In the following example, you will compare the cost of renting a home versus the cost of purchasing a home over a period of 10 years.

When dealing with a rental, you need to take into consideration:

- rental increases
- money earned by the investment of the down payment

When dealing with a purchase, you need to take into consideration:

- down payment
- mortgage payments
- equity in the property
- increase in the value of the home
- property taxes
- homeowner's insurance
- maintenance

The calculations in the following example do not include all the costs involved (for example, closing costs or lawyers' fees). However, the calculations provide a fairly accurate comparison of the costs of renting versus purchasing.

Example 1C

Fred and Lori Patch can purchase a home for $210,000 or rent it for $950.00 per month. They have $30,000 for a down payment if they buy, or $30,000 to invest if they rent.

Assume that

- rental payments are $950 per month, and increase by 1.5% each year
- they can earn 2% interest per year on money they invest
- if they make a loan, the mortgage will be for 25 years at 3.5%, which means that each monthly mortgage payment will be $898.20

- the house will appreciate at 2% per year and will be worth about $256,000 after 10 years
- property taxes are $2350 per year, and increase by 1.5% annually
- house insurance is $625 per year, and increases by 1.5% annually
- maintenance is estimated at 1.5% per year, based on the appreciated value of the house each year

a) Use the following spreadsheet data to calculate the net rental cost after 10 years. Calculate the net cost using the first spreadsheet, which shows the cost of renting (the rent paid over 10 years), and the second spreadsheet, which shows the benefit of renting (investment earnings on $30,000 over 10 years).

net rental cost = total rent payments − increase in investments

- To calculate monthly payment, multiply previous payment by 1.015 (representing 1.5% increase).
- To calculate annual cost, multiply monthly payment by 12.
- To calculate total rent, add previous year's total rent and the current year's annual cost.
- The principal in the current year is copied from the previous year's balance.
- To calculate the interest, multiply the principal by 0.02 (representing 2%).
- To calculate the balance, add the principal and interest.
- To calculate the net increase, subtract the balance from the original $30,000 balance.

	A	B	C	D
1	Year	Monthly Payment	Annual Cost	Total Rent
2	1	$950.00	$11,400.00	$11,400.00
3	2	$964.25	$11,571.00	$22,971.00
4	3	$978.71	$11,744.57	$34,715.57
5	4	$993.39	$11,920.73	$46,636.30
6	5	$1,008.30	$12,099.54	$58,735.84
7	6	$1,023.42	$12,281.04	$71,016.88
8	7	$1,038.77	$12,465.25	$83,482.13
9	8	$1,054.35	$12,652.23	$96,134.37
10	9	$1,070.17	$12,842.02	$108,976.38
11	10	$1,086.22	$13,034.65	$122,011.03

	A	B	C	D	E
1	Year	Principal	Interest	Balance	Net Increase
2				$30,000.00	
3	1	$30,000.00	$600.00	$30,600.00	$600.00
4	2	$30,600.00	$612.00	$31,212.00	$1,212.00
5	3	$31,212.00	$624.24	$31,836.24	$1,836.24
6	4	$31,836.24	$636.72	$32,472.96	$2,472.96
7	5	$32,472.96	$649.46	$33,122.42	$3,122.42
8	6	$33,122.42	$662.45	$33,784.87	$3,784.87
9	7	$33,784.87	$675.70	$34,460.57	$4,460.57
10	8	$34,460.57	$689.21	$35,149.78	$5,149.78
11	9	$35,149.78	$703.00	$35,852.78	$5,852.78
12	10	$35,852.78	$717.06	$36,569.83	$6,569.83

b) Calculate the total cost of mortgage payments after 10 years assuming that you pay $898.20 per month over the length of the entire mortgage.

c) Use your mortgage payment calculation from part (b) and the following spreadsheet data to calculate the net cost of home ownership after 10 years. The formulas given below indicate what needs to be considered in your calculations.

Costs of Buying = down payment + mortgage payments + maintenance cost + property tax + house insurance

Benefits of Buying = appreciation + owner's equity

Net Costs = costs of buying − benefits of buying

Appreciation is the term used for the increase in the value of a house over time (in this instance, 10 years). The following spreadsheet shows the appreciation of the house as well as the maintenance costs, using the percentage increases given in the example.

	A	B	C	D	E
1	Year	Principal	Appreciation	Annual Maintenance	Total Maintenance
2		$210,000.00			
3	1	$214,200.00	$4,200.00	$3,213.00	$3,213.00
4	2	$218,484.00	$8,484.00	$3,277.26	$6,490.26
5	3	$222,853.68	$12,853.68	$3,342.81	$9,833.07
6	4	$227,310.75	$17,310.75	$3,409.66	$13,242.73
7	5	$231,856.97	$21,856.97	$3,477.85	$16,720.58
8	6	$236,494.11	$26,494.11	$3,547.41	$20,267.99
9	7	$241,223.99	$31,223.99	$3,618.36	$23,886.35
10	8	$246,048.47	$36,048.47	$3,690.73	$27,577.08
11	9	$250,969.44	$40,969.44	$3,764.54	$31,341.62
12	10	$255,988.83	$45,988.83	$3,839.83	$35,181.45

The following spreadsheet shows the property taxes and the insurance costs.

	A	B	C	D	E
1	Year	Annual Property Taxes	Total Property Taxes	Annual House Insurance	Total House Insurance
2	1	$2,350.00	$2,350.00	$625.00	$625.00
3	2	$2,385.25	$4,735.25	$634.38	$1,259.38
4	3	$2,421.03	$7,156.28	$643.89	$1,903.27
5	4	$2,457.34	$9,613.62	$653.55	$2,556.81
6	5	$2,494.20	$12,107.83	$663.35	$3,220.17
7	6	$2,531.62	$14,639.44	$673.30	$3,893.47
8	7	$2,569.59	$17,209.04	$683.40	$4,576.87
9	8	$2,608.14	$19,817.17	$693.65	$5,270.52
10	9	$2,647.26	$22,464.43	$704.06	$5,974.58
11	10	$2,686.97	$25,151.40	$714.62	$6,689.20

You also need to know that the increase in owner's equity after making mortgage payments for 10 years is $83,529.01.

d) Compare the net costs of renting and buying. Which would you prefer and why?

e) List some reasons why some people may prefer to rent instead of buying a home even though, after 10 years, it is less expensive to buy.

Solution

a) net cost of renting = \$122,011.03 − \$6569.83 = \$115,441.20

b) total mortgage cost = \$898.20 × 12 (payments per year) × 10 (years) = \$107,784.00

c) costs of buying = \$30,000 + \$107,784.00 + \$35,181.45 + \$25,151.40 + \$6689.20 = \$204,806.05

benefits of buying = \$45,988.83 + \$83,529.01 = \$129,517.84

net cost of buying = \$204,806.05 − \$129,517.84 = \$75,288.21

d) The net cost of renting is higher by \$40,152.99 (\$115,441.20 − \$75,288.21). In the long run, it is beneficial to buy since the benefits of buying mean that the owner will eventually have an item of value that can be sold.

e) People may rent instead of buy because

- renting does not require a large down payment
- they do not need to pay all the fees included with the purchase of a home
- they are not responsible for repairs and maintenance costs
- the appreciation and owner's equity are not available to them as cash until the home is sold
- maybe they did not expect to live in a rented house for 10 years

Learning Activity 1.9

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Gina realized that she had 3 more quarters in her pocket than she thought she had. If Gina has \$7.50 in quarters in her pocket, how many quarters did she originally think she had?
2. Leticia worked 20 hours this week and made \$220. If she works 15 hours next week at the same pay rate, how much will she earn?

continued

3. If the gas tank in your vehicle holds 30 litres of gasoline and gasoline costs $1.30 a litre, how much will it cost to fill up your vehicle with gasoline?
4. Evaluate: $\frac{1}{4} + \frac{2}{7}$
5. Estimate 13% of 306.

Part B: Deciding to Rent or Buy a Home

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

Note: You will not be required to use a spreadsheet program on your midterm examination.

William and Constance Swift can purchase an older home that needs updating for $195,000 or rent it for $1450 per month. They have $12,000 for a down payment if they buy, or $12,000 to invest if they rent.

Assume that

- rental payments are $1450.00 per month, and increase by 3.5% each year
- they can earn 4.6% interest per year on money they invest
- if they make a loan, the mortgage will be for 15 years at 5.75%
- owner's equity after 12 years will be $156,656.18
- the house will appreciate at 4.25% per year
- property taxes are $1950.00 per year, and increase by 2.6% annually
- house insurance is $475 per year, and increases by 2.8% annually
- maintenance is estimated at 2.5% per year, based on the appreciated value of the house each year

continued

Learning Activity 1.9 (continued)

Note that the equity has been calculated for you because it is a very large spreadsheet—too lengthy to print. You will need this number for part (g).

a) Complete Row 13 of the spreadsheet that shows the total rent paid in 12 years. What is the total rent paid?

	A	B	C	D
1	Year	Monthly Rent	Annual Rent	Total Rent Paid
2	1	$1,450.00	$17,400.00	$17,400.00
3	2	$1,500.75	$18,009.00	$35,409.00
4	3	$1,553.28	$18,639.32	$54,048.32
5	4	$1,607.64	$19,291.69	$73,340.01
6	5	$1,663.91	$19,966.90	$93,306.91
7	6	$1,722.15	$20,665.74	$113,972.65
8	7	$1,782.42	$21,389.04	$135,361.69
9	8	$1,844.80	$22,137.66	$157,499.35
10	9	$1,909.37	$22,912.48	$180,411.83
11	10	$1,976.20	$23,714.41	$204,126.24
12	11	$2,045.37	$24,544.42	$228,670.66
13				

b) Complete Row 14 of the spreadsheet that shows the value of the investment after 12 years. How much did the investment earn?

	A	B	C
1	Year	Annual Values	Total Earned
2	1	$12,000.00	
3	2	$12,552.00	$552.00
4	3	$13,129.39	$1,129.39
5	4	$13,733.34	$1,733.34
6	5	$14,365.08	$2,365.08
7	6	$15,025.87	$3,025.87
8	7	$15,717.06	$3,717.06
9	8	$16,440.05	$4,440.05
10	9	$17,196.29	$5,196.29
11	10	$17,987.32	$5,987.32
12	11	$18,814.73	$6,814.73
13	12	$19,680.21	$7,680.21
14			

continued

Learning Activity 1.9 (continued)

c) Using the spreadsheet data, calculate the net rental charge after 12 years. Use the formula:

Net rental cost = rental payments − investment earnings

d) Calculate the total cost of mortgage payments after 12 years.

e) Complete Row 13 of the spreadsheet to calculate the appreciated value of the house after 12 years and the total amount spent on maintenance costs after 12 years.

	A	B	C	D	E
1	Year	Value	Appreciation	Annual Maint.	Total Maint.
2	1	$195,000.00			
3	2	$203,287.50	$8,287.50	$5,082.19	$5,082.19
4	3	$211,927.22	$16,927.22	$5,298.18	$10,380.37
5	4	$220,934.13	$25,934.13	$5,523.35	$15,903.72
6	5	$230,323.83	$35,323.83	$5,758.10	$21,661.82
7	6	$240,112.59	$45,112.59	$6,002.81	$27,664.63
8	7	$250,317.37	$55,317.37	$6,257.93	$33,922.57
9	8	$260,955.86	$65,955.86	$6,523.90	$40,446.46
10	9	$272,046.49	$77,046.49	$6,801.16	$47,247.62
11	10	$283,608.46	$88,608.46	$7,090.21	$54,337.84
12	11	$295,661.82	$100,661.82	$7,391.55	$61,729.38
13	12	$308,227.45	$113,227.45	$7,705.69	$69,435.07
14					

f) Complete Row 13 of the spreadsheet to calculate the total cost of all property taxes and insurance payments for 12 years.

	A	B	C	D	E
1	Year	Annual Prop Tax	Total Prop Tax	Annual Insurance	Total Insurance
2	1	$1,950.00	$1,950.00	$475.00	$475.00
3	2	$2,000.70	$3,950.70	$488.30	$963.30
4	3	$2,052.72	$6,003.42	$501.97	$1,465.27
5	4	$2,106.09	$8,109.51	$516.03	$1,981.30
6	5	$2,160.85	$10,270.35	$530.48	$2,511.78
7	6	$2,217.03	$12,487.38	$545.33	$3,057.11
8	7	$2,274.67	$14,762.06	$560.60	$3,617.71
9	8	$2,333.81	$17,095.87	$576.30	$4,194.00
10	9	$2,394.49	$19,490.36	$592.43	$4,786.43
11	10	$2,456.75	$21,947.11	$609.02	$5,395.45
12	11	$2,520.62	$24,467.74	$626.07	$6,021.53
13					

continued

Learning Activity 1.9 (continued)

g) Calculate the net cost of home ownership after 12 years. Use the formula:

Net cost = down payment + mortgage payments + maintenance + property taxes + insurance − (appreciation + increase in owner's equity)

h) Which is less expensive after 12 years, renting or buying? How much less expensive?

i) State some things the Swift family must consider before buying this house.

Lesson Summary

In this lesson, you compared the costs and benefits of renting or buying a home. You are reminded again that some factors were not considered when calculating the cost of buying a home, because the problems would become too complex. The purpose of this lesson is to demonstrate that, in the long term, it is less expensive to buy a home than to rent.

Be sure to check your answers from the previous learning activity. You need to understand the material from this lesson before moving on to the following assignment. If any material seems challenging to you, be sure to ask your tutor/marker or learning partner for help. Also, make sure your resource sheet is up to date with all definitions and sample solutions for some of the more difficult questions.

Notes

Assignment 1.3

Making Decisions

Total: 33 marks

Note to Students: Do not forget to update your resource sheet. This is your last assignment for this module, so you may want to check that it is up to date.

Some of the questions in this assignment can be answered with the help of a spreadsheet program if you have a computer. If you use a spreadsheet, be sure to include clearly labelled printouts of the spreadsheets you create. Also, include a printed copy of the spreadsheet formulas you used to determine your answers.

1. Explain the following terms: *(3 marks)*

   Daily Maintenance

   _____

   _____

   _____

   Preventative Maintenance

   _____

   _____

   _____

   Emergency Repairs

   _____

   _____

   _____

continued

Assignment 1.3: Making Decisions (continued)

2. a) List two ways that people can be more efficient with their use of electricity. *(2 marks)*

b) List two ways that people can be more efficient with heating their homes. *(2 marks)*

continued

Assignment 1.3: Making Decisions (continued)

3. The Schneblae family can purchase a home for $215,000 or rent it for $1350.00 per month. They have $40,000 for a down payment if they buy, or $40,000 to invest if they rent.

   Assume that

   - rental payments are $1350.00 per month, and increase by 2.5% each year
   - they can earn 5% interest per year on money they invest
   - if they make a loan, the mortgage will be for 20 years at 6.5%
   - owner's equity after 6 years will be $46,961.22
   - the house is expected to appreciate at 3% per year
   - property taxes are $3065 per year, and are expected to increase at 3% per year
   - house insurance is $595 per year, and increases by 2.8% annually
   - maintenance is estimated at 1% per year, based on the value of the house at the beginning of each year

   a) Complete Row 6 of the spreadsheet that shows the total rent paid in 6 years. *(3 marks)*

	A	B	C	D
	Year	Monthly Rent	Annual Rent	Annual Total
1	1	$1,350.00	$16,200.00	$16,200.00
2	2	$1,383.75	$16,605.00	$32,805.00
3	3	$1,418.34	$17,020.13	$49,825.13
4	4	$1,453.80	$17,445.63	$67,270.75
5	5	$1,490.15	$17,881.77	$85,152.52
6				

   b) Complete Row 8 of the spreadsheet that shows the value of the investment ($40,000) after 6 years. How much did the investment earn? *(2 marks)*

	A	B	C
1	Year	Annual	Earned
2		$40,000.00	
3	1	$42,000.00	$2,000.00
4	2	$44,100.00	$4,100.00
5	3	$46,305.00	$6,305.00
6	4	$48,620.25	$8,620.25
7	5	$51,051.26	$11,051.26
8			

continued

Assignment 1.3: Making Decisions (continued)

c) Calculate the net rental charge after 6 years. Use the formula:

Net rental cost = rental payments − investment earnings *(2 marks)*

d) Calculate the total cost of mortgage payments after 6 years. *(4 marks)*

e) Complete Row 8 of the spreadsheet to calculate the appreciated value of the house after 6 years, and also calculate the total maintenance costs for 6 years. *(4 marks)*

	A	B	C	D	E
1	Year	Value	Appreciation	Maintenance	Total Maint.
2		$215,000.00			
3	1	$221,450.00	$6,450.00	$2,214.50	$2,214.50
4	2	$228,093.50	$13,093.50	$2,280.94	$4,495.44
5	3	$234,936.31	$19,936.31	$2,349.36	$6,844.80
6	4	$241,984.39	$26,984.39	$2,419.84	$9,264.64
7	5	$249,243.93	$34,243.93	$2,492.44	$11,757.08
8					

f) Complete Row 7 of the spreadsheet to calculate the total cost of all property taxes and insurance payments for 6 years. *(4 marks)*

	A	B	C	D	E
1	Year	Annual Prop Tax	Total Prop Tax	Annual Insurance	Total Insurance
2	1	$3,065.00	$3,065.00	$595.00	$595.00
3	2	$3,156.95	$6,221.95	$611.66	$1,206.66
4	3	$3,251.66	$9,473.61	$628.79	$1,835.45
5	4	$3,349.21	$12,822.82	$646.39	$2,481.84
6	5	$3,449.68	$16,272.50	$664.49	$3,146.33
7					

continued

Assignment 1.3: Making Decisions (continued)

g) Calculate the net cost of home ownership after 6 years. Use the formula:

Net cost = down payment + mortgage payments + maintenance + property taxes + insurance − (appreciation + increase in owner's equity) *(2 marks)*

h) Which is less expensive after 6 years, renting or buying? How much less expensive? *(2 marks)*

i) Why would some people rent instead of buy if it is less expensive after 6 years to buy than rent? State at least three reasons. *(3 marks)*

Notes

Module 1 Summary

Congratulations, you have completed the first module in the course. In this module, you studied the financial aspects of whether to rent or buy a home and the costs associated with maintaining a home. At this point, you should have completed the four assignments listed below. If you have not, then go back and complete them now. Also, this is a good time to look over your resource sheet for Module 1 and add any information you feel is important.

The next module shifts your focus to geometry and trigonometry. If you do not have a scientific calculator and a protractor, you will need to get them for the following module.

Submitting Your Assignments

It is now time for you to submit the Module 1 Cover Assignment and Assignments 1.1 to 1.3 to the Distance Learning Unit so that you can receive some feedback on how you are doing in this course. Remember that you must submit all the assignments in this course before you can receive your credit.

Make sure you have completed all parts of your Module 1 assignments and organize your material in the following order:

- ❑ Module 1 Cover Sheet (found at the end of the course Introduction)
- ❑ Module 1 Cover Assignment: Investments Using Spreadsheets
- ❑ Assignment 1.1: Affordability, Initial Costs, and Mortgages
- ❑ Assignment 1.2: Insurance and Property Tax
- ❑ Assignment 1.3: Making Decisions

For instructions on submitting your assignments, refer to How to Submit Assignments in the course Introduction.

Notes

Grade 12 Essential Mathematics (40S)

Module 1
Home Finance

Learning Activity Answer Keys

Module 1:
Home Finance

Learning Activity 1.1

There is no answer key for this learning activity.

Learning Activity 1.2

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Evaluate for $z = -1$: $3z - (-7)$
2. How much tax would you have to pay on an item that costs $49.99 (approximately) if the PST = 7% and the GST = 5%?
3. Since 10% of 440 is 44, what is 35% of 440?
4. Evaluate: $\left(\frac{8}{16}\right) \times 12$
5. You have to buy a new toaster for your house. The toaster you want to buy costs $54.45, including tax. If you give the cashier $60, how much change should you get back?

Answers:

1. 4 ($3(-1) + 7 = -3 + 7 = 4$)
2. $6 (12% of $100 = $12; 12% of $50 = $6)
3. 154 (10% of 440 = 44; 5% of 440 = 22; 35% of 440 = 44 + 44 + 44 + 22 = 154)
4. $6 \left(\left(\frac{1}{2}\right) \times 12 = 6\right)$
5. $5.55 (0.55 + 5 = 5.55)

Part B: Calculations Using the Gross Debt Service Ratio

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand. Don't forget that you can ask your learning partner or tutor/marker for help if you are having a hard time understanding.

1. State the Gross Debt Service Ratio. How does it relate to home affordability?

   Answer:

   Gross Debt Service Ratio (GDSR) =

   $$\frac{\text{Monthly Mortgage Payment + Property Taxes + Heating}}{\text{Gross Monthly Income}} \times 100$$

   GDSR must be less than 32% to indicate you can afford a specific home.

   GDSR can be used to tell you how much you can afford to spend on a home.

2. Calculate the Gross Debt Service Ratio for the following situations. For each situation, state the likelihood of a financial institution granting a mortgage for the house.

   a) Monthly mortgage payment is $710, monthly property taxes are $118, monthly heating costs equal $96, and the gross monthly income is $3000.

   Answer:

   $$\text{Gross Debt Service Ratio (GDSR)} = \frac{710 + 118 + 96}{3000} \times 100$$
   $$= \frac{924}{3000} \times 100$$
   $$= 30.8\% \text{ (round to the nearest tenth)}$$

   The financial institution would probably grant a mortgage in this case because the GDSR is lower than the maximum 32%. However, it is close to the maximum amount allowed.

b) Monthly mortgage payment is $716, annual property taxes are $2500, the monthly heating costs are $116, and the gross monthly income is $2340.

Answer:

$$\text{monthly property taxes} = \frac{2500}{12}$$
$$= \$208.33$$
$$\text{Gross Debt Service Ratio (GDSR)} = \frac{716 + 208.33 + 116}{2340} \times 100$$
$$= \frac{1040.33}{2340} \times 100$$
$$= 44.5\%$$

The financial institution would not grant a mortgage in this case because the GDSR calculated is much higher than 32%.

c) Monthly mortgage payment is $1000, annual property taxes are $2300, monthly heating costs average $105, and the gross annual income is $68,000.

Answer:

$$\text{monthly property taxes} = \frac{2300}{12}$$
$$= \$191.67$$
$$\text{monthly gross income} = \frac{\$68,000}{12}$$
$$= \$5666.67$$
$$\text{Gross Debt Service Ratio (GDSR)} = \frac{1000 + 191.67 + 105}{5666.67} \times 100$$
$$= \frac{1296.67}{5666.67} \times 100$$
$$= 22.9\%$$

The financial institution would most likely grant a mortgage in this situation because the GDSR is much lower than the 32% maximum.

3. The Cadloff family are planning to purchase a home. The family has a gross monthly income of $4400. They are able to make a down payment of $20,000 toward the purchase of their home. The bank offers the family an interest rate of 4%. They estimate their monthly property taxes to be around $230 and their heating costs to be about $120 per month. Calculate the maximum price the Cadloffs can pay for a home. (Use the chart below or create your own spreadsheet.)

Answer:

Maximum Affordable Home Price		
Gross monthly household income		$ 4,400.00
Multiply: (GDSR)	32%	
Total affordable household expenses		$ 1,408.00
Subtract:		
Monthly property taxes	$ 230.00	
Monthly heating costs	$ 120.00	
One-half of condo/strata fees (if applicable)	$	
Monthly affordable mortgage payment		$ 1,058.00
Divide: Interest factor (from Chart 1.1)	0.00526	
Amount of affordable mortgage		$ 201,140.68
Add: Cash down payment	$ 20,000.00	
Maximum affordable home price		$ 221,140.68

4. Alex Gardner wants to purchase a condominium. Alex has a gross annual income of $42,600. He has saved $10,000 for a down payment. His financial institution offered him an 3.5% interest rate on a mortgage. Alex estimates his monthly property taxes will be $110 and his monthly heating costs will be $40. Condo fees are $275 per month. Calculate the maximum price Alex can pay for his condominium. (Use either the chart below or your own spreadsheet.)

   Answer:

Maximum Affordable Home Price		
Gross monthly household income	($42,600 ÷ 12)	$ 3,550.00
Multiply: (GDSR)	32%	
Total affordable household expenses		$ 1,136.00
Subtract:		
Monthly property taxes	$ 110.00	
Monthly heating costs	$ 40.00	
One-half of condo/strata fees (if applicable)	$ 137.50	
Monthly affordable mortgage payment		$ 848.50
Divide: Interest factor (from Chart 1.1)	0.00499	
Amount of affordable mortgage		$ 170,040.08
Add: Cash down payment	$ 10,000.00	
Maximum affordable home price		$ 180,040.08

Learning Activity 1.3

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Evaluate: $\left(\frac{3}{7}\right) \times \left(\frac{14}{6}\right)$

2. You are furnishing your new apartment with a budget of $2800. You have already bought a couch for $925, table and chairs for $750, and a stove for $1075. How much money do you have left in your budget to buy a refrigerator? Is this reasonable?

3. Write two equivalent fractions for $\frac{17}{34}$.

4. Josiah and his family go out for dinner and their restaurant bill is $126. If they want to leave a 15% tip, how much should they leave?

5. You are approved for a $219,000 mortgage from your bank. If you have saved up an additional $16,000 for a down payment, how much can you afford to spend on a house?

Answers:

1. $1 \left(\frac{3 \times 14}{7 \times 6} = \frac{42}{42} = 1 \right)$

2. $50 (Costs = 900 + 700 + 1000 + 25 + 7 + 50 = 2600 + 100 + 50 = 2750; Net = 2800 − 2750 = 50)
   No, this isn't reasonable for a fridge.

3. There are many possible solutions, including $\frac{1}{2}$, $\frac{2}{4}$, and $\frac{34}{68}$.

4. $18.90 (12.60 + 6.30 = 18.90)

5. $235,000 (219,000 + 16,000)

Part B: Additional Cost Calculations

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Calculate the land transfer tax on a home with a purchase price of $185,000.

   Answer:

   Use the percentages you were given in the lesson.

   Amount under $30,000 = $30,000

   Tax on this amount = $0

   Amount between $30,000 and $90,000 = $90,000 − $30,000 = $60,000

   Tax on this amount = 0.5% × $60,000 = $300

   Amount between $90,000 and $150,000 = $150,000 − $90,000 = $60,000

   Tax on this amount = 1.0% × $60,000 = $600

   Amount between $150,000 and $185,000 = $185,000 − $150,000 = $35,000

   Tax on this amount = 1.5% × $35,000 = $525

   Land transfer tax = $0 + $300 + $600 + $525 = $1425

2. Ken Baron has just purchased a new home. The possession date of his new home is November 1. Annual property taxes on his new home are $1670. The due date for property taxes is June 30. Ken's home insurance is renewed April 1 of each year. He has to increase his home insurance from $285 to $326 per year and pay the difference for the extra months.

   a) Calculate Ken's property tax adjustment (i.e., the amount he must repay the seller).

      Answer:

      Since the possession date is after the seller has paid the taxes, Ken must repay the seller for the months of the year he has possession of the home (November and December).

      Property tax adjustment (owing) = $\frac{2}{12} \times \$1,670 = \$278.33$

b) Calculate Ken's home insurance adjustment.

Answer:

Difference in insurance premiums = \$326 − \$285 = \$41.

Number of months between possession date of new home and home insurance renewal = 5 (November 1 to April 1).

Home insurance adjustment = $\frac{5}{12} \times \$41 = \$17.08$

3. The Desrochers family has just purchased a new home in Winnipeg. The possession date of their new home is April 15.

   Annual property taxes on their new home are \$2495. The due date for property taxes in Winnipeg is June 30. The family's home insurance is renewed October 1 of each year. The family has to increase its home insurance from \$352 to \$448 per year and pay the difference for the extra months.

   a) Calculate the family's property tax adjustment (i.e., the amount the seller owes them).

   Answer:

   Since the possession date is before the taxes are due, the Desrochers will pay the taxes and the seller will owe them for the months in the home (January, February, March, and half of April).

   Property tax adjustment (credit) = $\frac{3.5}{12} \times \$2,495 = \$727.71$

   b) Calculate the family's home insurance adjustment.

   Answer:

   Difference in insurance premiums = \$448 − \$352 = \$96

   Number of months between possession date of new home and home insurance renewal = 5.5 (April 15 to October 1).

   Home insurance adjustment = $\frac{5.5}{12} \times \$96 = \$44$

4. The Wiebe family purchases a three-bedroom bungalow for $188,500. Before finalizing their offer on the bungalow, the Wiebes have a professional building inspector inspect the house. The inspector assures the Wiebes that the house is structurally sound. The inspection costs $275. The Wiebes need to take out a mortgage at a financial institution. They are charged a mortgage application fee of $65 and an appraisal fee of $40.

   The Wiebes retain a lawyer to act for them in the purchase of their home. They do not need a property survey done of their new property. Other legal disbursements cost $124.86. Their lawyer's fee is $350.

   The Wiebes' possession date is October 1. The amount of interest owing to the seller is $322.85. Property taxes for the year are $1583. The due date for property taxes is June 30. Their home insurance is renewed May 1 of each year. The family has to increase their home insurance from $336 to $382 per year and pay the difference for the extra months.

   The cost to hook up the phone is $60. The cost to activate the natural gas is $45. The Wiebes hire movers to move their furniture and appliances to their new home. The movers charge $380. Before they move in, the family purchases a new dishwasher for $490.50. They have the hardwood floors refinished at a cost of $1700. They paint the bedrooms themselves. The cost of the paint and brushes is $138.70.

   Use the form provided at the end of this lesson or create your own spreadsheet to calculate the Wiebe family's total closing costs and extras to purchase their new home.

Answer:

Land Transfer Tax calculation:

0% × 30,000 =	$ 0.00
0.5% × (90,000 − 30,000) =	$ 300.00
1% × (150,000 − 90,000) =	$ 600.00
1.5% × (188,500 − 150,000) =	$ 577.50
	$ 1477.50

Total Closing Costs		
Initial Fees		
Inspection Fee	$ 275.00	
Mortgage Application Fee	$ 65.00	
Appraisal Fee	$ 40.00	
Total Initial Fees		$ 380.00
Lawyer's Disbursement and Fees		
Land Transfer Tax (see calculation above)	$ 1477.50	
Property Survey	$ 0.00	
Other Legal Disbursements	$ 124.86	
Legal Fees	$ 350.00	
Total Lawyer's Disbursement and Fees		$ 1952.36
Adjustments		
Interest Adjustment	$ 322.85	
Property Tax Adjustment ($1,583 × 3/12)	$ 395.75	
Home Insurance Adjustment ($382 − $336) × 7/12)	$ 26.83	
Total Adjustments		$ 745.43
Other Additional Costs		
Service Charges ($60 + $45))	$ 105.00	
Moving Expenses	$ 380.00	
Immediate Repairs ($1,700)	$ 1,700.00	
Appliances ($490.50))	$ 490.50	
Decorating Costs	$ 138.70	
Total Other Additional Costs		$ 2,814.20
Total Closing Costs and Extras		$ 5,891.99

5. Refer to Question 4. Determine the Wiebe family's total closing costs and extras as a percentage of the total purchase price of their new home.

   Answer:

$$\text{Percent} = \frac{\text{total closing costs and extras}}{\text{purchase price}} \times 100$$

$$= \frac{\$5,891.99}{\$188,500.00} \times 100$$

$$= 3.1\%$$

6. Lauren Johansson has received a promotion from her company and is relocating in Winnipeg. She has just purchased a bungalow for $282,500. Before finalizing her offer, she has a professional building inspector inspect the house. The inspection fee costs her $300. The mortgage application fee costs $75. An appraisal fee costs $40.

   She retains a lawyer to act for her in the purchase of her home. Her lawyer's fee is $300. She needs a property survey of her new property. The cost of this survey is $325. Other legal disbursements cost her $105.20.

   The possession date of Lauren's new home is March 1. The amount of interest owing to the seller is $242.75. Property taxes for the year are $1680. The due date for property taxes in Winnipeg is June 30. (Because Lauren will be paying the taxes for the whole year, the seller must pay her for the taxes for January and February. This will be shown as a credit on the chart.) Home insurance for the year will cost her $314.

   The cost to hook up the phone is $55. The cost to activate the natural gas is $45. Lauren hires a moving company to move her possessions to her new home. Her employer pays the cost of the moving company. Before she moves in, Lauren purchases a new washing machine and dryer at a cost of $499.99 and $349.99, respectively. She has the kitchen cabinets, counters, and flooring replaced at a cost of $14,150. She also has an alarm system installed at a cost of $600. She has her new house painted at a cost of $1590.

   Use the form provided at the end of this lesson to calculate Lauren's total closing costs and extras to purchase her new home.

Answer:

Land Transfer Tax calculation:

0% × 30,000 =	$ 0.00
0.5% × (90,000 − 30,000) =	$ 300.00
1% × (150,000 − 90,000) =	$ 600.00
1.5% × (200,000 − 150,000) =	$ 750.00
2.0% × (282,500 − 200,000) =	$1650.00
	$3300.00

Total Closing Costs		
Initial Fees		
Inspection Fee	$ 300.00	
Mortgage Application Fee	$ 75.00	
Appraisal Fee	$ 40.00	
Total Initial Fees		$ 415.00
Lawyer's Disbursement and Fees		
Land Transfer Tax (see calculation above)	$ 3300.00	
Property Survey	$ 325.00	
Other Legal Disbursements	$ 105.20	
Legal Fees	$ 300.00	
Total Lawyer's Disbursement and Fees		$ 4030.20
Adjustments		
Interest Adjustment	$ 242.75	
Property Tax Adjustment ($1,680 × 2/12)	$ (–280.00)	
Home Insurance Adjustment	$ 314.00	
Total Adjustments		$ 276.75
Other Additional Costs		
Service Charges ($55 + $45)	$ 100.00	
Moving Expenses	$ 0.00	
Immediate Repairs ($14,150 + $600)	$ 14,750.00	
Appliances ($499.99 + $349.99)	$ 849.98	
Decorating Costs	$ 1,590.00	
Total Other Additional Costs		$ 17,289.98
Total Closing Costs and Extras		$ 22,011.93

7. Refer to Question 6. Determine Lauren's total closing costs and extras as a percentage of the total purchase price of her new home.

   Answer:

$$\text{Percent} = \frac{\text{total closing costs and extras}}{\text{purchase price}} \times 100$$

$$= \frac{\$22,011.93}{\$282,500.00} \times 100$$

$$= 7.8\%$$

Learning Activity 1.4

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Tyla purchases a home for $207,000 with no down payment. She has calculated that she will spend $278,187 paying for the house during the 25-year amortization period. How much money in interest will she pay during this 25-year period?
2. Tyla wants to purchase a television for her new home. One television is on sale for 10% off the purchase price of $750. Another television is on sale for 15% off the purchase price of $800. Which television is the least expensive?
3. Solve for g: $2g - 11 = 7$
4. Convert this percent to a fraction in lowest terms: 66%.
5. Complete the pattern: 1, 2, 4, 7, ____ , ____ , ____ .

Answers:

1. $71,187 (278,187 − 207,000)
2. The first television is less expensive. ($750 − $75 = $675; $800 − $80 − $40 = $680)
3. $g = 9$ ($2g = 18 \rightarrow g = 9$)
4. $\frac{33}{50}$ $\left(\frac{66 \div 2}{100 \div 2} \rightarrow \frac{33}{50}\right)$
5. 11, 16, 22 (keep adding one more than the previous difference)

Part B: Mortgage Calculations

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

Use the amortization table at the end of this lesson to complete this learning activity.

1. What interest rates are financial institutions now charging for a five-year mortgage? The interest rate can be found by consulting a financial institution, the Saturday *Winnipeg Free Press*, or the Internet.

   Answer:

   Answers will vary, because the interest rate changes with the economy. It is important to know where you can find this information when you are buying a home. Different financial institutions may have slightly different rates.

2. Calculate the monthly payments for each of the following fixed-rate mortgages.

   a) $150,000 mortgage at 2.25% amortized over 15 years.

      Answer:

      Refer to the amortization table at the end of this lesson.

      Find the 15-year amortization period and go down the rate column until you locate 2.25%. The monthly payment for a $1,000 mortgage is $6.55 Since the loan required is $150,000, the value of $6.55 must be multiplied by 150 ($150,000 ÷ $1,000).

      The monthly payment is $6.55 × 150 = $982.50.

   b) $235,000 mortgage at 3.5% amortized over 25 years.

      Answer:

      Find the 25-year amortization period and go down the rate column until you locate 3.5%. The monthly payment for a $1,000 mortgage is $4.99. Since the loan required is $235,000, the value of $4.99 must be multiplied by 235 ($235,000 ÷ $1,000).

      The monthly payment is $4.99 × 235 = $1172.65.

c) $170,000 mortgage at 4% amortized over 20 years.

Answer:

Find the 20-year amortization period and go down the rate column until you locate 4%. The monthly payment for a $1,000 mortgage is $6.04. Since the loan required is $170,000, the value of $6.04 must be multiplied by 170 ($170,000 ÷ $1,000).

The monthly payment is $6.04 × 170 = $1026.80

3. Moira Diaz purchases a home for $190,000. She makes a down payment of $20,000 and takes out a fixed-rate mortgage at 2.25% for the balance of the purchase price. The mortgage is to be amortized over 10 years.

a) Determine Moira's monthly mortgage payments.

Answer:

Balance owing = purchase price − down payment

= $190,000 − $20,000

= $170,000

Refer to the amortization table found at the end of this lesson. Find the 10-year amortization period and go down the rate column until you locate 2.25%. The monthly payment of a $1,000 mortgage is $9.31. Since the loan Moira requires is for $170,000, the value of $9.31 must be multiplied by 170 ($170,000 ÷ $1,000).

Moira's monthly payment = $9.31 × 170 = $1582.70.

b) Calculate the amount of interest Moira pays during the 10-year amortization period.

Answer:

Since Moira is amortizing the mortgage over a 10-year period and there are 12 months in a year, she makes a total of 10 × 12 = 120 payments.

Total mortgage payments over the 10-year period = $1582.70 × 120 = $189,924.00.

Total interest Moira pays during the 10-year amortization period = $189,924.00 − $170,000.00 = $19,924.00.

4. Refer to Question 3. Suppose Moira chooses to amortize her mortgage over 25 years rather than 10 years. Suppose the interest rate remains fixed at 2.25%.

   a) Determine Moira's monthly mortgage payments.

      Answer:

      The balance owing remains the same as in Assignment question #3, $170,000.

      Refer to the amortization table found at the end of this lesson. Find the 25-year amortization period and go down the rate column until you locate 2.25%. The monthly payment for a $1,000 mortgage is $4.36. Since the loan Moira requires is for $170,000, the value of $4.36 must be multiplied by 170 ($170,000 ÷ $1,000).

      Moira's monthly payment = $4.36 × 170 = $741.20.

   b) Calculate the amount of interest Moira pays during the 25-year amortization period.

      Answer:

      Since Moira is amortizing the mortgage over a 25-year period and there are 12 months in a year, she makes a total of 25 × 12 = 300 payments.

      Total mortgage payments over the 25-year period = $741.20 × 300 = $222,360.00.

      Total interest Moira pays during the 25-year amortization period = $222,360 − $170,000 = $52,360.

   c) How would the interest she pays during a 25-year amortization period compare to the interest she pays during a 10-year amortization period?

      Answer:

      Difference in interest between 25-year amortization period and 10-year amortization period = $52,360 − $19,924 = $32,436. This illustrates that the lower monthly interest payments ($741.20 vs. $1582.70) do not indicate a saving in the long run.

   d) Why might Moira choose a longer amortization period?

      Answer:

      A longer amortization reduces the monthly payment, but she will make monthly payments for more years.

5. Complete a schedule of mortgage payments chart for the first three months of Question 3.

Answer:

Payment 1

Interest $= \$170{,}000.00 \times 0.0225 \times \frac{1}{12} = \$318.75$

Principal $= \$1582.70 - \$318.75 = \$1263.95$

Unpaid balance $= \$170{,}000.00 - \$1263.95 = 168{,}736.05$

Owner's equity $= \$20{,}000.00 + \$1263.95 = \$21{,}263.95$

Payment 2

Interest $= \$168{,}736.05 \times 0.0225 \times \frac{1}{12} = \$316.38$

Principal $= \$1582.70 - \$316.38 = \$1266.32$

Unpaid balance $= \$168{,}736.05 - \$1266.32 = \$167{,}469.73$

Owner's equity $= \$21{,}263.95 + \$1266.32 = \$22{,}530.27$

Payment 3

Interest $= \$167{,}469.73 \times 0.0225 \times \frac{1}{12} = \$314.01$

Principal $= \$1582.70 - \$314.01 = \$1268.69$

Unpaid balance $= \$167{,}469.73 - \$1268.69 = \$166{,}201.04$

Owner's equity $= \$22{,}530.27 + \$1268.69 = \$23{,}798.96$

Payment #	Payment	Interest	Principal	Unpaid Balance	Owner's Equity
				$170,000.00	$20,000.00
1	$1,582.70	$318.75	$1,263.95	$168,736.05	$21,263.95
2	$1,582.70	$316.38	$1,266.32	$167,469.73	$22,530.27
3	$1,582.70	$314.01	$1,268.69	$166,201.04	$23,798.96

6. Refer to the schedule of mortgage payments chart in Question 5.

   a) Calculate the total interest paid in the first three months.

   Answer:

   Total interest $= \$318.75 + \$316.38 + \$314.01 = \$949.14$

b) Calculate the total principal paid down in the first three months.

Answer:

Total principal = $1263.95 + $1266.32 + $1268.69 = $3798.96

c) How does the total principal paid down compare to the total interest paid?

Answer:

The total principal paid is $2849.82 more than the total interest paid.

7. Use a spreadsheet to complete a schedule of mortgage payments chart for the first 24 months of Question 4. If you don't have a computer, you should complete the first 5 months of the chart.

Answer:

Payment #	Payment	Interest	Principal	Unpaid Balance	Owner's Equity
				$170,000.00	$20,000.00
1	$741.20	$318.75	$422.45	$169,577.55	$20,422.45
2	$741.20	$317.96	$423.24	$169,154.31	$20,845.69
3	$741.20	$317.16	$424.04	$168,730.27	$21,269.73
4	$741.20	$316.37	$424.83	$168,305.44	$21,694.56
5	$741.20	$315.57	$425.63	$167,879.81	$22,120.19
6	$741.20	$314.77	$426.43	$167,453.39	$22,546.61
7	$741.20	$313.98	$427.22	$167,026.16	$22,973.84
8	$741.20	$313.17	$428.03	$166,598.14	$23,401.86
9	$741.20	$312.37	$428.83	$166,169.31	$23,830.69
10	$741.20	$311.57	$429.63	$165,739.68	$24,260.32
11	$741.20	$310.76	$430.44	$165,309.24	$24,690.76
12	$741.20	$309.95	$431.25	$164,877.99	$25,122.01
13	$741.20	$309.15	$432.05	$164,445.94	$25,554.06
14	$741.20	$308.34	$432.86	$164,013.08	$25,986.92
15	$741.20	$307.52	$433.66	$163,579.40	$26,420.60
16	$741.20	$306.71	$434.49	$163,144.91	$26,855.09
17	$741.20	$305.90	$435.30	$162,709.61	$27,290.39
18	$741.20	$305.08	$436.12	$162,273.49	$27,726.51
19	$741.20	$304.26	$436.94	$161,836.55	$28,163.45
20	$741.20	$303.44	$437.76	$161,398.80	$28,601.20
21	$741.20	$302.62	$438.58	$160,960.22	$29,039.78
22	$741.20	$301.80	$439.40	$160,520.82	$29,479.18
23	$741.20	$300.98	$440.22	$160,080.60	$29,919.40
24	$741.20	$300.15	$441.05	$159,639.55	$30,360.45

8. The Rossbrook family is considering buying a bungalow with a purchase price of $245,000. Their gross monthly income is $4960. The family can make a down payment of $40,000 and they expect their financial institution to offer them a fixed-rate mortgage rate of 2.75% over 20 years. The annual taxes on the property are $2544. The annual heating costs of the house are $1680.

   a) What is the monthly mortgage payment?

   Answer:

   Mortgage amount = $245,000 − $40,000
   = $205,000

   Monthly mortgage payment for $1000 mortgage = $5.41
   (see amortization table)

   Mortgage payment = $205 × 5.41
   = $1109.05

   b) Calculate the Gross Debt Service Ratio.

   Answer:

   $$\text{Monthly taxes} = \frac{2544}{12} = \$212$$

   $$\text{Monthly heating costs} = \frac{1680}{12} = \$140$$

   Gross Debt Service Ratio (GDSR)

   $$= \frac{\text{Monthly Mortgage Payment + Property Taxes + Heating}}{\text{Gross Monthly Income}} \times 100$$

   $$= \frac{1109.05 + 212 + 140}{4960} \times 100$$

   $$= 29\%$$

   c) Can the Rossbrook family afford this home?

   Answer:

   The Clarks can afford this home because their GDSR is less than 32%.

Learning Activity 1.5

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Sharlee is covered for 70% of the replacement cost of the contents in her home. If the contents of her home are worth $150,000, how much money will Sharlee receive in the event of a house fire?
2. Evaluate for $t = 5$: $3t - 8$
3. Carly is three times as old as Marla. Marla is one-fourth as old as Pauly. If Pauly is 20, how old are Carly and Marla?
4. If 17×18 is 306, what is 17×20?
5. Evaluate: $\frac{1}{5} + \frac{2}{3}$

Answers:

1. $105,000 (10% of 150,000 = 15,000; $15,000 \times 7 \rightarrow$ think $10,000 \times 7 + 5000 \times 7 = 70,000 + 35,000 = 105,000$)
2. $7 (15 - 8)$
3. Marla is 5, Carly is 15 (Marla = $\frac{20}{4} = 5$, Carly = $3 \times 5 = 15$)
4. 340 ($17 \times 2 = 34$; $306 + 34 = 340$)
5. $\frac{13}{15} \left(\frac{3}{15} + \frac{10}{15} = \frac{13}{15} \right)$

Part B: Home Insurance

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. a) Find out how much the replacement value is for where you live. You can probably get this information from a parent or guardian.

   Answer:

   Answers will vary.

   b) Use the descriptions of the four types of areas that Manitoba is divided into to determine which area you live in.

   Answer:

   Answers will vary.

   c) What type of coverage would you choose to have for your house? Use either the *standard* or *comprehensive coverage* and the table describing them in detail to make this decision.

   Answer:

   Typically, most people have standard coverage because it is cheaper. Some reasons you might choose comprehensive coverage could be:

   - contents protection against melting snow and ice on roof
   - mysterious disappearance
   - sewer back–up ($5,000)

   d) Decide whether you would want a $200 deductible or a $500 deductible. Explain why you chose one or the other.

   Answer:

   If you are uncomfortable with having a higher deductible or you do not typically have $500 to spare for unexpected costs, you may choose a $200 deductible.

   If you want a lower monthly payment and can afford a $500 unexpected expense, you may choose a $500 deductible.

e) Using the information you gathered and the choices you made in parts (a) to (d), calculate your possible home insurance costs. If you have an alarm system, deduct $15.

Answer:

Answers will vary.

2. a) Why is it important to have homeowner's insurance?

Answer:

Homeowner's insurance is important because it safeguards a homeowner against damage and/or loss to both the homeowner's building and contents. It also covers third-person liability in case someone else gets injured on your property.

b) Why is it important to have tenant's insurance?

Answer:

Tenant's insurance is important because it protects renters against damage and loss to their personal possessions. It also protects against liability from damage the tenant may inadvertently cause to the building or other renters.

3. a) Explain the difference between the replacement cost of a home and its resale value.

Answer:

Replacement cost is the cost of rebuilding a home and replacing all its contents, and resale value is the amount the home and its contents would sell for on the market.

b) On which value is homeowner's insurance based?

Answer:

Homeowner's insurance is based on replacement cost.

4. Jay Wallace owns a home with a Boeckh replacement value of $175,000. The home is in an unprotected area of Manitoba. Jay chooses standard insurance with a deductible of $500. Determine Jay's annual insurance premium.

Answer:

Using the Insurance Rate Chart at the end of the lesson, the standard insurance premium in Area 4 ($500 deductible) = $830.

5. Joy Lewicki rents an apartment in Altona. Her personal possessions have a Boeckh replacement value of $40,000. Joy chooses comprehensive tenant's insurance with a deductible of $200. Calculate her annual insurance premium.

   Answer:

   Using the chart on Tenant's Package Policy, comprehensive insurance premium for all areas of Manitoba ($500 deductible) = $269.

   Cost of $200 deductible: $269 × 10% = $26.90

   Total premium: $269.00 + $26.90 = $295.90

6. Al McMillan owns a home with a Boeckh replacement value of $190,000. His home is located outside Winnipeg in a semi-protected area. He is interested in an insurance policy with $500 deductible. If Al chooses comprehensive insurance rather than standard insurance, how much more would his annual premium be?

   Answer:

   Comprehensive insurance premium in Area 3 ($500 deductible) = $776

   Standard insurance premium in Area 3 ($500 deductible) = $705

   Difference = $776 − $705 = $71

7. Martin Humboldt owns a home with a Boeckh replacement value of $190,000. The home is located in Metro Winnipeg. He chooses comprehensive homeowner's insurance with a deductible of $200. In addition to the $5000 of sewer back-up coverage he has with his policy, he opts to pay another $120 for $15,000 of additional sewer back-up coverage. Calculate his annual insurance premium.

   Answer:

   Comprehensive insurance premium in Metro Winnipeg ($500 deductible) = $717

   Cost of $200 deductible: $717 × 10% = $71.70

   Adjusted comprehensive premium: $717.00 + $71.70 = $788.70

   Premium with additional sewer back-up: $788.70 + $120.00 = $908.70

Learning Activity 1.6

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Evaluate: $\frac{3}{5} \times \frac{10}{7}$
2. Cleavon is buying his lunch at a food court in the mall. He spends $4.25 on a slice of pizza, $2.75 on a drink, and $3.50 on a salad. How much does he spend on his lunch?
3. Convert the following decimal to a percent: 0.006
4. You want to have the following items in your backyard: a shed, a dog run, and a garden. If your backyard is 10 m × 10 m, can you fit a shed that is 4 m × 5 m, a dog run that is 3 m × 10 m and garden that is 5 m × 5 m?
5. You are paid $10.50 per hour. If you work 30 hours this week and 24 hours next week, how much will you be paid for these two weeks?

Answers:

1. $\frac{6}{7}\left(\frac{3}{\cancel{5}_{1}} \times \frac{\cancel{10}^{2}}{7} = \frac{6}{7}\right)$
2. $10.50 ($(4 + 2 + 3) + $(0.25 + 0.75 + 0.50) = $9.00 + $1.50 = $10.50)
3. 0.6% (0.006 × 100 = 0.6%)
4. Yes (First check the areas. The backyard has an area of 100 m^2, while the combined items have an area of 75 m^2. Additionally, the 3 rectangles can fit in the large square.)
5. $567 (54($10) + 54($0.50) = $540 + $27 = $567)

Part B: Property Taxes

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. The Duhamel family owns a home with a total portioned assessment of $90,240. The frontage of the home is 45 feet. The annual municipal rate is 14.132 mills and the annual education rate is 15.732 mills. Assume the family has no local improvement taxes.

   a) Calculate the total annual municipal taxes for the property.

   Answer:

$$\text{General municipal tax} = \frac{\text{total portioned assessment}}{1000} \times \text{municipal mill rate}$$
$$= \frac{\$90,240}{1000} \times 14.132$$
$$= \$1275.27$$

   b) Calculate the total annual education taxes for the property.

   Answer:

$$\text{Education tax} = \frac{\text{total portioned assessment}}{1000} \times \text{education mill rate}$$
$$= \frac{\$90,240}{1000} \times 15.732$$
$$= \$1419.66$$

   c) Calculate the total annual municipal and education taxes for the property.

   Answer:

   Total = $1275.27 + $1419.66 = $2694.93

2. The Lorenzo family bought a home in Selkirk for $196,400. The total portioned assessment of the building is 45% of the value of the house when it was bought. The home has a 35-foot frontage. The annual municipal rate is 11.256 mills and the annual education rate is 14.395 mills. There is an annual local improvement tax for lane oiling.

   a) What is the total portioned assessment of the property?

      Answer:

      Assessment = 0.45 × $196,400 = $88,380

   b) Calculate the annual municipal tax on the property.

      Answer:

      $$\text{General municipal tax} = \frac{\text{total portioned assessment}}{1000} \times \text{municipal mill rate}$$

      $$= \frac{\$88,380}{1000} \times 11.256$$

      $$= \$994.81$$

      Local improvement tax = 35 ft. × $9.00 = $315.00
      (see chart for rate per foot)

      Total municipal taxes = $994.81 + $315.00 = $1309.81

   c) Calculate the annual education tax on the property.

      Answer:

      $$\text{Education tax} = \frac{\text{total portioned assessment}}{1000} \times \text{education mill rate}$$

      $$= \frac{\$88,380}{1000} \times 14.395$$

      $$= \$1272.23$$

   d) What are the annual taxes on the property (in total)?

      Answer:

      Total = $1309.81 + $1272.23 = $2582.04

Learning Activity 1.7

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Melika is taking a vacation to Hawaii. She wants to know if she can carry her suitcase on the airplane. She needs to pack clothes that weigh 5.4 kg, toiletries that weigh 2.8 kg, and books that weigh 1.2 kg. If the airport has a limit of 10 kg per carry-on bag, can she take her bag with her on the plane?
2. Evaluate: $\frac{3}{7} \times \frac{7}{6}$
3. A canoe is on sale for 35% off the regular price of $300. How much is the canoe on sale for?
4. Continue the pattern: 2, 6, 18, 54, _____ , _____ .
5. If 40 DVDs cost $100, how much does each DVD cost?

Answers:

1. Yes (Weight = 5.4 + 2.8 + 1.2 = 9.4 kg)
2. $\frac{1}{2} \left(\frac{3}{7} \times \frac{7}{6} = \frac{3}{6} = \frac{1}{2} \right)$
3. $195 (10% of 300 = $30; 30% of 300 = $90; 5% of 300 = $15; 35% of 300 = $105; 300 − 105 = $195)
4. 162, 486 (multiply previous term by 3)
5. $2.50 (100 ÷ 4 = 25, so 100 ÷ 40 = 2.5)

Part B: Planning Preventative Maintenance

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Explain the differences between preventative maintenance and emergency repairs.

   Answer:

   Answers will vary. Points should include the following:

   - preventative maintenance helps you to avoid emergency repairs
   - preventative maintenance usually costs less than emergency repairs
   - emergency repairs must be done immediately
   - preventative maintenance is done on a regular basis—typically at specific times of year (fall and spring)

2. In order to complete this part of the learning activity, you may need to talk to the person in charge of your household or your learning partner in order to get all of the information you need. For this learning activity, you will need:

   - a folder, duotang or binder
   - pieces of paper
   - dividers (optional)

   Part I: Checklists

   Create a logbook that includes:

   a) a checklist describing items that need to be checked each month
   b) lists of items to be checked each season (these lists should be divided into subgroups, such as things to turn off/on, interior tasks, and exterior tasks)
   c) an annual checklist (things that need to be done once every year)

   To create these checklists, refer back to the list of preventative maintenance provided in this course, as well as the list that you made (with your learning partner). Divide these lists in order to make the checklists outlined above.

Part II: Dividers (optional)

After creating your checklists, you should include dividers titled *interior*, *exterior*, *basement*, *attic*, *garage*, and *systems*. Within each of these sections, you will be able to keep receipts and warranties.

Although this section is optional within this learning assignment, it is not optional if you are using it for your own home because it is important that you keep all of this information (for yourself, the insurance company, and for the future homeowner).

Answer:

The resulting logbooks with checklists will vary with each household.

Learning Activity 1.8

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Evaluate: 2^6
2. If Myla takes 14 minutes to play one hole of golf, how long will it take her to play 9 holes of golf?
3. Zahra arrived at work at 8:15 A.M. and left work at 6:15 P.M. If Zahra gets paid $10 an hour, and time-and-a-half for any hours worked over 8 hours in one day, how much did Zahra earn this day?
4. Write $2\frac{1}{3}$ as an improper fraction.
5. What number satisfies the following equation? $\frac{6}{42} = \frac{x}{7}$

Answers:

1. 64 ($2^6 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 64$)
2. 126 minutes ($14 \times 9 = (10 + 4) \times 9 = 90 + 36 = 126$ minutes)
3. $110.00 (Regular: 8:15–4:15 = 8 hours = 8 × $10 = $80; Overtime: 4:15–6:15 = 2 hours = 2 × $15 = $30.00)
4. $\frac{7}{3}$ $\left(2 + \frac{1}{3} = \frac{6}{3} + \frac{1}{3} = \frac{7}{3}\right)$
5. $x = 1$ $\left(\frac{6 \div 6}{42 \div 6} = \frac{1}{7}\right)$

Part B: Energy Awareness

In this learning activity, you will create some form of media that can be used to spread awareness about energy efficiency around the house. You can make

- a pamphlet
- a PowerPoint presentation
- a flyer
- a poster
- an essay
- a video/commercial

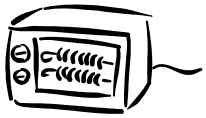
Regardless of which form you choose, you must include the following information:

- major sources of energy waste in a home (you can use your home as an example)
- different types of energy that you use in your home
- suggestions of how to improve energy efficiency around your house
- one example of modern technology created to help improve energy efficiency (e.g., Geothermal heating or grey water systems)

Answer:

You have many types of media to choose from. An example of a pamphlet template is shown on the following page.

Inside left	centre	right
ELECTRICAL ENERGY Lorem ipsum dolor sit amet, consectetur adipiscing elit. Morbi imperdiet libero eu leo fringilla elementum. Mauris euismod dignissim lacus, et cursus velit consequat a. Fusce adipiscing faucibus diam a congue. Nulla varius convallis mi a posuere. Sed erat diam, hendrerit non scelerisque a, molestie ut lacus.	**HEAT ENERGY** Quisque vel urna non dui molestie pellentesque. Nulla facilisi. In hac habitasse platea dictumst. Mauris odio dui, egestas ut aliquet a, bibendum non lectus. Phasellus arcu dui, pellentesque in ornare non, commodo vitae tellus. Vestibulum fringilla sapien eget est blandit id tincidunt arcu vehicula.	**TIPS** **Energy** Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Donec vulputate massa sed turpis mattis id sodales enim auctor. **Heat** Nulla magna elit, pulvinar quis dapibus sit amet, porttitor tristique urna. Duis dignissim, lorem non.

Inside flap	back	front
NEW TECHNOLOGY Proin eleifend, orci sit amet aliquam rutrum, lectus ante ornare augue, sed mollis nunc tortor vel leo. Nunc suscipit venenatis ligula quis euismod. Aenean nec massa id dolor malesuada rhoncus. Fusce sodales erat at velit mattis vitae tempus lectus tristique. 	**SOMETHING INTERESTING I LEARNED ABOUT ENERGY** Etiam vestibulum vulputate elementum. Suspendisse nec rutrum leo. Sed vitae turpis ante. Integer egestas, quam sed volutpat semper, nibh lacus pharetra massa, quis porttitor ipsum sem vel neque. Aenean quis ligula vel leo fringilla faucibus.	**BE GREEN — ENERGY EFFICIENT!** 

Learning Activity 1.9

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Gina realized that she had 3 more quarters in her pocket than she thought she had. If Gina has $7.50 in quarters in her pocket, how many quarters did she originally think she had?
2. Leticia worked 20 hours this week and made $220. If she works 15 hours next week at the same pay rate, how much will she earn?
3. If the gas tank in your vehicle holds 30 litres of gasoline and gasoline costs $1.30 a litre, how much will it cost to fill up your vehicle with gasoline?
4. Evaluate: $\frac{1}{4} + \frac{2}{7}$
5. Estimate 13% of 306.

Answers:

1. 27 (Number of quarters = $4 \times 7 + 2 = 30$ in Gina's pocket. Gina thought she had 27 quarters in her pocket.)
2. $165 (Wage = $\frac{220}{20}$ = $11 an hour. Income = $15 \times 11 = 10 \times 11 + 5 \times 11 =$ $110 + $55 = $165.)
3. $39 ($30 \times 10 = 300$; $30 \times 3 = 90$; $30 \times 13 = 390$; $30 \times \$1.30 = \$39$)
4. $\frac{15}{28}\left(\frac{7}{28} + \frac{8}{28} = \frac{15}{28}\right)$
5. ≈ 40 (10% of $306 \approx 31$; 1% of $306 \approx 3$; 3% of $306 \approx 9$; 13% of $306 \approx 31 + 9 \approx 40$)

Part B: Deciding to Rent or Buy a Home

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

William and Constance Swift can purchase an older home that needs updating for $195,000 or rent it for $1450 per month. They have $12,000 for a down payment if they buy, or $12,000 to invest if they rent.

Assume that

- rental payments are $1450.00 per month, and increase by 3.5% each year
- they can earn 4.6% interest per year on money they invest
- if they make a loan, the mortgage will be for 15 years at 5.75%
- owner's equity after 12 years will be $156,656.18
- the house will appreciate at 4.25% per year
- property taxes are $1950.00 per year, and increase by 2.6% annually
- house insurance is $475 per year, and increases by 2.8% annually
- maintenance is estimated at 2.5% per year, based on the appreciated value of the house each year

a) Complete Row 13 of the spreadsheet that shows the total rent paid in 12 years. What is the total rent paid?

Answer:

Total rent paid in 12 years = $254,074.18

	A	B	C	D
1	Year	Monthly Rent	Annual Rent	Total Rent Paid
2	1	$1,450.00	$17,400.00	$17,400.00
3	2	$1,500.75	$18,009.00	$35,409.00
4	3	$1,553.28	$18,639.32	$54,048.32
5	4	$1,607.64	$19,291.69	$73,340.01
6	5	$1,663.91	$19,966.90	$93,306.91
7	6	$1,722.15	$20,665.74	$113,972.65
8	7	$1,782.42	$21,389.04	$135,361.69
9	8	$1,844.80	$22,137.66	$157,499.35
10	9	$1,909.37	$22,912.48	$180,411.83
11	10	$1,976.20	$23,714.41	$204,126.24
12	11	$2,045.37	$24,544.42	$228,670.66
13	12	$2,116.96	$25,403.52	$254,074.18

b) Complete Row 14 of the spreadsheet that shows the value of the investment after 12 years. How much did the investment earn?

Answer:

The amount earned by the $12,000.00 investment after 12 years = $8585.50

	A	B	C
1	Year	Annual Values	Total Earned
2	1	$12,000.00	
3	2	$12,552.00	$552.00
4	3	$13,129.39	$1,129.39
5	4	$13,733.34	$1,733.34
6	5	$14,365.08	$2,365.08
7	6	$15,025.87	$3,025.87
8	7	$15,717.06	$3,717.06
9	8	$16,440.05	$4,440.05
10	9	$17,196.29	$5,196.29
11	10	$17,987.32	$5,987.32
12	11	$18,814.73	$6,814.73
13	12	$19,680.21	$7,680.21
14	13	$20,585.50	$8,585.50

c) Using the spreadsheet data, calculate the net rental charge after 12 years. Use the formula:

Net rental cost = rental payments − investment earnings

Answer:

Net rental cost = rental payments − investment earnings

= #(a) − #(b)

= $254,074.18 − $8585.50

= $245,488.68

d) Calculate the total cost of mortgage payments after 12 years.

Answer:

15-year Mortgage Rate at 5.75% = $8.27 per thousand borrowed (using Amortization Table)

Mortgage = $183,000.00

$$\text{Payment} = 8.27 \times \frac{\$183,000}{1000} = \$1513.41 \text{ per month}$$

Total in 12 years = $1513.41 × 12 × 12 = $217,931.04

e) Complete Row 13 of the spreadsheet to calculate the appreciated value of the house after 12 years and the total amount spent on maintenance costs after 12 years

Answer:

Total appreciation of the house in 12 years = $126,327.12

Total cost of maintenance after 12 years = $77,468.25

	A	B	C	D	E
1	Year	Value	Appreciation	Annual Maint.	Total Maint.
2	1	$195,000.00			
3	2	$203,287.50	$8,287.50	$5,082.19	$5,082.19
4	3	$211,927.22	$16,927.22	$5,298.18	$10,380.37
5	4	$220,934.13	$25,934.13	$5,523.35	$15,903.72
6	5	$230,323.83	$35,323.83	$5,758.10	$21,661.82
7	6	$240,112.59	$45,112.59	$6,002.81	$27,664.63
8	7	$250,317.37	$55,317.37	$6,257.93	$33,922.57
9	8	$260,955.86	$65,955.86	$6,523.90	$40,446.46
10	9	$272,046.49	$77,046.49	$6,801.16	$47,247.62
11	10	$283,608.46	$88,608.46	$7,090.21	$54,337.84
12	11	$295,661.82	$100,661.82	$7,391.55	$61,729.38
13	12	$308,227.45	$113,227.45	$7,705.69	$69,435.07
14	13	$321,327.12	$126,327.12	$8,033.18	$77,468.25

f) Complete Row 13 of the spreadsheet to calculate the total cost of all property taxes and insurance payments for 12 years.

Answer:

Total property taxes for 12 years = $27,053.90

Total insurance costs for 12 years = $6,665.13

	A	B	C	D	E
1	Year	Annual Prop Tax	Total Prop Tax	Annual Insurance	Total Insurance
2	1	$1,950.00	$1,950.00	$475.00	$475.00
3	2	$2,000.70	$3,950.70	$488.30	$963.30
4	3	$2,052.72	$6,003.42	$501.97	$1,465.27
5	4	$2,106.09	$8,109.51	$516.03	$1,981.30
6	5	$2,160.85	$10,270.35	$530.48	$2,511.78
7	6	$2,217.03	$12,487.38	$545.33	$3,057.11
8	7	$2,274.67	$14,762.06	$560.60	$3,617.71
9	8	$2,333.81	$17,095.87	$576.30	$4,194.00
10	9	$2,394.49	$19,490.36	$592.43	$4,786.43
11	10	$2,456.75	$21,947.11	$609.02	$5,395.45
12	11	$2,520.62	$24,467.74	$626.07	$6,021.53
13	12	$2,586.16	$27,053.90	$643.60	$6,665.13

g) Calculate the net cost of home ownership after 12 years. Use the formula:

Net cost = down payment + mortgage payments + maintenance + property taxes + insurance − (appreciation + increase in owner's equity)

Answer:

Net cost = down payment + mortgage payments + maintenance + property taxes + insurance − (appreciation + increase in owner's equity)

Net cost = $12,000.00 + $217,931.04 + $77,468.25 + $27,053.90 + $6,665.13 − ($126,327.12 + $156,656.18)

Net cost = $58,135.02

h) Which is less expensive after 12 years, renting or buying? How much less expensive?

Answer:

Buying is less expensive after 2 years.

Difference = rental costs − buying costs

= $245,488.68 − $58,135.02

= $187,353.66

i) State some things the Swift family must consider before buying this house.

Answer:

Swift family must consider the following:

- the house is older and will require some work—can they afford this, or are they willing to do the work themselves
- the mortgage payments at 15 years are quite high—can they afford this?
- the maintenance costs are quite high because they are buying an older home
- if they rent, they have very little equity after 12 years (only equity is the investment of $12,000)
- if they buy, they will have a lot of equity after 12 years, and the house will be almost paid (just another 3 years of payments)
- by buying a lower cost house, they save on property taxes
- if they update the house, the value will increase a lot
- finally, and very important, the cost of buying after 12 years is MUCH LESS than the cost of renting

Notes

Grade 12 Essential Mathematics (40S)

Module 2
Geometry and Trigonometry

Module 2:
Geometry and Trigonometry

Introduction

In this module, you will review some geometry from previous courses, including five basic "angle rules" and circle formulas. Then you will be introduced to two new trigonometric formulas used to solve non-right triangles. You will also study the properties of various quadrilaterals and other polygons. Trigonometry is a branch of mathematics that is used for land surveying. The properties of polygons are useful for architecture and other design fields.

You may find this module to be quite demanding, so it is very important to ask questions if there is something you do not understand. Don't forget that you can call your tutor/marker or ask your learning partner for help.

Assignments in Module 2

When you have completed the assignments for Module 2, submit your completed assignments to the Distance Learning Unit either by mail or electronically through the learning management system (LMS). The staff will forward your work to your tutor/marker.

Lesson	Assignment Number	Assignment Title
	Cover Assignment	Circle Geometry
3	Assignment 2.1	Polygons
5	Assignment 2.2	The Sine Law
6	Assignment 2.3	Trigonometry

Resource Sheet

When you write your midterm examination, you are encouraged to take a Midterm Examination Resource Sheet with you into the examination. This sheet will be one letter-sized page, 8½ " by 11", with both sides in your handwriting or typewritten. You will submit it with your examination, but you do not receive any marks for it.

Many students have found that preparing a resource sheet is an excellent way to review. It provides you with a summary of the important facts of each module. You should complete a resource sheet for each module to help with your studying and reviewing. Lesson summaries and module summaries are included for you to use as a guide.

You may use the following list of instructions to help you with preparing your resource sheet for the material in Module 2. On this sheet, you should record mathematics terms and definitions, formulas, sample questions, or a list of places where you often make mistakes. You should also identify special areas that require extra attention or review by writing the page numbers.

After you have completed each module's resource sheet, you may summarize the sheets from Modules 1, 2, 3, and 4 to prepare your Midterm Examination Resource Sheet. The midterm examination for this course is based on Modules 1 to 4.

Resource Sheet for Module 2

As you go through the lessons of this module, you may want to consider the following suggestions regarding the creation of a resource sheet.

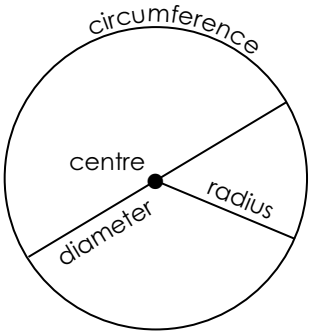
1. List all the important mathematics terms, and define them if necessary.
2. List all the formulas and perhaps a sample problem that shows how each formula is used.
3. If necessary, write the solutions to some problems, showing in detail how you did the calculations.
4. Copy any questions that represent the key points of the lesson, and perhaps include the solutions as well.
5. Identify the problems you found most difficult, and copy the page numbers onto the resource sheet so that you can review them before writing the examination. You may also copy the problems and the solutions onto your resource sheet, and later write them onto your Midterm Examination Resource Sheet.
6. Write any comments, ideas, shortcuts, or other reminders that may be helpful during an examination.

Module 2 Cover Assignment: Introduction to Circle Geometry

Circles have been an important part of the study of geometry for literally thousands of years, long before π was conceived as an important value. Finding a circle's area and perimeter was a mathematical challenge taken on by Archimedes, who lived around 250 B.C.E. Over the years, circles have continued to be applied to design in buildings, roads, and machines. Often, we will need to determine the diameter, area, and circumference of a circle. All of these values can be determined if you know the radius of the circle.

The diameter is equal to twice the radius.

$d = 2r$



The circumference is equal to the radius multiplied by 2π.

$C = \pi d$ or $C = 2\pi r$

The area of a circle is equal to the radius multiplied by the radius multiplied by π.

$A = \pi r^2$

Example 1

The radius of a circle is 5 cm.

a) What is the diameter?

b) What is the circumference?

c) What is the area?

Solution

a) $d = 2r = 2(5) = 10$ cm

b) $C = 2\pi r = 2\pi(5) = 10\pi = 31.41$ cm

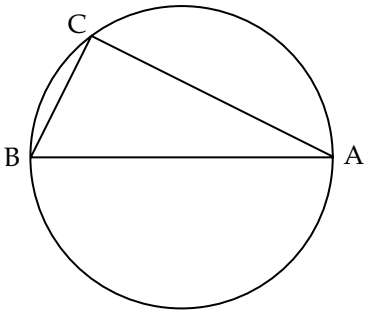
c) $A = \pi r^2 = \pi(5^2) = 25\pi = 78.54$ cm^2

Example 2

$\overline{AB}$ is a diameter with length = 7.

$\angle C$ is a right angle. $\overline{AC}$ has length = 6.

What is the length of $\overline{BC}$?



Solution

This is a right-angled triangle problem.
You can use the Pythagorean Theorem:

$a^2 + b^2 = c^2$

This can also be written as:

$BC^2 + AC^2 = AB^2$

Remember that the hypotenuse, $\overline{AB}$ or "*c*," is always the longest side of the triangle.

$BC^2 + 6^2 = 7^2$

$BC^2 + 36 = 49$

$BC^2 = 13$

$BC = 3.61$

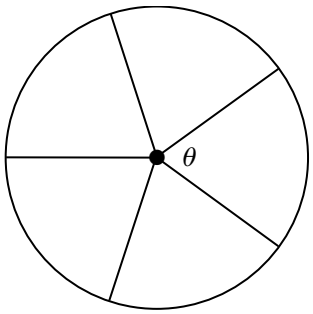
Example 3

A circular pie must be cut into five pieces of equal size. Calculate the angle of the "pointed" end of each piece of pie.

Solution

There are 360^{o} in a circle, and each piece of pie is $\frac{1}{5}$th of the circular pie.

$$\theta = \frac{360^{\circ}}{5} = 72^{\circ}$$



Notes

Module 2 Cover Assignment

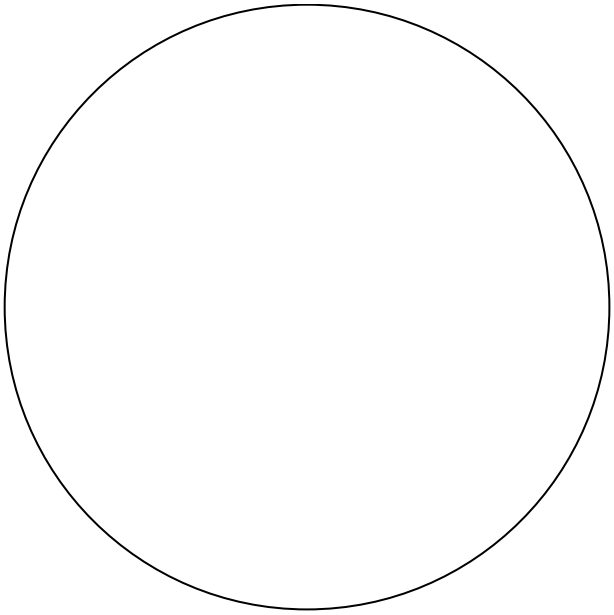
Circle Geometry

Total: 10 marks

1. A carpenter must design a window that is an octagon (an eight-sided polygon) with all interior angles the same size and all sides the same length. Use a protractor, ruler, and pencil to draw the octagon inside the circle below.

   Hint: In Example 3, what would have been the angle of the "pointed end" of the piece of pie if the pie had been cut into eight pieces?

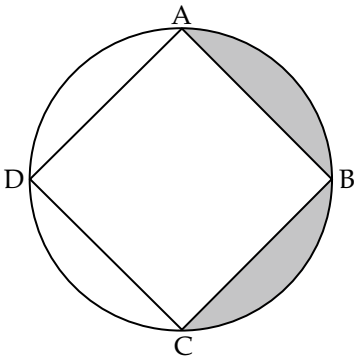
   What is the size (in degrees) of each of the 8 interior angles of the window? Show your calculations. *(4 marks)*



continued

Module 2 Cover Assignment: Circle Geometry

2. If the radius of the following circle is 4 cm, and ABCD is an inscribed square, calculate the area of the shaded part of the diagram. Show the steps in your procedures. *(6 marks)*



Lesson 1: Review of Geometry

Lesson Focus

In this lesson, you will

- ❑ look at three ways to label an angle
- ❑ solve problems involving supplementary and complementary angles
- ❑ solve problems involving vertically opposite angles
- ❑ solve problems involving alternate interior angles

Lesson Introduction

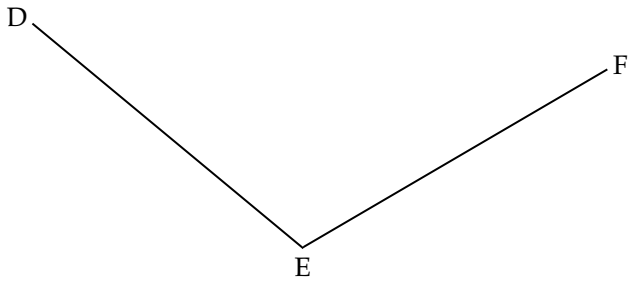
In this lesson, you will review some of the geometry that you studied in previous grades. You will review different ways of naming angles, and also some rules about equivalent angles in a variety of geometric figures.

As you work through this lesson, you might keep in mind some of the applications of angles in everyday life. For example, the comfort of a seat depends on the angle of the backrest. Also, when driving a car, you may need to adjust the angle of the rear-view mirror to get a better view. In sports, angles are important when shooting a basketball, passing a puck, or punting a football.

Labelling Angles

You may remember that it is helpful to give names to angles when you draw them. The vertex, or the point where the two arms of an angle meet, is the middle letter of the angle name.

For example, the following angle would be called angle DEF.



This angle could also be called angle FED. It is the same angle, just named in a different order. Most often, the three letters used to name an angle are written in alphabetical order.

Sometimes, as long as it is clear which angle is being referred to, angles are named using only the vertex, and in this example you would name the angle as angle E. The symbol for angle is ∠. Thus, there are three ways to name the above angle, ∠FED, ∠DEF, and ∠E.

Angle Rules

You may remember that there are five rules or relationships involving angles and angle measurements. These rules will be reviewed in this lesson and used throughout this module.

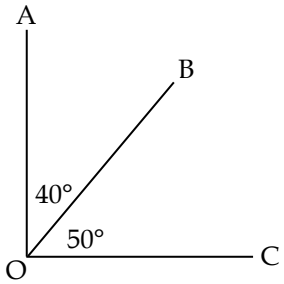
These rules are also used by workers in many occupations, such as surveyors, carpenters, cabinet makers, and designers of homes and other structures, just to name a few. You should include these five rules on your resource sheet.

Rule 1: Complementary Angles

If two angles add to 90°, they are **complementary angles**, or, you could also say one is the complement of the other.

Example 1

Are ∠AOB and ∠BOC complementary?



Solution

∠AOB = 40°

∠BOC = 50°

∠AOB + ∠BOC = 40° + 50° = 90°.

The two angles are complementary because their sum is 90°.

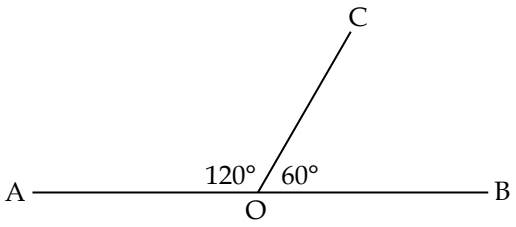
∠AOB is the complement of ∠BOC, or ∠BOC is the complement of ∠AOB. Either description is correct.

Rule 2: Supplementary Angles

If two angles add to 180°, one is the supplement of the other.

Example 1

Are ∠AOC and ∠COB supplementary?



Solution

∠AOC = 120°

∠COB = 60°

∠AOC + ∠COB = 120° + 60° = 180°

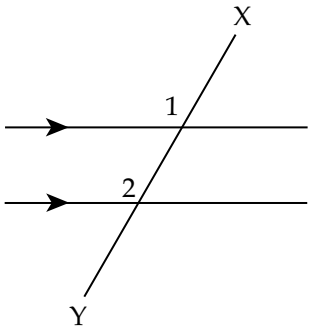
Since the sum of the measures of the two angles is 180°, the angles are supplementary.

∠AOC is the supplement of ∠BOC or ∠BOC is the supplement of ∠AOC. Either description is correct.

Rule 3: Corresponding Angles

To understand corresponding angles, you must first understand what is meant by the term **transversal**. A transversal is a line that intersects two or more lines. The lines may or may not be parallel. In this course, we will, in most cases, have the transversal intersect pairs of parallel lines.

In the diagram below, $\overline{XY}$ is a transversal. This transversal creates eight angles with the two parallel lines. Two of the angles are numbered in the diagram.

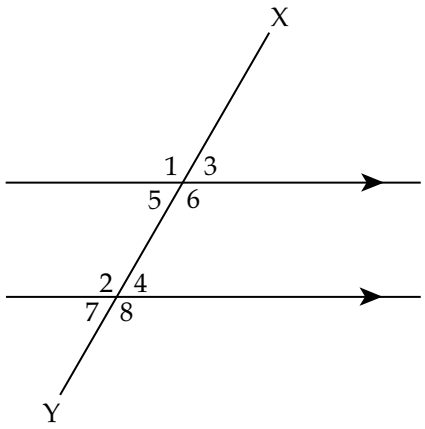


Note on your resource sheet that parallel lines are indicated in a diagram by drawing arrows on both lines, as in this diagram.

Use your protractor to find the measures of ∠1 and ∠2. You should find that they are the same size.

These angles are called **corresponding angles** because they are located in corresponding positions with respect to the parallel lines. ∠1 and ∠2 are both located to the left of the transversal and above a parallel line.

Use your protractor to find any other sets of angles on the diagram below that share the same measurement, and record your results.



You should discover that angles 1 and 2, as well as angles 6 and 8, all have the same measures. These pairs of angles are corresponding angles. You already know that angles 1 and 2 are corresponding angles because they are located in corresponding positions. Angles 6 and 8 are also located in corresponding positions, to the right of the transversal and below the parallel lines.

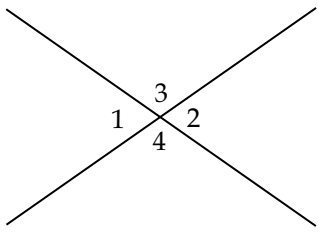
Similarly, angles 3 and 4, as well as angles 5 and 7, share identical measurements. These pairs of angles are also corresponding angles and are located in corresponding positions.

Why do you suppose angles 3, 4, 5, and 7 all have the same measures?

Let's explore this further . . .

Rule 4: Vertically Opposite Angles

Whenever two lines intersect, four angles are formed.

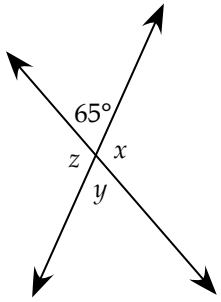


Use your protractor to measure $\angle 1$ and $\angle 2$ in the diagram. Did you find that they are the same size? If you measure $\angle 3$ and $\angle 4$, you will find that they are equal as well.

These pairs of angles, $\angle 1$ and $\angle 2$, or $\angle 3$ and $\angle 4$, are called **vertically opposite angles**. Vertically opposite angles are the angles that are opposite each other when two lines intersect. Vertically opposite angles are always equal.

Example 1

Using what you know about vertically opposite angles and supplementary angles, determine the measures of $\angle x$, $\angle y$, and $\angle z$ in the diagram below.



Solution

$\angle x$ is a supplement of the 65° angle (since the two angles form a straight line).

So $\angle x = 180° - 65° = 115°$.

Therefore, $\angle x = 115°$.

$\angle x$ and $\angle z$ are vertically opposite angles.

So $\angle x = \angle z$.

Therefore, $\angle z = 115°$.

$\angle y$ and the 65° angle are also vertically opposite angles.

Therefore, $\angle y = 65°$.

You could also find $\angle y$ by observing that $\angle y$ and $\angle z$ are supplementary angles.

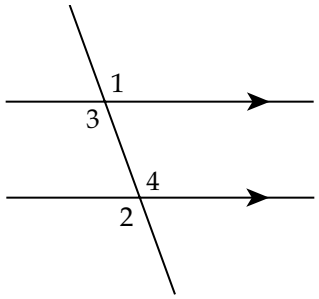
So $\angle y = 180° - 115° = 65°$.

So $\angle y = 65°$.

Rule 5: Alternate Angles

To alternate is to go back and forth. For the purposes of this module, to alternate means to go from one side to the other side of the transversal.

The diagram below shows ∠1 and ∠2 alternating on the exterior of the parallel lines. They are called **exterior alternate angles**. Do you see their location on opposite sides of the transversal?



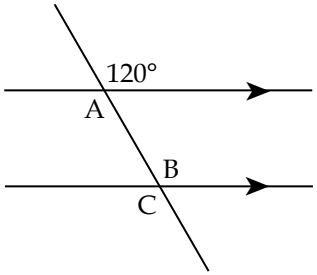
∠3 and ∠4 are inside the parallel lines, and they alternate on the inside of either side of the transversal. They are called **interior alternate angles**.

Exterior alternate angles always have the same measures when the lines are parallel to each other. Likewise, interior alternate angles are always equal when lines are parallel and cut by a transversal.

Stated in reverse, if the alternate angles across a transversal are equal, then the lines are parallel.

Example 1

Using what you know about vertically opposite angles and alternate interior angles, find the measurements of ∠A, ∠B, and ∠C in the figure below.



Solution

∠A is vertically opposite to the 120° angle.

Therefore, ∠A = 120°.

∠B and ∠A are alternate interior angles, and the transversal intersects parallel lines.

Therefore, ∠B = ∠A = 120°.

∠B and ∠C are vertically opposite angles.

Therefore, ∠B = ∠C = 120°.

You could also find ∠C by observing that ∠C and the 120° angle are alternate exterior angles.

Therefore, ∠C = 120°.

Additionally, you could also find ∠B by observing that it is a corresponding angle to the 120° angle.

Learning Activity 2.1

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. If the area of a circle equals 16π m^2, what does the radius of a circle equal?
2. ∠A and ∠B are complementary angles. If ∠A = 62°, what is the measure of ∠B?
3. If the perimeter of a square is 20 m, what is the area of the square?
4. Evaluate for $g = -4$: $5g - 13$
5. ∠C and ∠D are supplementary angles. If ∠C = 62°, what is the measure of ∠D?

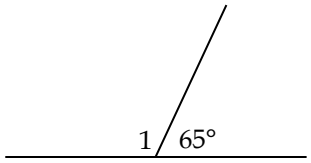
continued

Learning Activity 2.1 (continued)

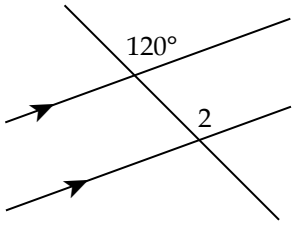
Part B: Angle Measurement

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

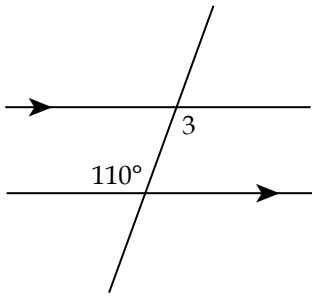
1. State why $\angle 1 = 115°$ in the diagram below.



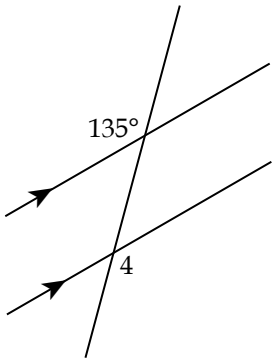
2. State the property that explains why $\angle 2 = 120°$.



3. State the property that explains why $\angle 3 = 110°$.



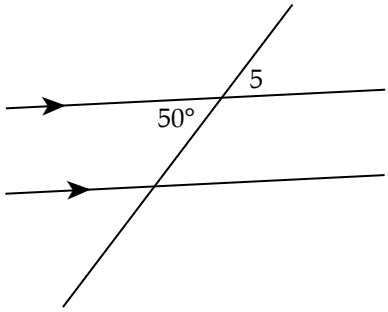
4. State the property that explains why $\angle 4 = 135°$.



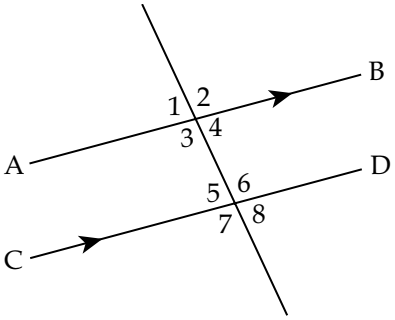
continued

Learning Activity 2.1 (continued)

5. State the property that explains why $\angle 5 = 50°$.



6. Use what you know about angle properties and pairs of parallel lines cut by a transversal to find the measure of each angle. State a reason for each answer. You are given that $\overline{AB}$ is parallel to $\overline{CD}$ and $\angle 5 = 80°$.



Lesson Summary

In this lesson, you reviewed complementary and supplementary angles, vertically opposite angles, and transversals with corresponding, interior alternate, and exterior alternate angles for parallel lines. This review is meant to prepare you for Lesson 2 and the study of geometric figures.

Notes

Lesson 2: Polygons and Quadrilaterals

Lesson Focus

In this lesson, you will

- ❑ discover how to calculate the sum of the interior angles of a quadrilateral
- ❑ identify squares, rectangles, rhombuses, parallelograms, and trapezoids, including isosceles trapezoids
- ❑ learn the properties of side lengths and angle measures for various types of quadrilaterals
- ❑ learn the properties of diagonals for various types of quadrilaterals

Lesson Introduction

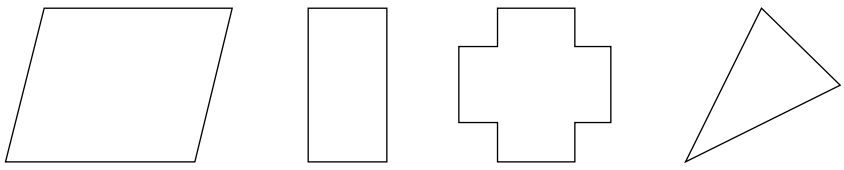
In the previous lesson, you reviewed some properties of angles. In this lesson, you will apply these angle properties, as well as other properties, to a variety of four-sided polygons with parallel sides.

Geometry involving parallel lines is very much a part of designing and building many types of structures, including houses, bridges, semi-trailer vans, furniture, and so on. Anyone with knowledge of geometry, including angles and polygons, will find this a great benefit in the workplace and at home.

Polygons

A polygon is a 2-dimensional figure. All polygons are made up of three or more line segments that are connected to enclose a space.

Some examples of polygons are shown below:



Regular and Irregular Polygons

There are many types of polygons, including regular and irregular polygons. **Regular polygons** are polygons where all the sides have the same length and all the angles are equal. This means that if one angle of a polygon measures 108°, then all the other angles must have that same measurement. Also, if one side length measure is 5 cm, all other side lengths of this polygon must also measure 5 cm.

If a polygon has two angles of different sizes, or two sides of different lengths, the polygon is not a regular polygon. All figures that are not regular polygons are called **irregular polygons**. You should add these definitions to your resource sheet.

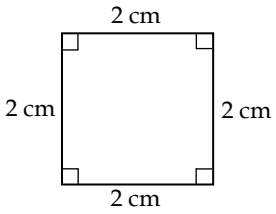
A chart of regular polygons is provided at the end of this lesson. As you work through the next three lessons, refer back to this chart as necessary.

The following example will help clarify which figures are regular polygons and which figures are irregular polygons.

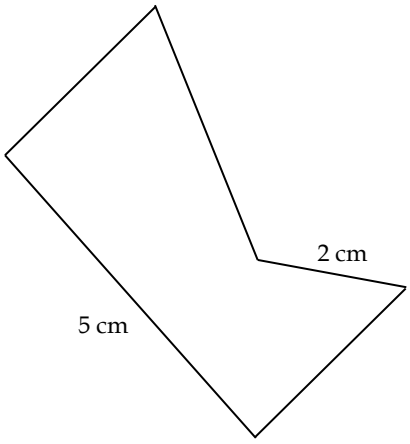
Example 1

Using the definitions of regular and irregular polygons stated above, identify the following polygons as regular or irregular.

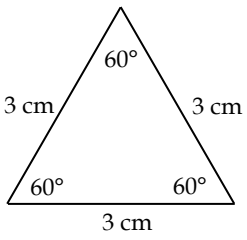
a)



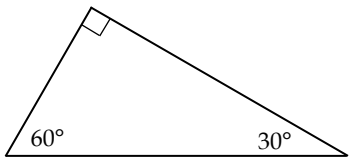
b)



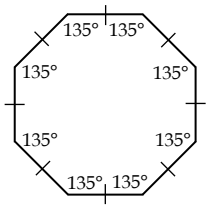
c)



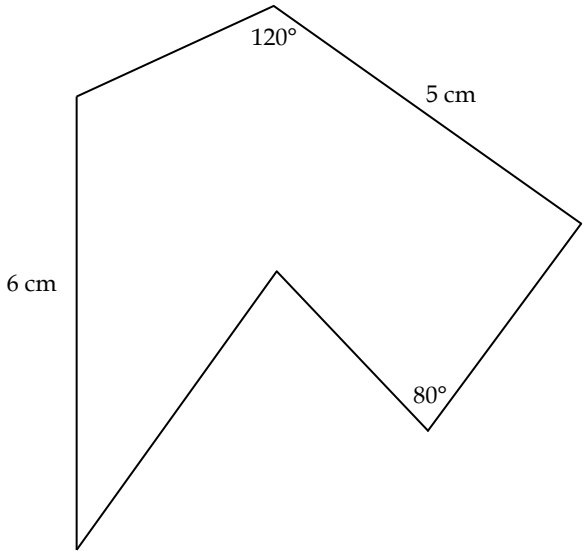
d)



e)



f)



Solution

a) A square is a regular polygon because all angles = 90° and all sides are the same (2 cm).

b) This is an irregular polygon because one side = 5 cm and one side = 2 cm. Therefore, the sides are not equal.

c) An equilateral triangle is a regular polygon because all angles = 60° and all sides are the same (3 cm).

d) This right triangle is an irregular polygon because one angle = 90°, another angle = 30°, and the third angle = 60°. All the angles are not equal; therefore, this isn't a regular polygon.

e) This octagon is a regular polygon because all sides = 1 cm and all angles = 135°.

f) This is an irregular polygon because all the angles are not equal, and all the sides are not equal.

Naming Polygons

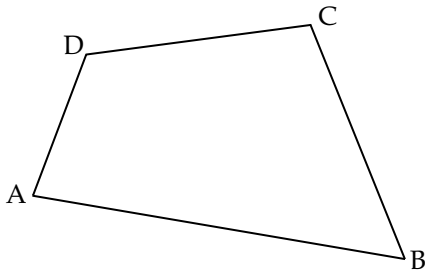
Polygons are named by the number of sides they have. For example, a polygon having three sides is called a triangle. The following chart lists the names and number of sides of some common polygons.

Polygon	Number of Sides
Triangle	3
Quadrilateral	4
Pentagon	5
Hexagon	6
Heptagon	7
Octagon	8
Decagon	10

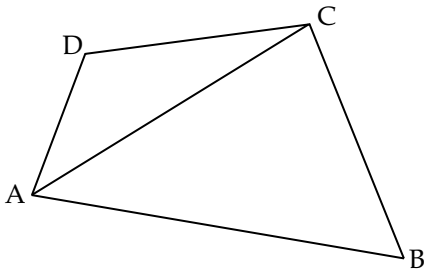
Quadrilaterals

Quadrilaterals are four-sided polygons. The quadrilateral shown below is quadrilateral ABCD. Capital letters are used to identify the vertices (corners) of a polygon, and the letters should be written in order as you go around the polygon. It would be incorrect to identify the quadrilateral as ABDC.

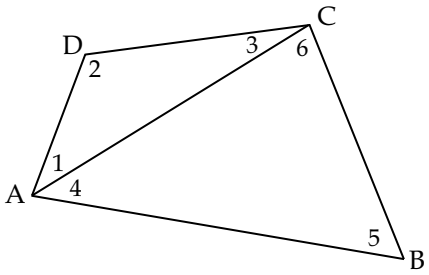
Consecutive angles are angles located at the opposite ends of one side. For example, ∠A and ∠B are consecutive angles. ∠A and ∠C are **non-consecutive angles**. For a quadrilateral, two non-consecutive angles are also called **opposite angles**. Therefore, ∠A is opposite ∠C, and ∠B is opposite ∠D. The vertices of a polygon are the points where the sides meet. In the diagram above, the vertices are the points A, B, C, and D. Note also that the symbol for segment AB is $\overline{AB}$, and "AB" represents the distance from A to B.



Any quadrilateral can be drawn as a combination of two triangles by drawing a segment to connect one pair of opposite vertices.



The sum of the angles of a triangle is 180^o. Therefore, since two triangles are used, the sum of the interior angles of a quadrilateral is (2×180) or 360^o. This is true for any quadrilateral.



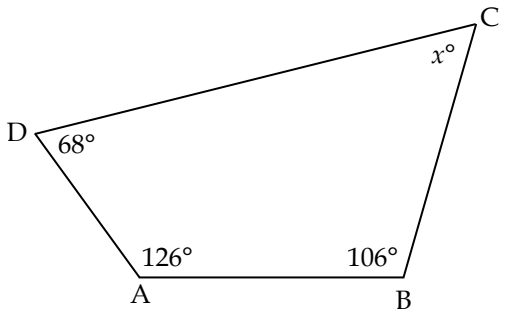
$\angle 1 + \angle 2 + \angle 3 = 180°$

$\angle 4 + \angle 5 + \angle 6 = 180°$

Therefore, $\angle 1 + \angle 2, + \angle 3 + \angle 4 + \angle 5 + \angle 6 = 360°$.

Example 1

Given the fact that the sum of the interior angles in a quadrilateral is 360°, find $\angle C$ in the following diagram.



Solution

$\angle A + \angle B + \angle C + \angle D = 360°$ (Substitute the values for $\angle A$, $\angle B$, and $\angle D$.)

$126° + 106° + \angle C + 68° = 360°$ (Rearrange and isolate $\angle C$.)

$\angle C = 360° - 126° - 106° - 68°$ (Complete the calculation.)

$\angle C = 60°$

Types of Quadrilaterals

You will be working with five basic types of quadrilaterals. The sum of the interior angles of all quadrilaterals is 360°. However, different types of quadrilaterals have a variety of additional properties.

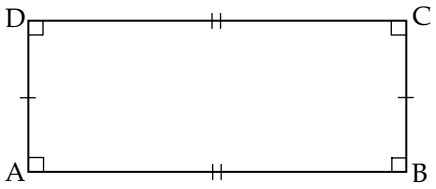
Writing the names of the different types of quadrilaterals along with their properties onto your resource sheet is a good idea. You will find this information useful in the following learning activity, in Assignment 2.1, and in the midterm examination.

1. **Rectangle**

   Fact 1: Opposite sides of a rectangle are parallel.

   Fact 2: Opposite sides of a rectangle are equal.

   Fact 3: All interior angles of a rectangle equal 90°.

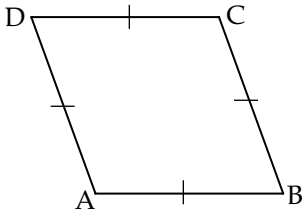


2. **Rhombus**

   Fact 1: Opposite sides of a rhombus are parallel.

   Fact 2: All sides of a rhombus are equal.

   Fact 3: Opposite interior angles of a rhombus are equal.

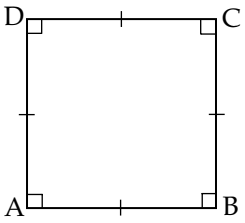


3. Square

Fact 1: Opposite sides of a square are parallel.

Fact 2: All sides of a square are equal.

Fact 3: All interior angles of a square equal 90°.



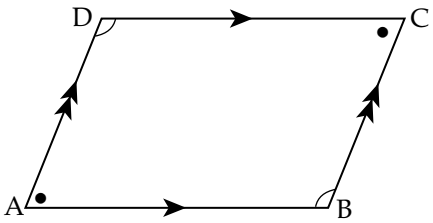
Note that a square is a special example of both a rectangle and a rhombus.

4. Parallelogram

Fact 1: Opposite sides of a parallelogram are parallel.

Fact 2: Opposite sides of a parallelogram are equal.

Fact 3: Opposite interior angles of a parallelogram are equal.



Note that rectangles, squares, and rhombi are all special examples of parallelograms.

5. Trapezoids

Fact 1: One pair of sides of a trapezoid is parallel

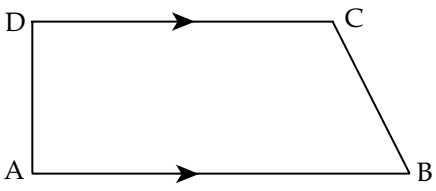
In isosceles trapezoids, the following facts are true:

Fact 1: One pair of sides of an isosceles trapezoid is parallel.

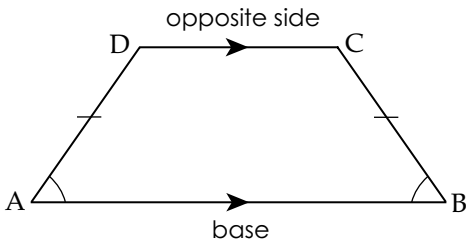
Fact 2: The base angles of an isosceles trapezoid are equal.

Fact 3: The nonparallel sides of an isosceles trapezoid are equal in length.

regular trapezoid



isosceles trapezoid



Example 1

Use the facts of quadrilaterals to answer the following problems:

a) Which quadrilaterals have all equal sides?

b) Which quadrilaterals have all interior angles equal to 90°?

c) Which quadrilaterals have opposite sides that are parallel?

d) Which quadrilaterals have opposite sides that are equal?

e) Which quadrilaterals have opposite interior angles that are equal?

Solution

a) Square, rhombus

b) Square, rectangle

c) Rectangle, square, parallelogram, rhombus

d) Rectangle, square, parallelogram, rhombus

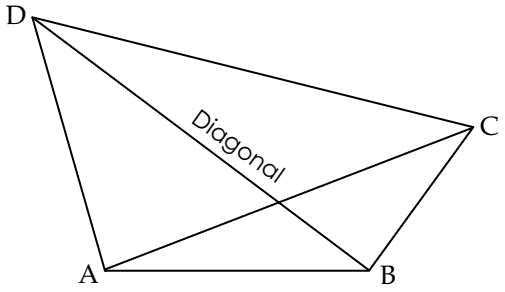
e) Rectangle, square, parallelogram, rhombus

Diagonals of Quadrilaterals

A **diagonal** is a line segment joining two non-consecutive vertices of a polygon. Diagonals create more properties in quadrilaterals.

Example 1

Which of these line segments are diagonals?



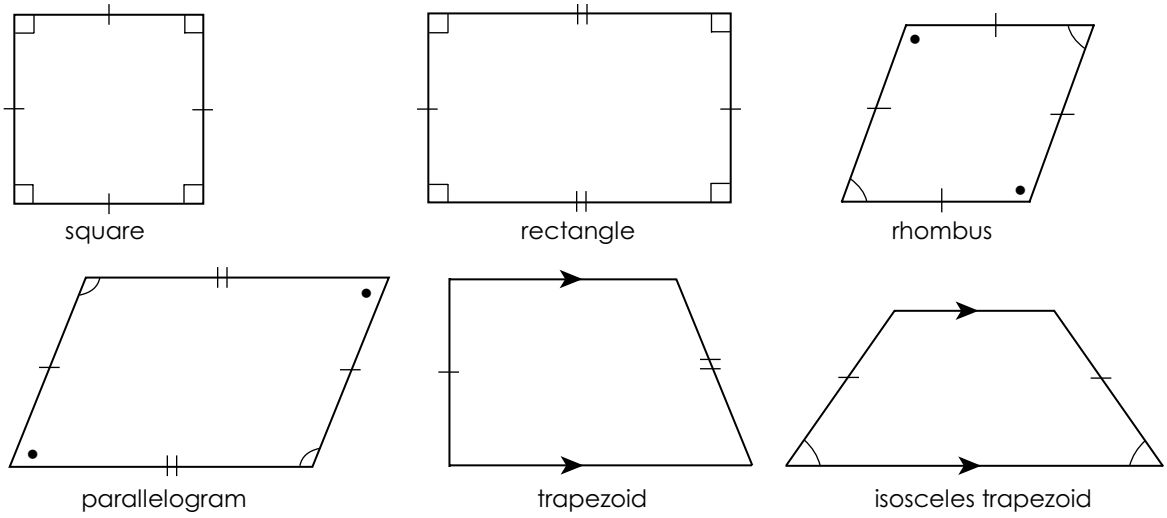
Solution

$\overline{BD}$ and $\overline{AC}$ are diagonals as they connect two non-consecutive vertices of the polygon.

$\overline{AB}$, $\overline{BC}$, $\overline{CD}$, and $\overline{AD}$ are all sides of the polygon, so they cannot be diagonals.

Example 2

Some quadrilaterals have diagonals that are equal to each other. Draw and measure the diagonals of a square, rectangle, rhombus, parallelogram, trapezoid, and isosceles trapezoid. What do you observe?



Solution

You should discover that the diagonals of a square and a rectangle are equal.

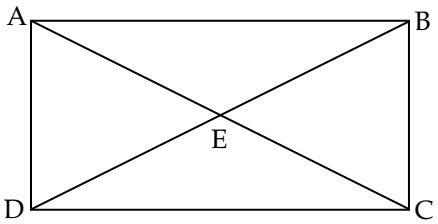
Depending on how you drew your trapezoid, it could have equal or unequal diagonals.

Diagonals of an isosceles trapezoid are equal while diagonals of a non-isosceles trapezoid are not equal.

The diagonals of a parallelogram and a rhombus are not equal.

Mutually Bisecting Diagonals

Mutually bisecting diagonals are diagonals in a polygon that cut each other in half.



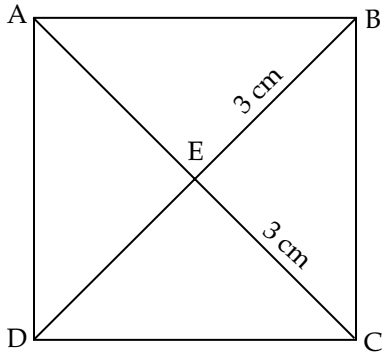
Measure $\overline{EA}$ and $\overline{EC}$ in the rectangle shown above. Also, measure $\overline{ED}$ and $\overline{EB}$. You will find that $\overline{EA} = \overline{EC}$ and $\overline{ED} = \overline{EB}$. The diagonals are being cut in half, or bisected by each other. Thus, $\overline{AC}$ and $\overline{BD}$ are mutually bisecting diagonals.

All parallelograms have the property of mutually bisecting diagonals, which includes rectangles, rhombuses, squares, and parallelograms.

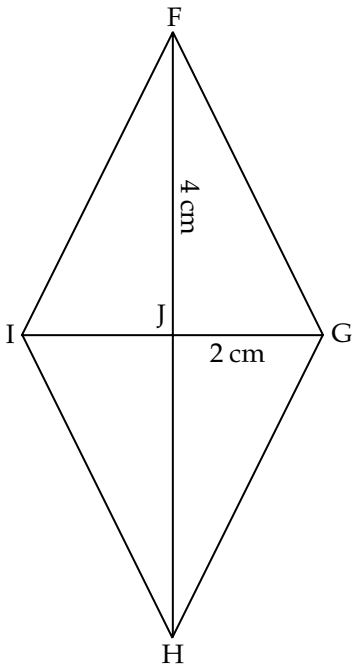
Example 1

Use what you know about mutually bisecting diagonals to solve the following problems.

a)



b)



a) Given square ABCD with $\overline{EB} = \overline{EC} = 3$ cm, what are the lengths of $\overline{AC}$ and $\overline{BD}$?

b) Given rhombus FGHI with $\overline{FJ} = 4$ cm and $\overline{GJ} = 2$ cm, what are the lengths of $\overline{FH}$ and $\overline{IG}$?

Solution

a) A square is a quadrilateral with mutually bisecting diagonals.

Therefore, $\overline{AE} = \overline{EC}$ and $\overline{BE} = \overline{ED}$.

Then, $\overline{AC} = 2\left(\overline{EC}\right) = 2(3) = 6$ cm, and $\overline{BD} = 2\left(\overline{EB}\right) = 2(3) = 6$ cm.

b) A rhombus is a quadrilateral with mutually bisecting diagonals.

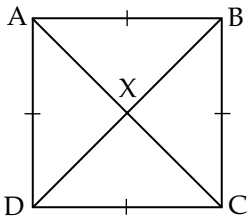
Therefore, $\overline{FJ} = \overline{HJ}$ and $\overline{IJ} = \overline{GJ}$.

Then, $\overline{HJ} = 4$ cm and $\overline{FH} = 4 + 4 = 8$ cm.

Also, $\overline{IJ} = \overline{GH} = 2$ cm and $\overline{GI} = 2 + 2 = 4$ cm.

Perpendicular Diagonals

Perpendicular diagonals form four right angles (90° angles) at the point where they intersect in a polygon. The diagram below is square ABCD with diagonals $\overline{AC}$ and $\overline{BD}$.



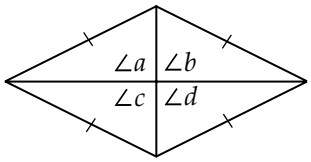
Use a protractor to measure ∠AXB, ∠BXC, ∠CXD, and ∠AXD in the above square.

You should find that ∠AXB = ∠BXC = ∠CXD = ∠AXD = 90°.

This shows that squares have the property of perpendicular diagonals.

Another quadrilateral with the property of perpendicular diagonals is a rhombus.

Example 1



What are the measurements of $\angle a$, $\angle b$, $\angle c$, and $\angle d$ in the above rhombus?

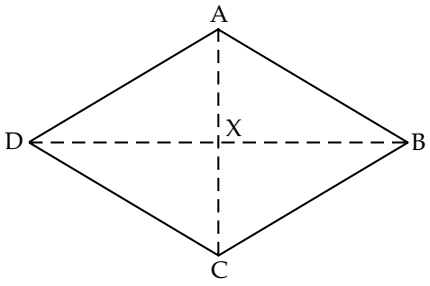
Solution

A rhombus is a quadrilateral with perpendicular diagonals. Therefore, all four angles are equal to 90°.

Therefore, $\angle a = \angle b = \angle c = \angle d = 90°$.

Perpendicular Bisecting Diagonals

Diagonals that are **mutually bisecting** and **perpendicular** to each other are also called **perpendicular bisectors**. These are diagonals that form four 90° angles where they intersect and also cut each other in half.



Given rhombus ABCD, measure ∠AXB, ∠BXC, ∠CXD, and ∠DXA.

Also, measure $\overline{AX}$, $\overline{BX}$, $\overline{CX}$, and $\overline{DX}$.

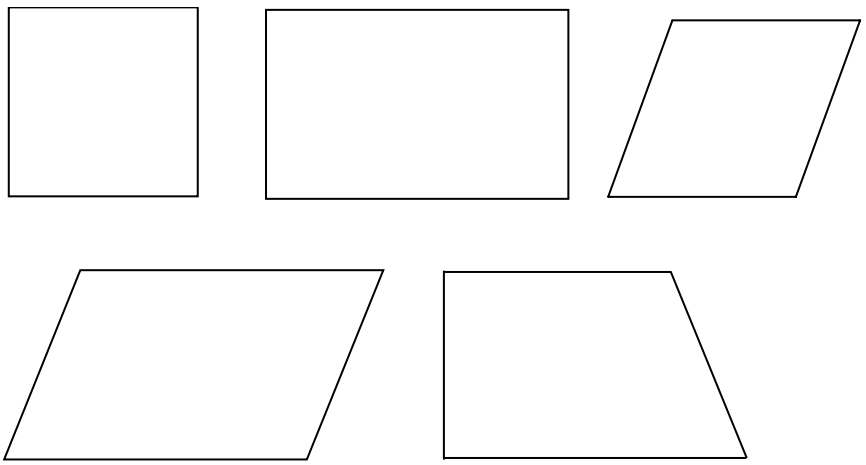
You should find that ∠AXB = ∠BXC = ∠CXD = ∠DXA = 90°.

You should also find that $\overline{AX} = \overline{CX}$ and $\overline{BX} = \overline{DX}$.

All the angles formed by the intersecting diagonals are equal in this rhombus. Also, each diagonal cuts the other diagonal in half. Therefore, a rhombus has the property of perpendicular bisecting diagonals.

Example 1

Draw the diagonals in the following quadrilaterals. Then measure the angles where the diagonals intersect and determine whether the diagonals bisect each other. Determine which quadrilaterals have the property of perpendicular bisecting diagonals.



Solution

You should discover that only the square and the rhombus have the property of perpendicular bisecting diagonals.

Example 2

Complete the chart below to organize the information you have just learned about diagonals.

Quadrilaterals	Mutually Bisecting Diagonals	Perpendicular Diagonals	Perpendicular Bisecting Diagonals
Square			
Rectangle			
Rhombus			
Parallelogram			
Trapezoid			
Isosceles Trapezoid			

Solution

Your chart should look like the one below.

Quadrilaterals	Mutually Bisecting Diagonals	Perpendicular Diagonals	Perpendicular Bisecting Diagonals
Square	✓	✓	✓
Rectangle	✓	✗	✗
Rhombus	✓	✓	✓
Parallelogram	✓	✗	✗
Trapezoid	✗	✗	✗
Isosceles Trapezoid	✓	✗	✗

You should add the above properties of the different types of quadrilaterals to your resource sheet.

Now that you have studied some of the properties of quadrilaterals and other polygons, it is time to complete the following assignment.

Learning Activity 2.2

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. ∠A, ∠B, and ∠C are all angles in a triangle. If ∠A = 40° and ∠B = 30°, what is the measure of ∠C?
2. If $4x - 3x + 8x + 2x = 121$, then $6x - 2 = ?$
3. During the Red River Ex, the number of visitors doubled each day. If the Red River Ex opened on Friday with 350 visitors, how many visitors were there on Sunday?
4. Evaluate for $y = 5$: $\left(\frac{30}{y}\right) - 7$
5. How many 15 m^3 containers can you fill with 300 m^3 of sand?

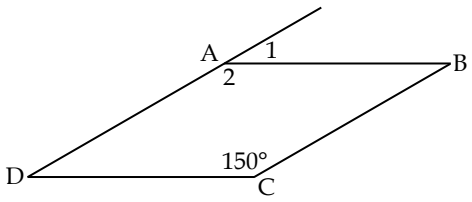
Part B: Quadrilaterals

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

Don't forget that you can ask your learning partner or tutor/marker for help if you are having a hard time understanding the material.

1. Given parallelogram ABCD, state the measure of ∠1.

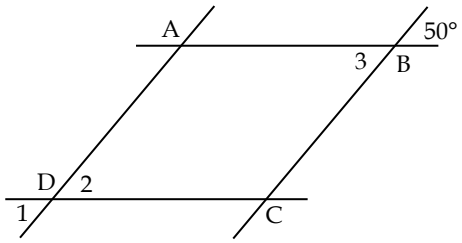
   a)



continued

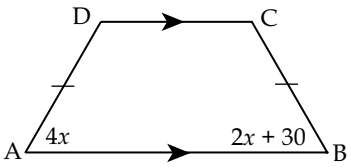
Learning Activity 2.2 (continued)

b)



2. Identify all the possible types of quadrilaterals described by each statement:
   a) A quadrilateral has opposite sides parallel, and at least one interior angle is 35°.
   b) A quadrilateral has one pair of opposite sides parallel, but the parallel sides are not the same length.
   c) A quadrilateral has one pair of opposite sides parallel and the same length.
   d) A quadrilateral has opposite sides parallel, and at least one 90° interior angle.
   e) A quadrilateral has both pairs of opposite sides parallel, at least two consecutive sides the same length, and at least one 90° angle.
   f) A quadrilateral has opposite sides parallel, consecutive angles equal, and consecutive sides not the same length.
   g) A quadrilateral has diagonals that are perpendicular to each other, but not the same length.
   h) A quadrilateral has diagonals that are the same length, but not perpendicular to each other.

3. Use your knowledge of trapezoids to solve for x.



continued

4. The diagram below displays a rhombus. Using what you know about rhombuses, find the measurements of:

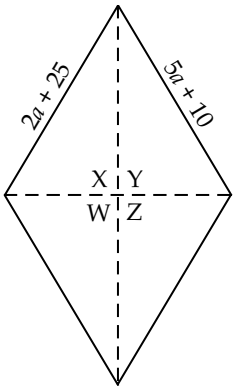
   a) ∠W

   b) ∠X

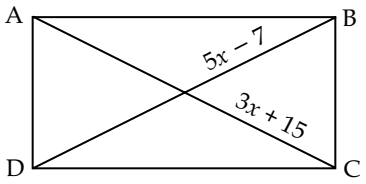
   c) ∠Y

   d) ∠Z

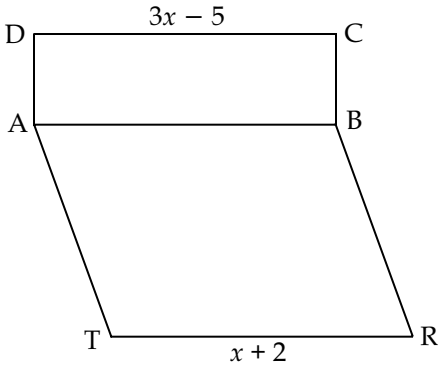
   e) a



5. Given rectangle ABCD, find the value of x.



6. Find the value of x if ABCD is a rectangle and ABRT is a parallelogram.



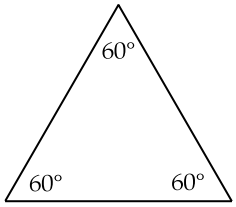
Lesson Summary

In this lesson, you identified different types of polygons. You studied the properties of a variety of quadrilaterals, including squares, rectangles, rhombuses, parallelograms, and trapezoids. The properties you studied included the angle measures and side lengths of quadrilaterals. You also studied the properties of diagonals of quadrilaterals, including diagonals that are perpendicular and/or diagonals that bisect each other.

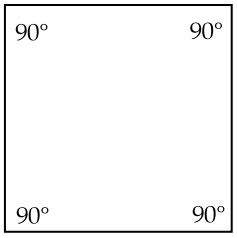
In the next lesson, you will study parallelograms and how they relate to other types of quadrilaterals.

Notes

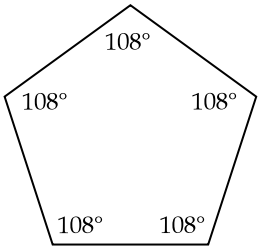
Regular Polygon Chart



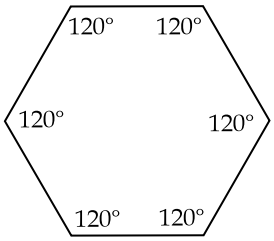
triangle



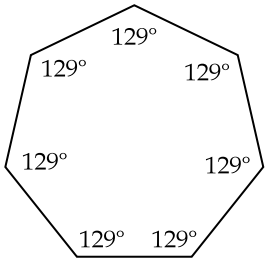
square



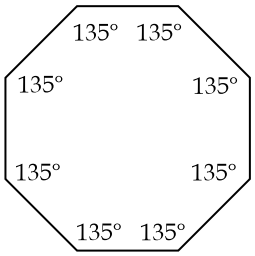
pentagon



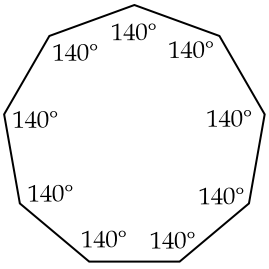
hexagon



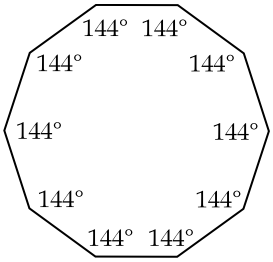
heptagon



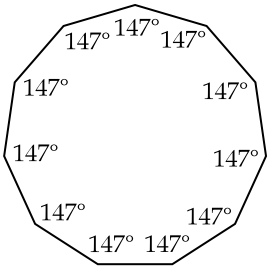
octagon



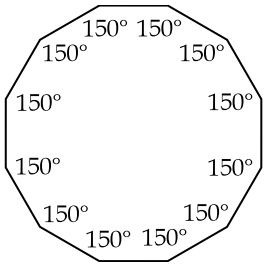
nonagon



decagon



undecagon



dodecagon

Notes

LESSON 3: PARALLELOGRAMS

Lesson Focus

In this lesson, you will

- ❑ study different types of parallelograms, including rectangles, rhombuses, and squares
- ❑ solve problems using the properties of parallelograms

Lesson Introduction

In the previous lesson, you studied the properties of various quadrilaterals, including parallelograms. In this lesson, you will focus on parallelograms and introduce a number of properties not mentioned previously.

Parallelograms

In the previous lesson, it was stated that a parallelogram is a quadrilateral. This means that it has four sides and the interior angles add up to 360°. In a **parallelogram**, the opposite pairs of sides are parallel. In Lesson 2, it was stated that:

- **Fact 1:** Opposite sides of a parallelogram are equal.
- **Fact 2:** Opposite interior angles of a parallelogram are equal.

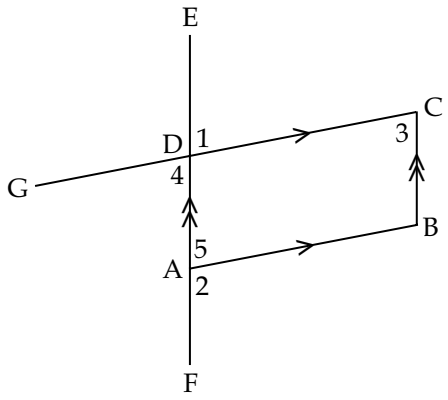
You may recall that two slashes, //, indicate parallel lines. In the statement, $\overline{AB} // \overline{CD}$, we say that line segment $\overline{AB}$ is parallel to the line segment $\overline{CD}$.

The previous lesson stated that the opposite interior angles of a parallelogram are equal. The following example will demonstrate this, using the properties of parallel lines.

Example 1

Can you follow the logic of this example, which proves opposite angles of a parallelogram are always of equal measure?

ABCD is a parallelogram. $\overline{AD}$ has been extended to E and F. Also, $\overline{CD}$ has been extended to G.



$\overline{EF}$ is now a transversal, crossing parallel lines $\overline{AB}$ and $\overline{CD}$.

$\angle 1 = \angle 5$ (Corresponding angles for parallel lines.)

$\angle 1 = \angle 4$ (Vertically opposite angles.)

So, $\angle 4 = \angle 5$ (Both are equal to $\angle 1$.)

As well, $\overline{GC}$ is now a transversal, crossing parallel lines $\overline{AD}$ and $\overline{BC}$.

$\angle 4 = \angle 3$ (Corresponding angles for parallel lines.)

So, $\angle 3 = \angle 5$ (Both are equal to $\angle 4$.)

$\angle 3$ and $\angle 5$ are opposite angles of parallelogram ABCD.

Therefore, opposite angles of a parallelogram are equal.

Properties of Parallelograms

Another property of any parallelogram is that consecutive angles of a parallelogram are supplementary. In other words, consecutive angles of a parallelogram add up to 180°.

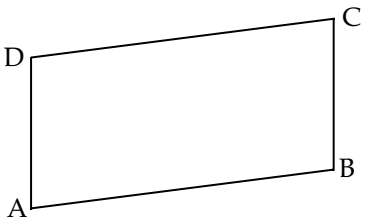
Consecutive angles of a polygon are the two angles at the opposite ends of any side of a polygon.

$\angle A$ and $\angle D$ are consecutive angles

$\angle D$ and $\angle C$ are consecutive angles

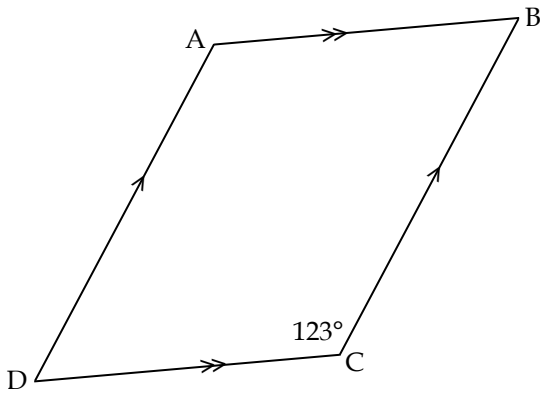
$\angle C$ and $\angle B$ are consecutive angles

$\angle B$ and $\angle A$ are consecutive angles



Example 1

In the diagram below, ∠C = 123°. What are the measures of angles A, B, and C?



Solution

∠C and ∠A are opposite angles of a parallelogram.

Therefore, ∠C = ∠A and ∠A = 123°.

∠C and ∠B are consecutive angles.

Therefore, ∠C + ∠B = 180°. (Substitute the value for ∠C.)

123° + ∠B = 180°. (Subtract 123° from both sides.)

∠B = 57°.

∠B and ∠D are opposite angles of a parallelogram.

Therefore, ∠B = ∠D and ∠D = 57°.

You have discovered another fact about parallelograms:

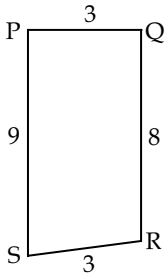
- **Fact 3:** Consecutive angles of a parallelogram are supplementary.

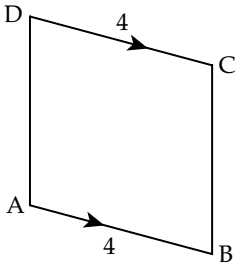
Two other properties of parallelograms are related to equal opposite sides:

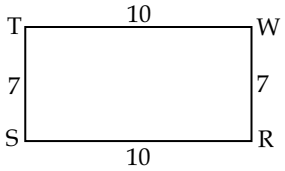
- **Fact 4:** If the opposite sides of a quadrilateral are equal, then the quadrilateral is a parallelogram.
- **Fact 5:** If one pair of opposite sides of a quadrilateral is parallel and equal, then the quadrilateral is a parallelogram.

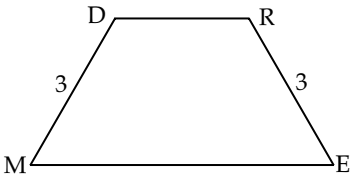
Example 2

Using the five facts you know about parallelograms as well as the definition of a parallelogram, which of the following quadrilaterals are parallelograms?









Solution

PQRS is not a parallelogram because opposite pairs of sides are not equal.

ABCD is a parallelogram because one pair of opposite sides is parallel and equal.

RSTW is a parallelogram because opposite sides are equal.

DREM is not a parallelogram because opposite sides are not parallel.

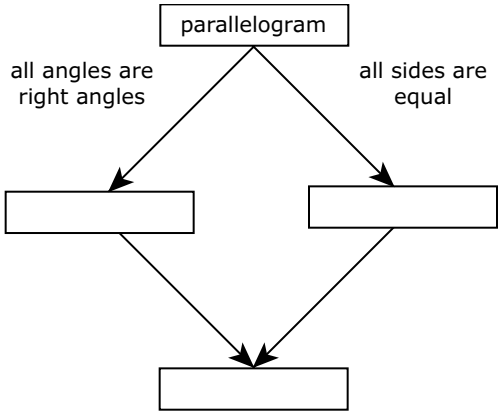
Types of Parallelograms

In the previous lesson, you studied rhombuses, rectangles, and squares. These are all different types of parallelograms.

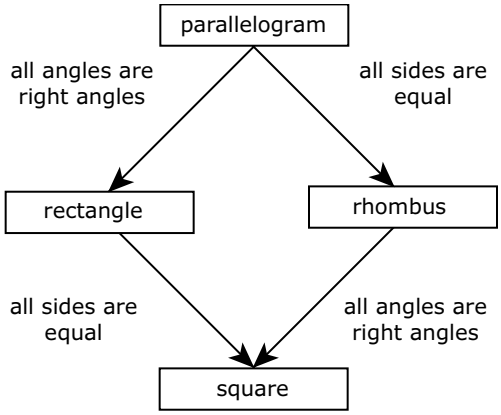
- A rectangle is a parallelogram with four right angles.
- A rhombus is a parallelogram with four sides of equal length.
- A square is a parallelogram with four sides of equal length and four angles of equal size (right angles).

Example 1

Using what you know about different types of parallelograms, complete the diagram below, which will demonstrate how parallelograms are related.



Solution



Remembering the properties of a parallelogram helps you remember the properties of a rectangle, a rhombus, and a square, since the same properties apply.

Example 2

Now that you have learned the properties of different parallelograms, do you know which parallelograms are regular polygons? It may be helpful to go back and review the definition of a regular polygon before answering this question.

Solution

A square is a regular polygon.

All sides of a square are equal and all interior angles in a square are equal. It should be noted that even though all sides of a rhombus are equal, the interior angles of a rhombus are not equal. A rhombus, therefore, is not a regular polygon.

Before you complete the following learning activity, you should take the time to update your resource sheet. You should make sure you have added the five facts for parallelograms. You should also add a brief description of the three types of parallelograms—rectangle, square, and rhombus.

It is now time to apply what you have learned about parallelograms. If you have difficulty understanding the following questions, you can ask your learning partner or tutor/marker for help. Don't forget to use the answer key to check your work!

Learning Activity 2.3

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. $\angle A$ and $\angle B$ are vertically opposite angles. If $\angle A = 124°$, what is the measure of $\angle B$?
2. $\angle A$ and $\angle B$ are alternate interior angles. If $\angle A = 172°$, what is the measure of $\angle B$?
3. Sam's age is 125% of Jacob's age. If Jacob is 20, what is Sam's age?
4. The perimeter of a rectangle with sides a, b, c, and d is 40 m. If sides a and c are 16 m long, what are the lengths of sides b and d?
5. What is the radius of a circle with an area of 36π m^2?

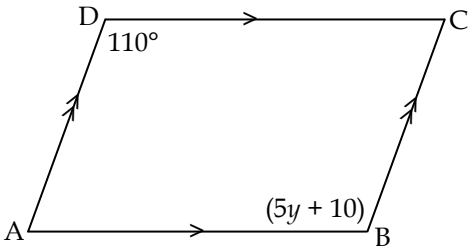
continued

Learning Activity 2.3 (continued)

Part B: Parallelograms

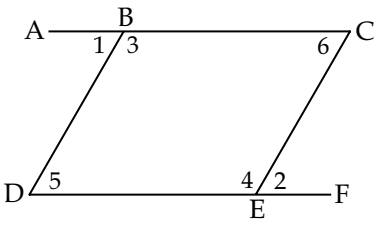
Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Find the value for y and the measures of angles C and A in the figure below.



2. ∠A and ∠X are consecutive angles of a parallelogram.
   a) If ∠A = 40°, what is the measure of ∠X?
   b) If ∠X = 37°, what is the measure of ∠A?

3. Given: Parallelogram BCED
   Show that ∠1 must equal ∠2.

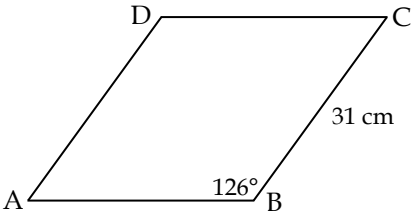


4. In quadrilateral XWZY, which angles are consecutive with ∠W? Select the correct answer.
   a) ∠Y and ∠Z
   b) ∠X and ∠Z
   c) ∠X and ∠Y and ∠Z
   d) ∠X and ∠Y

continued

Learning Activity 2.3 (continued)

5. Find the measures in the following rhombus.



$\overline{AB}$ = _____

$\overline{CD}$ = _____

$\overline{AD}$ = _____

$\angle ABC$ = _____

$\angle BCD$ = _____

$\angle ADC$ = _____

$\angle BAD$ = _____

Lesson Summary

In this lesson, you studied different types of parallelograms—rectangles, squares, and rhombuses. Each type of parallelogram has certain properties. For example, a square is a rectangle with four equal sides or a rhombus with four right angles.

Parallelograms are four-sided polygons. In the next lesson, you will be looking at polygons with three sides.

Complete the assignment following this lesson. This assignment is part of your evaluation for this module. Ask your learning partner or tutor/marker any questions that you have about this lesson or the previous two lessons.

Assignment 2.1

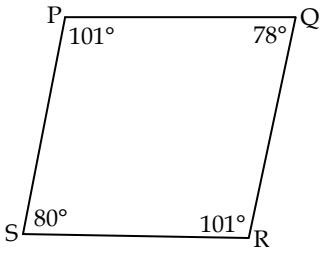
Polygons

Total: 31 marks

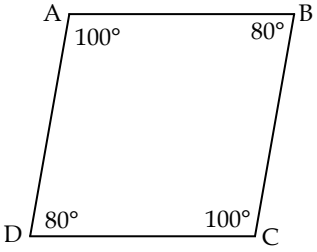
Note to Students: Have you made a resource sheet for this module? Do you have the definitions and formulas on your resource sheet? If so, you should use it now. If not, now would be a good time to make one.

1. Which of the following quadrilaterals are parallelograms? *(3 marks)*

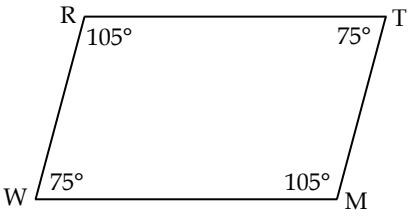
a)



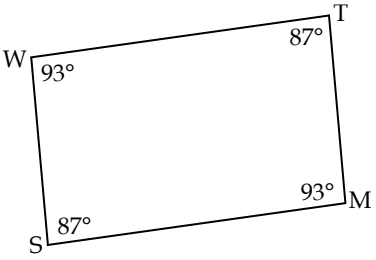
b)



c)



d)



continued

Assignment 2.1: Polygons (continued)

2. Find the following measures for parallelogram ABCD, shown below. *(5 marks)*

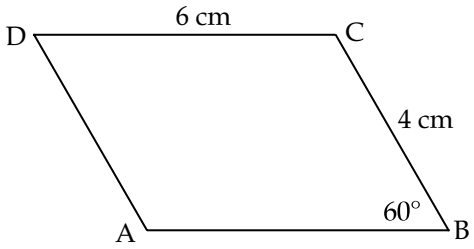
$\overline{AD}$ = _____

$\overline{AB}$ = _____

$\angle D$ = _____

$\angle C$ = _____

$\angle A$ = _____

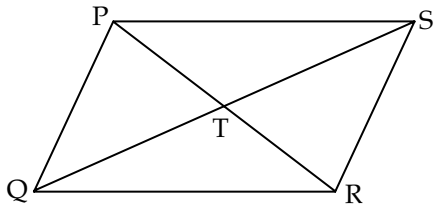


3. Find the value of x and then the requested values. *(4 marks)*

a) Parallelogram PQRS with $\overline{PT} = 2x - 5$ and $\overline{TR} = x - 1$.

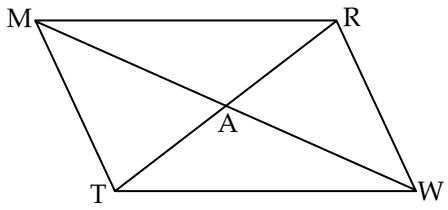
$\overline{TR}$ = _____

$\overline{PR}$ = _____

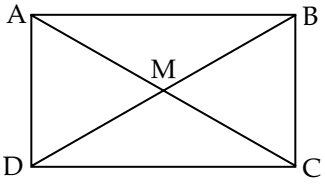


b) Parallelogram RWTM with $\overline{MA} = 5x$, $\overline{AR} = 4x + 1$, and $\overline{TA} = 2x + 5$.

$\overline{MA}$ = _____



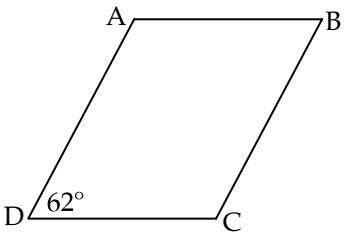
4. ABCD is a rectangle. Show that $\overline{AM}$ is half the length of $\overline{BD}$. *(3 marks)*



continued

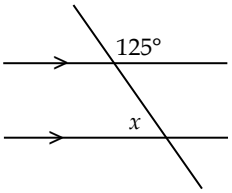
Assignment 2.1: Polygons (continued)

5. Consider the diagram below. If ∠ADC = 62°, what are the measures of ∠BAD, ∠BCD, and ∠ABC? Solve this problem using the properties of consecutive angles. *(3 marks)*

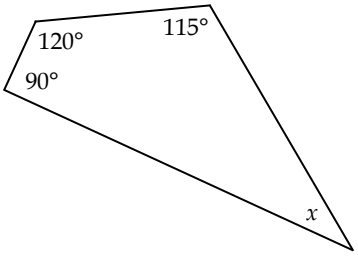


6. State the number of degrees of each angle marked with an x. *(6 marks)*

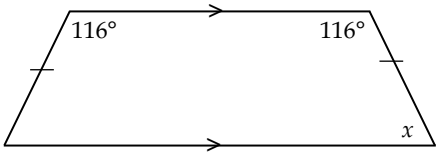
a)



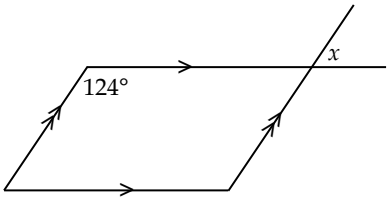
b)



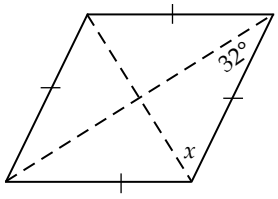
c)



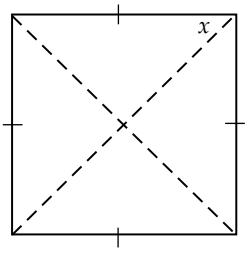
d)



e)



f)

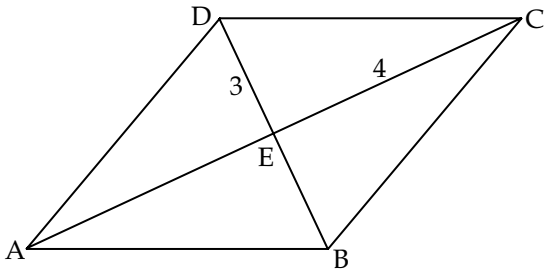


continued

Assignment 2.1: Polygons (continued)

7. Given the picture of a starfish below, what type of polygon would you get if you connected all the consecutive tips of the arms of the starfish? *(1 mark)*

8. ABCD is a rhombus with diagonals $\overline{AC}$ and $\overline{BD}$ intersecting at E. $\overline{DE} = 3$, and $CE = 4$. Calculate the length of $\overline{AB}$. Show how you arrive at your answer. *(3 marks)*



9. Consider the following picture of downtown Winnipeg and answer the following questions. *(3 marks)*

a) What do you notice about the shapes of city blocks?

b) Why do you think they are constructed in this way?

c) What are some factors that could change the shape of a city block?

Lesson 4: Triangles

Lesson Focus

In this lesson, you will

- ❑ identify different types of triangles
- ❑ review the Pythagorean theorem and trigonometric ratios
- ❑ observe how triangles are the building blocks of polygons with four or more sides

Lesson Introduction

In the previous lessons you studied quadrilaterals and parallelograms in some depth. In this lesson, you will study a variety of triangles, which are three-sided polygons. You will also review some procedures for calculating side lengths and angle measurements of triangles. A triangle is one of the basic shapes in geometry and is considered the basic shape of all polygons, as all polygons can be drawn as a combination of triangles.

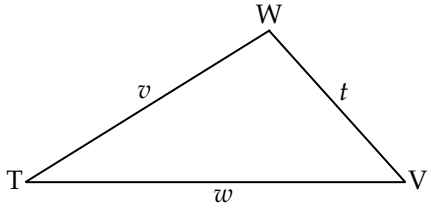
Triangles

Triangles are polygons that have three sides. The sum of the interior angles of a triangle is 180°.

You may wish to add this fact to your resource sheet.

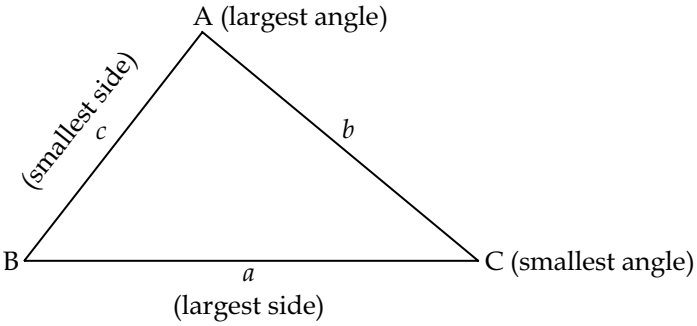
Labelling Triangles

A triangle is a polygon with three vertices and three sides. Each vertex (and also each angle) is labelled with a capital letter and each side is labelled with a non-capital letter. Since a triangle has three sides, each angle has exactly one opposite side. For this reason, the side opposite a vertex is labelled with the same letter as the vertex. Note that in the diagram below, side t is opposite angle T, side v is opposite angle V, and so on.



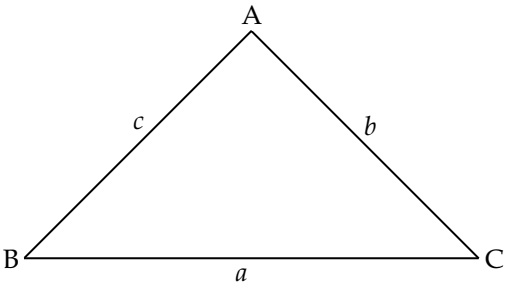
Types of Triangles

In a **scalene triangle,** the three sides have different lengths and the three angles have different measurements. The longest side is opposite the largest angle and the shortest side is opposite the smallest angle.



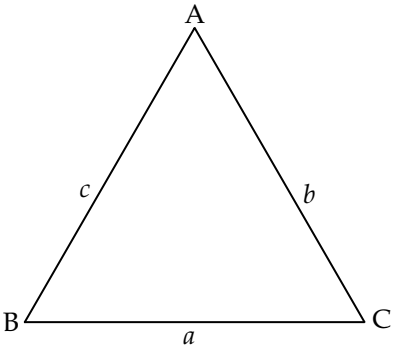
If ∠A > ∠B > ∠C, then a > b > c.

An **isosceles triangle** has two equal sides and two equal angles. The two equal angles in an isosceles triangle are always opposite the two equal sides.



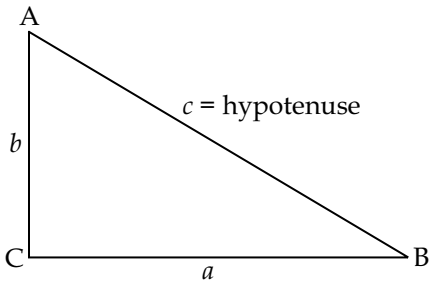
If ∠B = ∠C, then b = c.

An **equilateral triangle** has three equal sides and three equal angles.



If ∠A = ∠B = ∠C, then a = b = c.

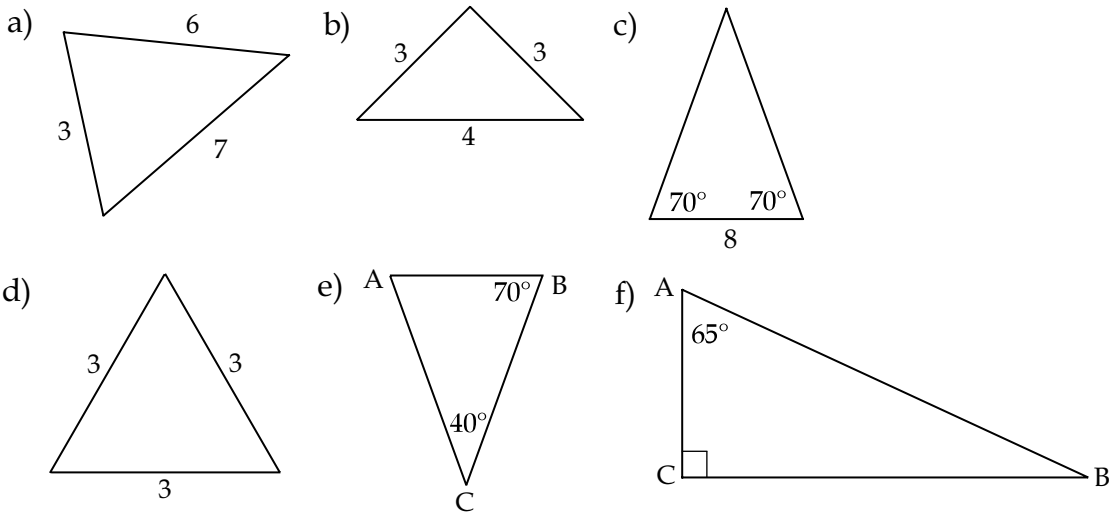
A **right triangle** (also known as a **right-angled triangle**) has one right angle (90^o). The side opposite the right angle is called the hypotenuse.



Since ∠C (90°) is the largest angle, then the hypotenuse (c) is the longest side.

Example 1

Identify the following triangles as scalene, isosceles, or equilateral.



Solution

a) This triangle is scalene as it does not have two equal sides.

b) This triangle is isosceles because it has two equal sides.

c) This triangle is isosceles because it has two equal angles.

d) This triangle is equilateral because it has three equal sides.

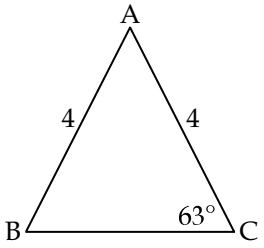
e) The measure of ∠A is (180 − 40 − 70) 70^o. Therefore the triangle is isosceles because two angles are equal to 70^o.

f) In this right triangle, ∠B is ($180^o - 90^o - 65^o$) 25^o, and so the triangle is scalene because it has three unequal angles.

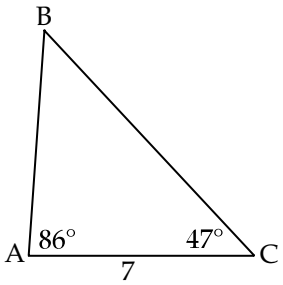
Example 2

Use the diagrams to answer the following questions.

a) What are the measures of ∠A, ∠B, and *c*?



b) What are the measures of ∠B, *b*, and *c*?



Solution

a) Triangle ABC is isosceles because AB = AC = 4

∠B = 63° because it is opposite one of the two equal sides.

∠A = 180° − 63° − 63° = 180° − 126° = 54°

c = 4—given in the diagram. Note that *c* is the side opposite ∠C

b) ∠B = 180° − 47° − 86° = 180° − 133° = 47°

Therefore, triangle ABC is isosceles because two angles = 47°

b = 7—the side opposite ∠B

Therefore, *c* = 7 because it is opposite ∠C, and the sides opposite equal angles are equal.

Example 3

What is the measure of each angle in an equilateral triangle?

Solution

All the angles in a triangle add up to 180°.

All the angles in an equilateral triangle are equal.

Therefore, each angle = $\left(\frac{180}{3}\right) = 60°$.

Example 4

a) Is an equilateral triangle a regular or irregular polygon?

b) Is an isosceles triangle a regular or irregular polygon?

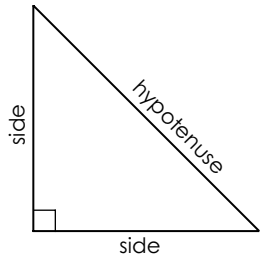
Solution

a) Regular polygons have all sides equal and all interior angles equal. An equilateral triangle has three equal sides and three equal angles. Therefore, an equilateral triangle is a regular polygon.

b) An isosceles triangle has two equal sides and two equal angles and, therefore, is not a regular polygon unless the third side and third angle are equal to the other sides and angles. Generally, we say that an isosceles triangle is not a regular polygon.

Review of Right-Angled Triangles

In previous courses, you solved **right-angled triangles**, which are triangles with one 90° angle. A right-angled triangle may also be called a **right triangle**.



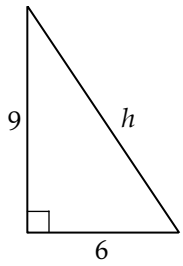
If you know the lengths of two sides of a right triangle, you can calculate the length of the third side using the Pythagorean theorem:

$$a^2 + b^2 = c^2$$

where a and b represent the side lengths, and c represents the length of the hypotenuse.

Example 1

In the image below, one side of the triangle measure six metres and the other side measures nine metres. What is the length of the hypotenuse?



Solution

Use $a^2 + b^2 = c^2$.

$a = 6$, $b = 9$, and h = hypotenuse length

Then

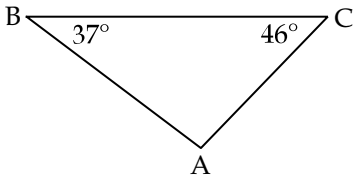
$6^2 + 9^2 = h^2$	(Square 6 and 9.)
$36 + 81 = h^2$	(Complete the addition.)
$117 = h^2$	(Find the square root of both sides.)
$10.8 = h$	

Therefore, the length of the hypotenuse is 10.8 metres.

If you know two angles of a triangle, you can calculate the third angle using the fact that the sum of the angles of a triangle equals 180^o.

Example 2

Calculate the size of $\angle A$.



Solution

$\angle A + \angle B + \angle C = 180^o$

We know that $\angle B = 37^o$ and $\angle C = 46^o$.

Then, $\angle A + 37^o + 46^o = 180^o$.

Conversely, $\angle A = 180^o - 37^o - 46^o = 97^o$.

Therefore, $\angle A = 97^o$.

If you know the measure of one angle (other than the right angle) and one side length of a right triangle, you can calculate the length of another side using the trigonometric ratios of sine, cosine, and tangent. These ratios are known in their abbreviated form as sin, cos, and tan.

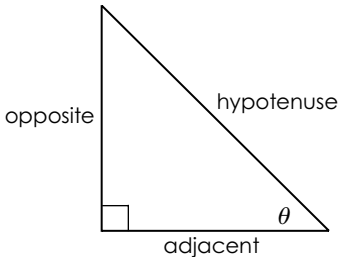
Here is a review of trigonometric ratios and how they are used.

The trigonometric ratios are given below:

$$\sin\theta = \frac{\text{side opposite the angle } \theta}{\text{hypotenuse}}$$

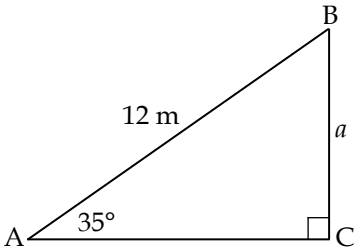
$$\cos\theta = \frac{\text{side adjacent to the angle } \theta}{\text{hypotenuse}}$$

$$\tan\theta = \frac{\text{side opposite the angle } \theta}{\text{side adjacent to the angle } \theta}$$



Example 3

Calculate the length of side a.



Solution

Triangle ABC is a right triangle.

$\theta = 35^{\circ}$, a is the opposite side, $c = 12$ m is the hypotenuse

Use the trig ratio: $\sin\theta = \dfrac{\text{opposite}}{\text{hypotenuse}}$

$$\sin 35^{\circ} = \frac{a}{12} \qquad \text{(Multiply both sides by 12.)}$$

$$12 \times \sin 35^{\circ} = a$$

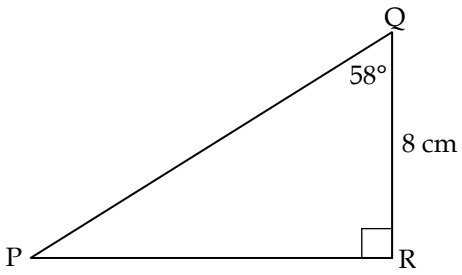
$$a = 12 \times 0.57357$$

$$a = 6.88$$

Therefore, the side length of a is 6.88 m.

Example 4

Calculate the length of the hypotenuse.



Solution

Triangle PQR is a right triangle.

$\theta = 58^{o}$, the adjacent side is 8 cm

Calculate the length of r, the hypotenuse.

Use the trig ratio: $\cos\theta = \dfrac{\text{adjacent}}{\text{hypotenuse}}$

$$\cos 58° = \frac{8}{r}$$ (Multiply both sides by r.)

$$r \times \cos 58° = 8$$ (Divide both sides by cos 58°.)

$$r = \frac{8}{\cos 58°}$$

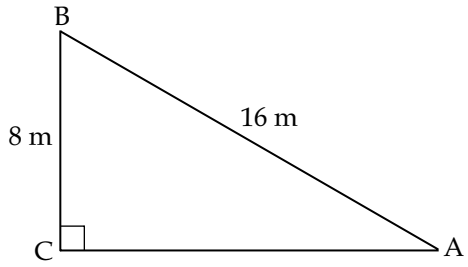
$$r = \frac{8}{0.530} = 15.1$$

Therefore, the length of the hypotenuse is 15.1 cm.

If you know the length of two sides of a right triangle, you can use the trig ratios listed above to calculate the size of one angle.

Example 5

Calculate the size of ∠A



Solution

Triangle ABC is a right triangle.

a = 8 m and a is opposite ∠A

c = hypotenuse = 16 m

Use trig ratio: $\sin\theta = \dfrac{\text{opposite}}{\text{hypotenuse}}$

$$\sin\theta = \frac{8}{16} = 0.5$$

You must now find the inverse trig ratio of sin:

$\theta = \sin^{-1}(0.5) = 30^{o}$

Therefore, ∠A = θ = 30^{o}.

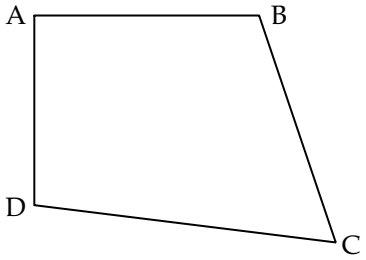
Be sure to add the definitions and properties of the different types of triangles to your resource sheet. Also, note that to find an unknown angle, you will always use the inverse function.

Triangles in Other Polygons

A triangle is the simplest of all polynomials, and all polygons can be drawn as one or more triangles. For this reason, a triangle is a useful tool when calculating the sum of all the interior angles of any polygon.

We know that the sum of the interior angles of a triangle is 180^{o}. We can now demonstrate that the sum of the interior angles of any quadrilateral, such as quadrilateral ABCD shown in Figure A, must be 360^{o}.

Figure A



Create Figure B by drawing diagonal $\overline{AC}$. The quadrilateral is now a combination of two triangles.

$\angle 1 + \angle 2 + \angle 3 = 180^{o}$

$\angle 4 + \angle 5 + \angle 6 = 180^{o}$

$\angle A + \angle B + \angle C + \angle D = 2 \times 180^{o} = 360^{o}$

Therefore, the sum of the interior angles of quadrilateral ABCD = 360^{o}.

Figure B

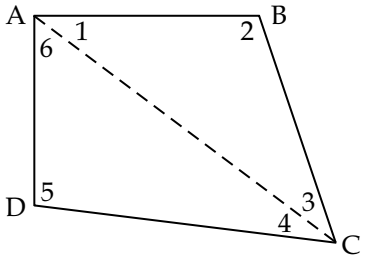


Figure C shows pentagon ABCDE. If you draw all possible diagonals from vertex A, you get the following diagram showing the pentagon as three triangles. Therefore, the sum of the interior angles of a pentagon is $3 \times 180^{o} = 540^{o}$

Figure C

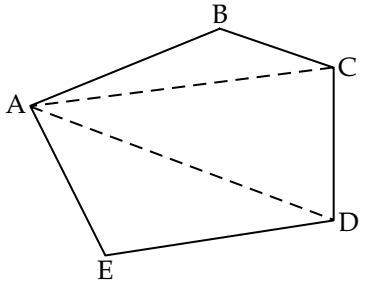
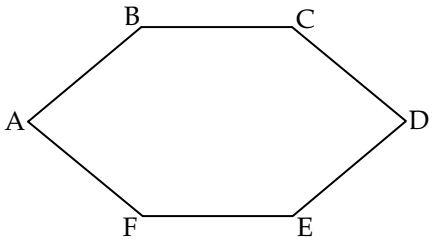


Figure D shows hexagon ABCDEF. Draw all possible diagonals from vertex A. The hexagon should now be a combination of four triangles, and the sum of the interior angles of the hexagon should be $4 \times 180^{o} = 720^{o}$

Figure C



To find the sum of the interior angles of any polygon with four or more sides, you first need to divide the polygon into triangles by drawing all possible diagonals from one of the vertices. After you count the number of triangles, you multiply that number by the sum of the angles in a triangle (180°) to find the sum of the angles in that polygon.

Sum of the angles in a polygon = # of triangles in a polygon × 180°

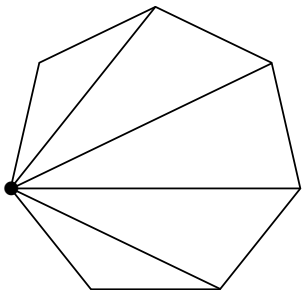
Include this formula on your resource sheet.

Example 5

Consider a heptagon. How many triangles are in a heptagon? What is the sum of the angles in a heptagon?

Solution

A heptagon can be divided into five triangles by drawing all possible diagonals from one of the vertices.



The sum of the angles in a heptagon is equal to the number of triangles in a heptagon times the sum of the angles in a triangle.

Sum of all angles = 5 × 180° = 900°

Therefore, the sum of the angles in a heptagon is 900°.

You may have noticed that the minimum number of triangles that are needed to divide any polygon is 2 less than the number of sides—that is, a 7-sided figure can be divided into 5 triangles with each triangle having a sum of 180°.

Now that you have explored the relationship between triangles and other polygons, you need to practice what you have learned.

Learning Activity 2.4

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. ∠A and ∠B are consecutive angles in a parallelogram. If ∠B = 37°, what is the measure of ∠A?
2. ∠A and ∠B are both base angles in an isosceles trapezoid. If ∠A = 57°, what is the measure of ∠B?
3. A Manitoba yoga centre distributes 42 yoga mats for each yoga session. After 6 yoga sessions, how many mats have they distributed?
4. How many sides does a hexagon have?
5. If $12 \times 16 = 192$, what is 14×16?

Part B: Applications of Triangles

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Complete the chart. It will be helpful in answering the following questions.

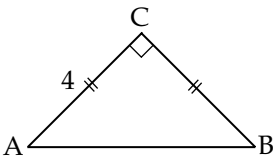
Polygon	Number of Sides	Minimum Number of Triangles	Sum of the Angles
Triangle Quadrilateral Pentagon Hexagon Heptagon Octagon Decagon			

continued

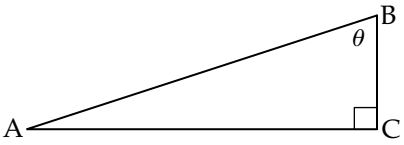
Learning Activity 2.4 (continued)

2. ABCDEF is a hexagon with ∠A = ∠B = ∠C = 100°. ∠D = 130°. The other two angles are equal. Find the measurements for ∠E and ∠F.

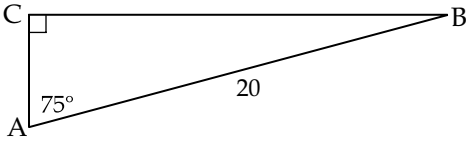
3. In the isosceles right triangle shown below, find the measurements for *a*, c, ∠B, and ∠A.



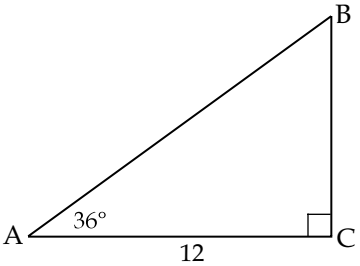
4. a) Label the sides of the triangle with the following: *a*, *b*, *c*, opposite, adjacent, and hypotenuse.



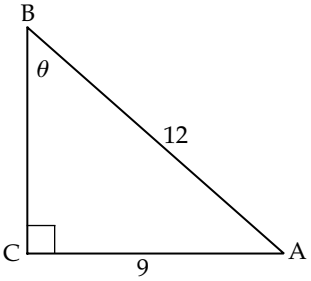
b) Calculate the value of *a*.



c) Find the length of the hypotenuse.



d) Find the value of θ, which is ∠B.



continued

Learning Activity 2.4 (continued)

5 a) Calculate the sum of the angles of a 9-sided polygon.

b) Calculate the sum of the angles of an 11-sided polygon.

6. Complete a chart that shows the relationship among all of the following:

Polygon
Triangle
Quadrilateral
Parallelogram
Rectangle
Rhombus
Square
Trapezoid
Isosceles Trapezoid

It may be helpful for you to include this diagram on your resource sheet (after you have checked your answers!) in order for you to remember the relationship among different types of polygons.

Lesson Summary

In this lesson, you reviewed scalene, isosceles, equilateral, and right triangles. You learned that all polygons with four or more sides can be drawn as a combination of triangles, and that this detail can be used to calculate the sum of the interior angles of any polygon. In the next lesson, you will learn how to find the side lengths and angle measures of non-right triangles.

Lesson 5: Trigonometry: The Sine Law

Lesson Focus

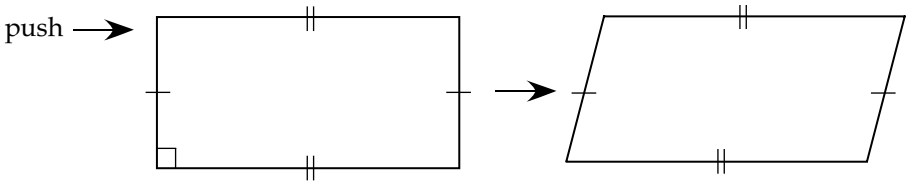
In this lesson, you will

- ❑ learn how and when to use the Sine Law
- ❑ solve problems, including real-life problems, using the Sine Law

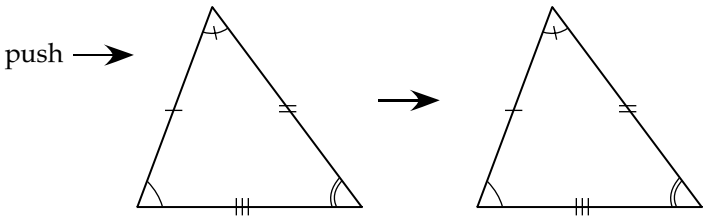
Lesson Introduction

Trigonometry can be used to calculate the side lengths and angle measures of triangles. Triangular shapes are used in construction to create rigid structures.

Quadrilaterals, on the other hand, are not rigid structures. In the diagram below, you can see how a rectangle can be *pushed* to form a parallelogram. All sides remain the same length, but the interior angles change.



A rectangle, therefore, is not a rigid structure. Similarly, any polygon with four or more sides is not a rigid structure. As stated above, however, a triangle is a rigid structure. If you *push* a triangle, the shape cannot change without changing the side lengths.



Due to the rigid structure of triangles, they are a common shape in construction of roof supports and tall towers.

In the previous lesson, you studied different types of triangles, which included calculating the side lengths and angle measurements of right-angled triangles. In this lesson, you will learn how to find the lengths of sides and measurements of angles of triangles that are not right-angled triangles.

The Sine Law

Non-right triangles are triangles that do not have a 90° angle. The trigonometric ratios of sin, cos, and tan are used to find the unknown measurements in right triangles only. To solve for the unknown measurements in triangles that do not have a right angle, you need different formulas. One of the formulas you can use is the **Sine Law**, also known as the **Law of Sines**.

It may be helpful for you to add this formula to your resource sheet. You should also include the situations in which the Sine Law can be used.

The Sine Law in words is: "The ratio of the sine of any angle over its opposite side is a constant."

The Sine Law is written as follows:

$$\frac{\sin \angle A}{a} = \frac{\sin \angle B}{b} = \frac{\sin \angle C}{c}$$

or

$$\frac{a}{\sin \angle A} = \frac{b}{\sin \angle B} = \frac{c}{\sin \angle C}$$

As long as you know both an angle and its opposite side, the Sine Law can help you.

The Sine Law can be used in two situations.

Situation One

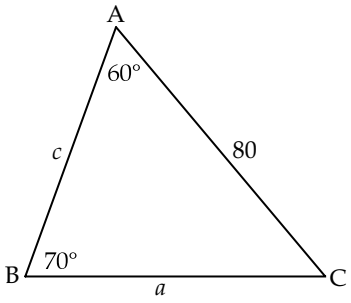
Given two angles of a triangle and one of its sides, you can solve a non-right triangle by using these steps:

1. Find the third angle by subtracting the sum of the two given angles from 180°.
2. Find the two missing sides using the Sine Law.

You may remember that **solving a triangle** means finding the lengths of ALL the missing sides, and the measurements of ALL the missing angles.

Example 1

Find the lengths of side *a*.



Solution

Remember, when you are using trigonometry, you must be sure your calculator is set to degrees. Add this reminder to your resource sheet.

$\angle C = 180° - (60° + 70°) = 50°$

Use the formula:

$$\frac{a}{\sin \angle A} = \frac{b}{\sin \angle B} = \frac{c}{\sin \angle C}$$

Note that you only ever use two of the ratios in the formula, separated by an "=" sign, and never all three at once.

To find *a*, use $\angle A$, $\angle B$, and *b*:

$$\frac{a}{\sin 60°} = \frac{80}{\sin 70°} \qquad \text{(Multiply both sides by sin 60°.)}$$

$$a = \frac{80 \sin 60°}{\sin 70°}$$

$$a = \frac{80(0.866)}{0.940}$$

$$a = 73.7$$

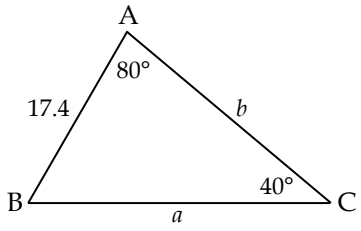
Side *a* is 73.7.

Note that the Sine Law formula used was $\frac{a}{\sin \angle A} = \frac{b}{\sin \angle B} = \frac{c}{\sin \angle C}$.

The reason for using this formula is that you needed to find sides *a* and *b*, and this version of the formula works best when you need to calculate side lengths because the length variable is on the top of the ratio.

Example 2

Solve the triangle by finding the lengths of sides a and b, and the measurement of $\angle B$.



Solution

Step 1: $\angle B = 180° - 80° - 40°$

$\angle B = 60°$

Step 2: Use side c because you know both side c and $\angle C$.

$$\frac{a}{\sin 80°} = \frac{17.4}{\sin 40°}$$

Cross-multiply to get rid of the denominators:

$a \sin 40° = 17.4 \sin 80°$

$$a = \frac{17.4 \sin 80°}{\sin 40°}$$

$a = 26.7$

Step 3: $\dfrac{b}{\sin 60°} = \dfrac{17.4}{\sin 40°}$

Cross-multiply to get rid of the denominators:

$b \sin 40° = 17.4 \sin 60°$

$$b = \frac{17.4 \sin 60°}{\sin 40°}$$

$b = 23.4$

This yields the final answer of $\angle B = 60°$, $a = 26.7$, and $b = 23.4$, which indicates a fully solved triangle.

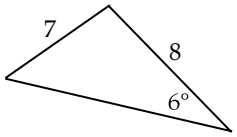
Situation Two

If you are given the lengths of two sides and the measurement of one angle of a triangle, you can use the Sine Law, but only if the angle you are given is opposite one of the given sides.

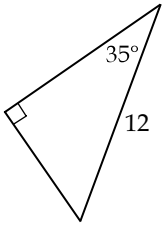
Example 3

Explain in which of the following triangles you could use the Sine Law.

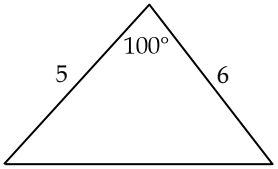
a)



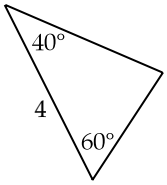
b)



c)



d)



Solution

a) You can use the Sine Law because you are given the lengths of two sides and you are also given the measure of an angle (6^o) that is opposite one of these given sides (7).

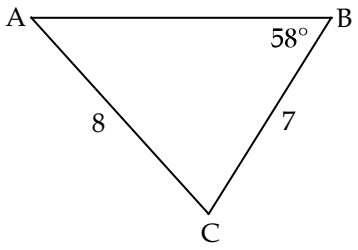
b) You can, but you do do not need to, use the Sine Law to solve a right-angled triangle. The Sine Law is needed to solve non-right triangles.

c) You cannot use the Sine Law because you are given the lengths of two sides, and the angle you are given is not opposite one of these given sides.

d) You can use the Sine Law because you are given the measure of two angles and the length of one side. When you are given two angles, you can calculate the third angle ($180^o - 40^o - 60^o = 80^o$). The given side length (4) is opposite a known angle (80^o).

Example 4

Find the measurements of ∠A and ∠C of ΔABC, given the diagram below.



Solution

Use the formula:

$$\frac{\sin \angle A}{a} = \frac{\sin \angle B}{b} = \frac{\sin \angle C}{c}$$

To find ∠A, use:

$$\frac{\sin \angle A}{a} = \frac{\sin \angle B}{b}$$ (Because you know a, ∠B, and b.)

$$\frac{\sin \angle A}{7} = \frac{\sin 58°}{8}$$ (Multiply both sides by 7.)

$$\sin \angle A = \frac{7 \sin 58°}{8}$$

$$\sin \angle A = 0.74204$$

$$\angle A = \sin^{-1}(0.74204)$$

$$\angle A = 47.9°$$

To find ∠C:

$$\angle C = 180° - (58° + 47.9°)$$

$$\angle C = 74.1°$$

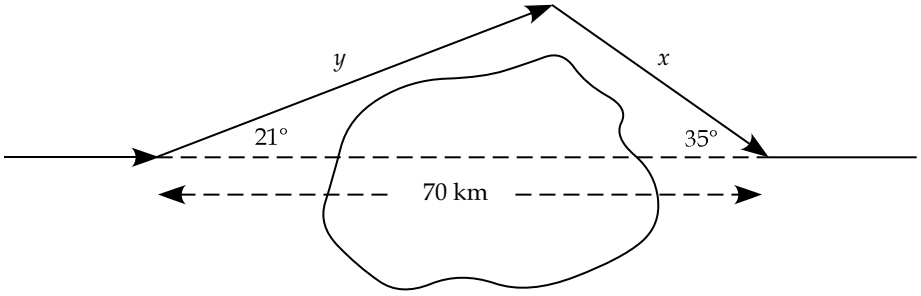
Therefore, ∠A = 47.9° and ∠C = 74.1°.

Note that the Sine Law formula used was $\frac{\sin \angle A}{a} = \frac{\sin \angle B}{b} = \frac{\sin \angle C}{c}$.

The reason for using this formula is that you needed to find ∠A and ∠C, and this version of the formula works best when you need to calculate angle measurements because the unknown angle is on the top of the ratio.

Example 5

Suppose you are the pilot of a commercial airliner. You find it necessary to detour around a group of thundershowers. You turn at an angle of 21° to your original path, fly for a while, turn, and intercept your original path at an angle of 35°, 70 kilometres from where you left it.



How much further did you have to go because of the detour?

Solution

$180° - (21° + 35°) = 124°$

By Law of Sines:

$$\frac{70}{\sin 124°} = \frac{x}{\sin 21°}$$

$$x = \frac{70 \sin 21°}{\sin 124°}$$

$$x = 30.3 \text{ km}$$

Also, $\dfrac{70}{\sin 124°} = \dfrac{y}{\sin 35°}$

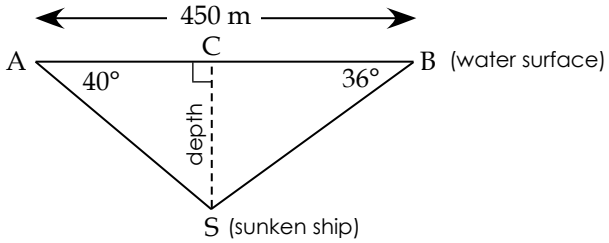
$$y = \frac{70 \sin 35°}{\sin 124°}$$

$$y = 48.4 \text{ km}$$

Extra distance is $x + y - 70 = 30.3 + 48.4 - 70 = 8.7$ km.

Example 6

Two observers on boats have located a sunken ship using sonar equipment. The sunken ship is in line between the two observers. The angle of depression from Observer A to the sunken ship is 40°, and the angle of depression from Observer B to the sunken ship is 36°. The distance between the observers is 450 metres. How far is the ship below the surface of the water? Round your answer to the nearest metre.



Note that the depth is the perpendicular distance from the sunken ship to the surface of the water.

Solution

$\angle ASB = 180° - (40° + 36°) = 104°$.

First, calculate b using the Sine Law:

$$\frac{b}{\sin 36°} = \frac{450}{\sin 104°}$$

$$b = \frac{450 \sin 36°}{\sin 104°}$$

$$b = 272.6 \text{ m}$$

Next, find CS in ΔACS: (ΔACS is a right triangle so we can use $\sin A = \frac{\text{opposite}}{\text{hypotenuse}}$)

$$k \sin 40° = \frac{CS}{272.6}$$

$$CS = 272.6 \sin 40°$$

$$CS = 175 \text{ m}$$

The depth of the sunken ship is 175 metres.

As these examples have shown, the Sine Law is useful for finding the missing sides and angles of non-right triangles. The examples also show that the Sine Law is useful for solving problems (involving non-right triangles) related to navigation and exploration. Use the following learning activity to practice solving triangles using the Sine Law.

Learning Activity 2.5

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. ∠A, ∠B, and ∠C are all angles in an isosceles triangle. If ∠A = 40° and ∠B and ∠C are base angles in the triangle, what is the measure of ∠C?
2. Which polygon has all equal sides and all interior angles equal to 90°?
3. ∠A and ∠B are opposite interior angles in a parallelogram. If ∠A = 38°, what is the measure of ∠B?
4. Evaluate: 20% of 315
5. You currently have $623 in your chequing account. You then spend $123 from your chequing account on clothes. You then deposit a cheque worth $142 into your chequing account. What is the final balance of your chequing account?

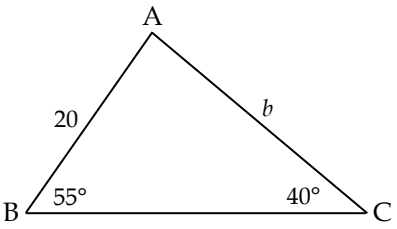
continued

Part B: The Sine Law

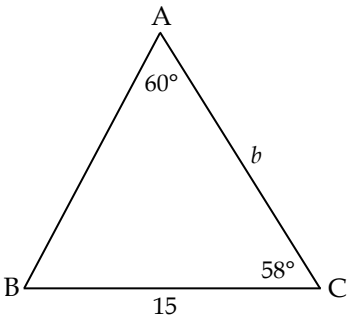
Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Find the length of side *b*.

a)

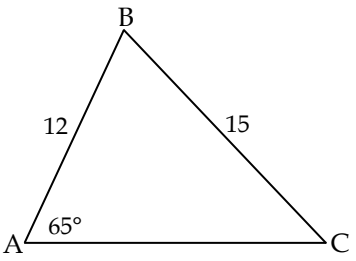


b)

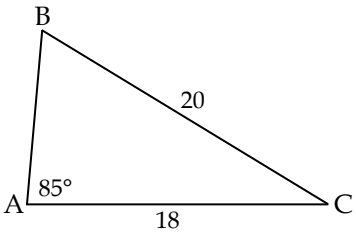


2. Find the measurement of angle C.

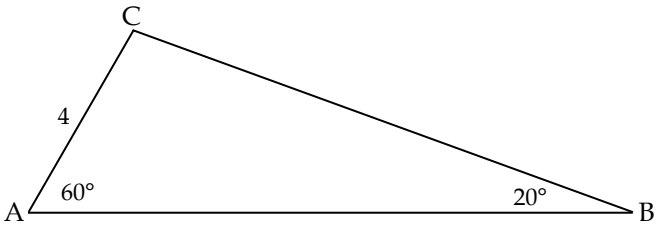
a)



b)



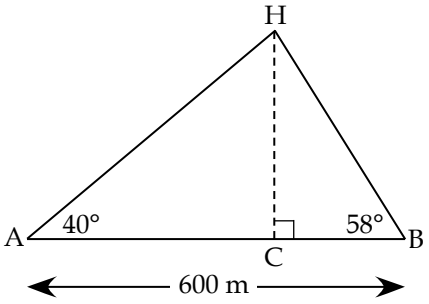
3. Find the length of $\overline{AB}$.



continued

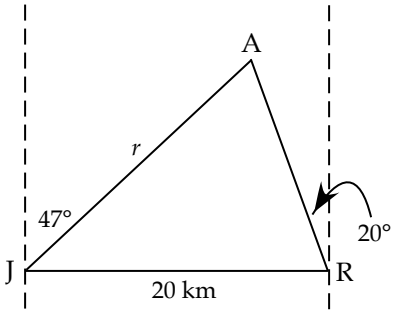
Learning Activity 2.5 (continued)

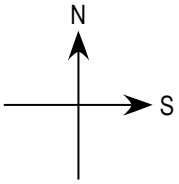
4. Alf and Beth are both looking at a hot air balloon. For Alf the angle of elevation is 40^{o}, and for Beth the angle of elevation is 58^{o}. How high is the balloon above ground if the distance between Alf and Beth is 600 metres? In the diagram, A represents Alf, B represents Beth, H represents the hot air balloon, and HC is the distance of the balloon above the ground.



5. Fire ranger Jamal is 20 km due west of fire ranger Raj. They spot a fire and report the sightings as follows:
   - Jamal reports that the fire is N 47° E of his station.
   - Raj reports that the fire is N 20° W of his station.

   How far is the fire from Jamal's station?





   Write the values of ∠AJR and ∠ARJ into the diagram before you solve the problem.

Lesson Summary

In this lesson, you learned how to use the Sine Law to find the lengths of missing sides and the measurements of missing angles. You also learned how the Sine Law could be applied to real-life situations.

Remember that the Sine Law applies to non-right triangles in certain situations. In the next lesson, you will study the Cosine Law. The Cosine Law can be used to solve non-right triangles that you cannot solve with the Sine Law.

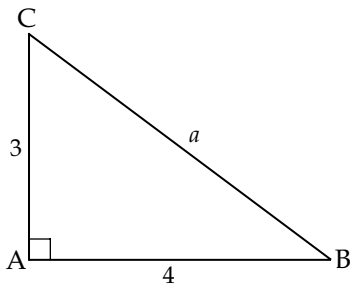
It is now time to complete Assignment 2.2. As you go through the assignment, record any new formulas and sample problems on your resource sheet. Your resource sheet is a useful tool to help you prepare for the midterm examination. Be sure you understand the material from this lesson before you complete the assignment, and don't hesitate to contact your learning partner or tutor/marker if you have any questions.

Assignment 2.2

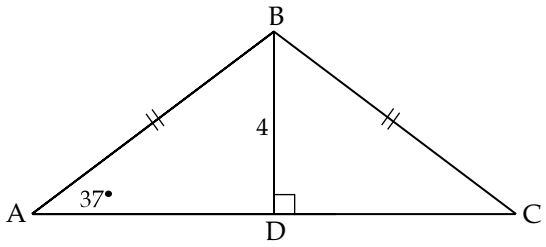
The Sine Law

Total: 33 marks

1. Use the given diagrams to solve the following:
   a) Find the measurement of side *a*. *(2 marks)*



   b) Triangle ABC is isosceles with $\overline{AB} = \overline{BC}$, $\angle A = 37°$, and $\overline{BD} = 4$. Calculate the length of $\overline{AC}$. *(4 marks)*

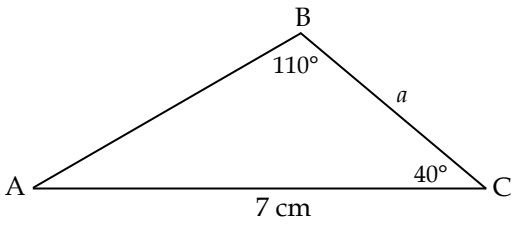


continued

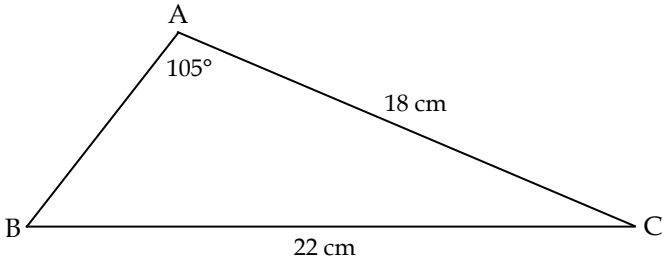
Assignment 2.2: The Sine Law (continued)

2. Solve for the requested measurements.

   a) Use the Sine Law to find the length of side *a*. *(3 marks)*



   b) Find the measurement of ∠C. *(4 marks)*



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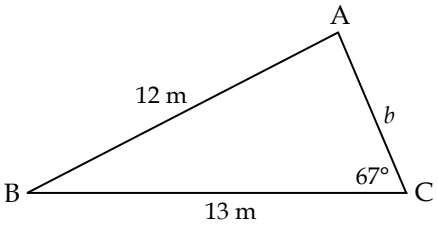
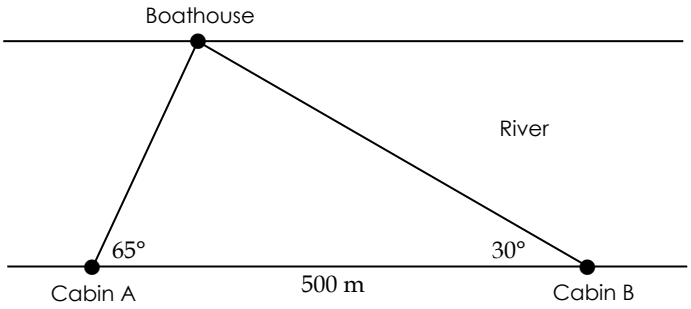
Assignment 2.2: The Sine Law (continued)

3. Use the Sine Law to solve the following triangle. *(4 marks)*



4. Two cabins are located on the same side of a river at its edge. The cabins are 500 m apart. A boathouse, also at the edge of the river, is located on the opposite side of the river. Use the illustration below to determine how much further the boathouse is from Cabin B than from Cabin A. *(5 marks)*



continued

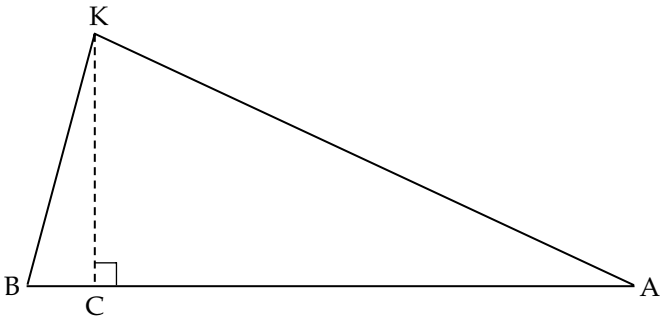
Assignment 2.2: The Sine Law (continued)

5. A kite is spotted simultaneously by two observers at points A and B, 3 km apart. The angles of elevation of the kite from A and B are 25° and 75°, respectively. How high above the ground is the kite? *(5 marks)*

   The angle of elevation is the angle above the horizontal (or the ground in this case) that the observer must look to see the object that is higher than the observer.

   As well, the word *respectively* means that the order of the observers matches the order of the angles. Hence, A is matched with 25° and B is matched with 75°.

   Hint: First, find the length of side BK, and then find KC.



continued

Assignment 2.2: The Sine Law (continued)

6. How can you determine whether or not it is possible for the sum of the angles of a polygon to total 4000^{o}? Show how you arrive at your answer. *(2 marks)*

7. a) Using the table you completed in Lesson 4, describe how you can find the sum of the interior angles of a polygon if you know the number of sides. *(2 marks)*

   b) Calculate the sum of the interior angles of a polygon with 22 sides. *(2 marks)*

Notes

Lesson 6: Trigonometry: The Cosine Law

Lesson Focus

In this lesson, you will

- ❑ learn how to use the Cosine Law
- ❑ solve real-life problems using the Cosine Law

Lesson Introduction

In the previous lesson, you used the Sine Law to solve non-right triangles, but found that some non-right triangles cannot be solved using the Sine Law. Another formula, the Cosine Law, is used to solve these triangles. As a result, all non-right triangles can be solved using either the Sine Law or the Cosine Law.

The Sine Law and the Cosine Law can be used in construction, industrial, commercial, or artistic applications. For example, the Sine Law or Cosine Law will be used when designing a triangular window (non-right triangle) or a triangular garden that must meet particular specifications for lengths and angles.

This lesson also demonstrates how problems relating to machinery and recreation can be solved using the Cosine Law.

The Cosine Law

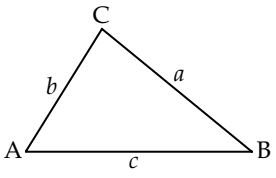
The Cosine Law can be used to solve certain non-right triangles. Just as the Sine Law could only be used in certain situations, it is also true that the Cosine Law can only be used in certain situations. Make sure you add this formula to your resource sheet, along with the situations in which you can use the Cosine Law.

The Cosine Law is written as follows for any triangle, ABC:

$a^2 = b^2 + c^2 - 2bc \cos \angle A$

$b^2 = a^2 + c^2 - 2ac \cos \angle B$

$c^2 = a^2 + b^2 - 2ab \cos \angle C$



Note that there are three versions of this formula, but there is a pattern. Notice the side squared on the left of the formula always corresponds to the angle on the right side of the formula.

As with the Sine Law, in order for the Cosine Law to work, you must label your triangles correctly, where a is opposite $\angle$A, b is opposite $\angle$B, and so on.

Just like the Sine Law, the Cosine Law can be used in only two situations.

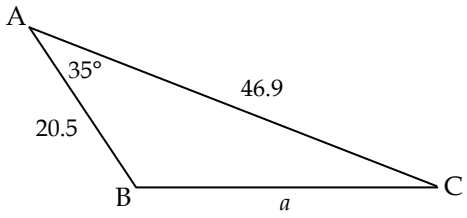
Situation One

If you are given two sides and the angle between them, you can solve the triangle using the following steps.

1. Calculate the length of the missing side using the Cosine Law.
2. If required, you can use the Sine Law to calculate the measure of the smallest of the unknown angles. The Sine Law may be used more accurately with smaller angles.
3. If required, you can find the third angle using the fact that the sum of angles in a triangle is 180°.

Example 1

Given the triangle measurements as shown, find the measure of side a.



Solution

Notice, you cannot use Sine Law because you don't know both a side and its opposite angle. Use Cosine Law.

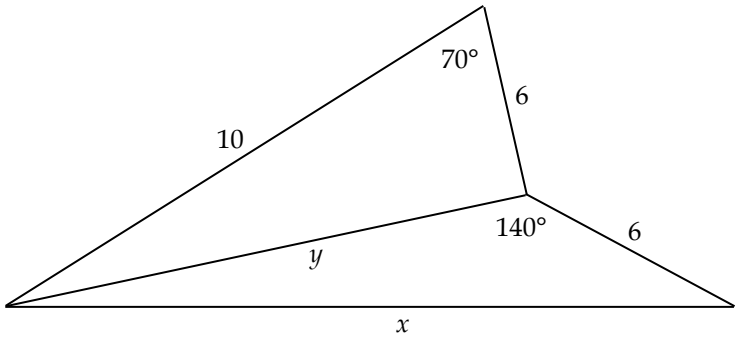
$a^2 = b^2 + c^2 - 2bc \cos \angle A$

$a^2 = 46.9^2 + 20.5^2 - 2(46.9)(20.5) \cos 35°$

$a = 32.3$

Example 2

Find the length of side x.



Solution

Solve for y in the top triangle.

You cannot use the regular trig ratios because these are no right triangles. You cannot use Sine Law because you don't have both an angle and its opposite side.

Use the Law of Cosines (use side y and its opposite angle of 70°):

$$y^2 = 10^2 + 6^2 - 2(6)10 \cos 70°$$

$$y^2 = 100 + 36 - 41.042 = 94.957$$

$$y = 9.74$$

Now solve for x in the bottom triangle.

Use the Law of Cosines (side x has an opposite angle of 140°):

$$x^2 = 9.74^2 + 6^2 - 2(9.74)6 \cos 140°$$

$$x^2 = 94.957 + 36 - (-89.535)$$

$$x^2 = 220.492$$

$$x = 14.8$$

If you are given two sides and the included angle of a triangle, use the Cosine Law to find the length of the third side. You cannot use the Sine Law because you do not know the length of a side and the measure of the opposite angle. For example, you do not know a combination such as $\angle A$ and a.

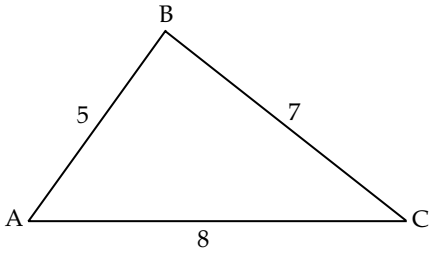
Situation Two

If you are given three sides of a non-right triangle, you can solve the triangle using the following steps:

1. Determine the measure of one of the larger angles using the Cosine Law (larger angles are opposite longer sides).
2. Calculate the measure of the smallest angle using the Sine Law.
3. Find the third angle using the fact that the sum of angles in a triangle is 180°.

Example 1

Find the measure of the smallest angle in triangle ABC, if $a = 7$, $b = 8$, and $c = 5$.



Solution

Since $c = 5$ is the shortest side, it follows that the angle opposite this, $\angle C$, is the smallest angle.

By the Law of Cosines:

$$5^2 = 7^2 + 8^2 - 2(7)8 \cos \angle C$$

This side and angle must be opposite each other.

You need to solve for $\angle C$. Start by getting the term with $\angle C$ by itself on the right.

$$25 = 49 + 64 - 112 \cos \angle C$$ (Subtract 49 and 64 from both sides.)

$$25 - 49 - 64 = -112 \cos \angle C$$

$$-88 = -112 \cos \angle C$$ (Simplify.)

$$\frac{-88}{-112} = \cos \angle C$$ (Divide both sides by (−112)).

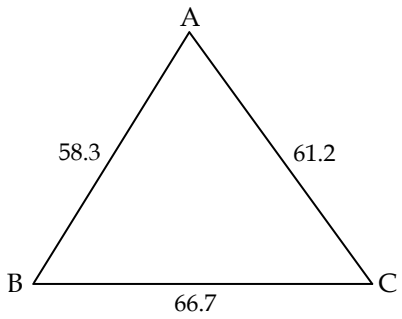
$$\cos \angle C = 0.7857$$

$$\angle C = \cos^{-1}(0.7857)$$ (Always use the inverse trigonometric function to find the angle.)

$$\angle C = 38.2°$$

Example 2

Solve for angles ∠A, ∠B, and ∠C in the following diagram.



Solution

Step 1: Use this formula to calculate ∠A.

$$a^2 = b^2 + c^2 - 2bc \cos \angle A$$

$$66.7^2 = 61.2^2 + 58.3^2 - 2(61.2)(58.3) \cos \angle A$$

$$66.7^2 - 61.2^2 - 58.3^2 = -2(61.2)(58.3) \cos \angle A$$

$$\cos \angle A = \frac{66.7^2 - 61.2^2 - 58.3^2}{-2(61.2)(58.3)}$$

$$\cos \angle A = 0.377728$$

$$\angle A = \cos^{-1}(0.377728)$$

$$\angle A = 67.8°$$

Step 2: $\dfrac{\sin \angle C}{c} = \dfrac{\sin \angle A}{a}$

$$\frac{\sin \angle C}{58.3} = \frac{\sin 67.8°}{66.7}$$

Calculate ∠C because c is the shortest side.

$$\sin \angle C = \frac{58.3 \sin 67.8}{66.7}$$

$$\sin \angle C = 0.80927$$

$$\angle C = \sin^{-1}(0.80927)$$

$$\angle C = 54.0°$$

Step 3: $\angle B = 180° - 67.8° - 54.0°$

$\angle B = 58.2°$

The answer is $\angle A = 67.8°$, $\angle B = 58.2°$, and $\angle C = 54.0°$.

As you can see, the Cosine Law is useful for finding the missing sides and angles in situations where the Sine Law will not work. Use the following activity to practise solving triangles using the Cosine Law.

Learning Activity 2.6

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. $\angle A$, $\angle B$, and $\angle C$ are all angles in an equilateral triangle. What are the measures of $\angle A$, $\angle B$, and $\angle C$?
2. A right-angled triangle has side lengths of 7.3 cm, 12.0 cm, and 9.5 cm. Which side length is the measure of the hypotenuse?
3. The ratio of the area of two squares is 100:64. What is the ratio of the side lengths in lowest terms?
4. Calculate the amount of tax on a $550 item with 12% tax.
5. Juanita invests $2500 for 1 year. The investment has an interest rate of 5%. How much will her investment be worth after one year?

continued

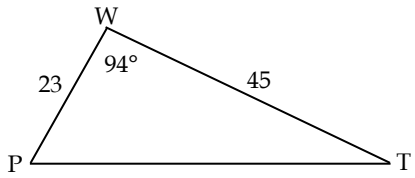
Learning Activity 2.6 (continued)

Part B: The Cosine Law

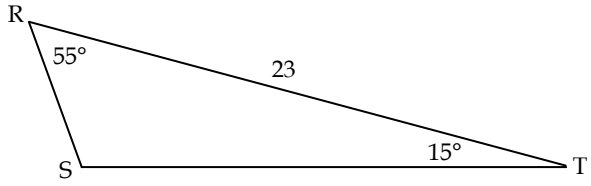
Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Which formula should you use to solve the following problems—the Sine Law or the Cosine Law? Do not solve the problems.

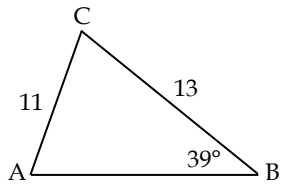
   a) Find the length of w.



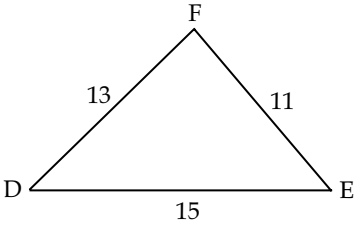
   b) Find the length of t.



   c) Find the measure of ∠A.



   d) Find the measure of ∠D.



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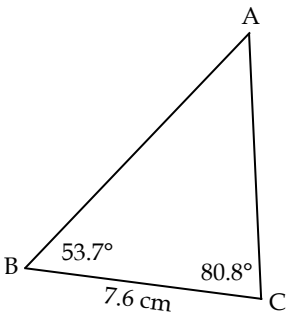
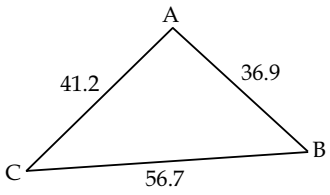
Learning Activity 2.6 (continued)

2. Find the measure of the side or angle indicated.

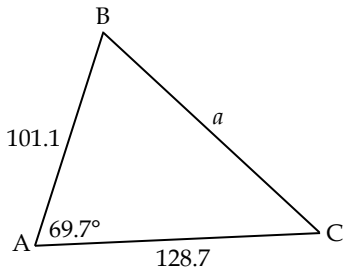
   a) Find side *b*.



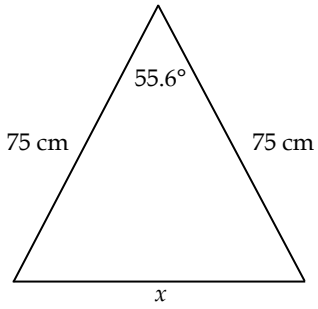
   b) Find angle A.



   c) Find side *a*.



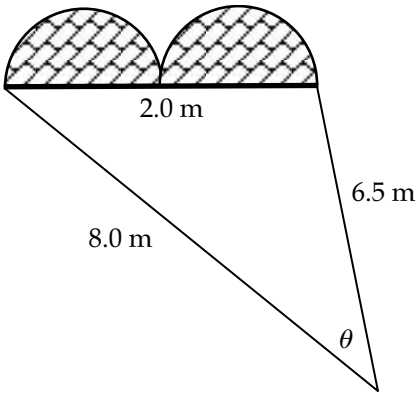
3. The arms of a "jaws" machine used for prying open crushed vehicles in accidents are 75 cm long. The jaws are joined at one end and open at various angles. If the angle formed by the arms is 55.6°, how far apart are the tips?



continued

Learning Activity 2.6 (continued)

4. The posts of a hockey goal are 2.0 m apart. A player attempts to score by shooting the puck along the ice from a point 6.5 m from one post and 8.0 m from the other post. Within what angle, θ, must the shot be made? (Give your answer to the nearest degree.)



Lesson Summary

In this lesson, you learned how to use the Cosine Law to solve non-right triangles. You also learned how the Cosine Law has real-life applications. You should understand the material from this lesson and the previous lesson before you complete the following assignment. Remember, ask your learning partner or tutor/marker for help if you need it. Assignment 2.3 concludes this module and after completing it, you are ready for Module 3.

Notes

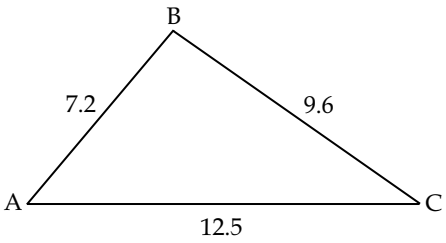
Assignment 2.3

Trigonometry

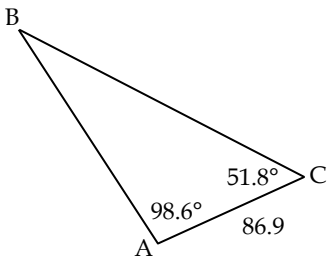
Total: 23 marks

1. Find the indicated measures.

   a) Find angle B. *(2 marks)*



   b) Find side *a*. *(3 marks)*



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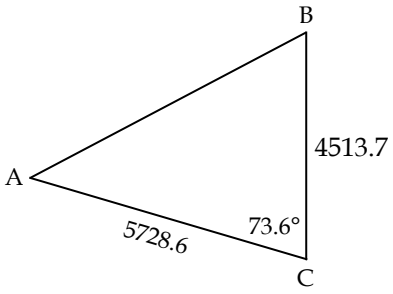
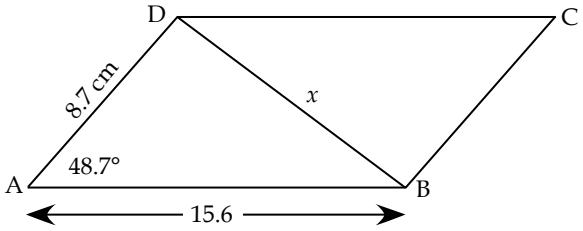
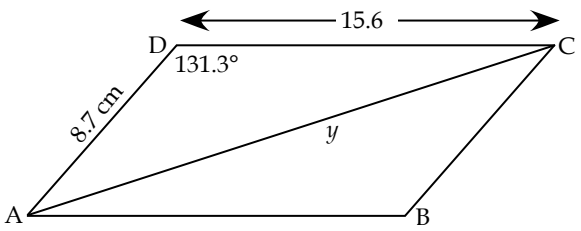
c) Find side *c* and then angle A. *(4 marks)*



2. The following drawings show the two diagonals of parallelogram ABCD. Find the lengths of both diagonals to determine how much longer one diagonal is compared to the other diagonal. *(5 marks)*





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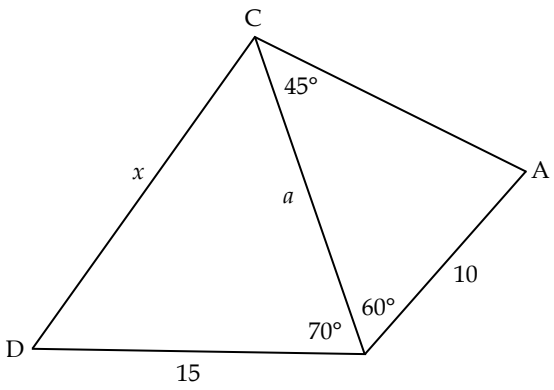
Assignment 2.3: Trigonometry (continued)

3. Find the length of a and then the length of x. *(5 marks)*



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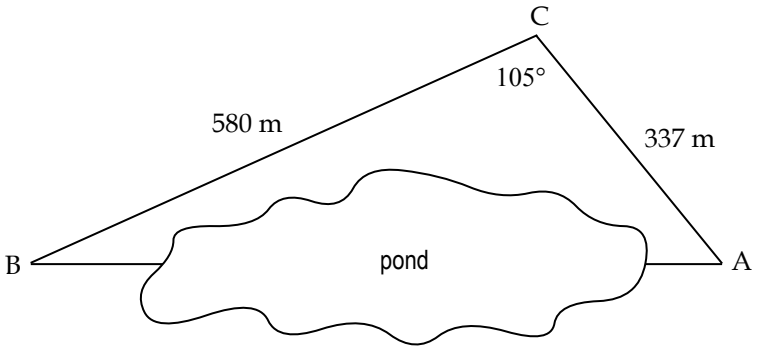
Assignment 2.3: Trigonometry (continued)

4. An electric transmission line is planned to go directly over a pond. The power line will be supported by posts at points A and B. A surveyor measures the distance from point B to point C as 580 m, the distance from point A to point C as 337 m, and BCA as 105°. What is the distance from point A to point B? *(2 marks)*



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Assignment 2.3: Trigonometry (continued)

5. Describe a situation in a construction, industrial, commercial, or artistic application where Sine Law or Cosine Law may be used. *(2 marks)*

Notes

Module 2 Summary

You have now completed Module 2. In this module, you studied the geometry of polygons. You also did trigonometric calculations for non-right triangles, where you solved triangles when you were given three pieces of information about them.

The next module focuses on business finance. You will study small businesses, including the financial aspects of owning a small business. As well, you will also learn about income taxes and how to file them.

Submitting Your Assignments

It is now time for you to submit the Module 2 Cover Assignment and Assignments 2.1 to 2.3 to the Distance Learning Unit so that you can receive some feedback on how you are doing in this course. Remember that you must submit all the assignments in this course before you can receive your credit.

Make sure you have completed all parts of your Module 2 assignments and organize your material in the following order:

- ❑ Module 2 Cover Sheet (found at the end of the course Introduction)
- ❑ Module 2 Cover Assignment: Circle Geometry
- ❑ Assignment 2.1: Polygons
- ❑ Assignment 2.2: The Sine Law
- ❑ Assignment 2.3: Trigonometry

For instructions on submitting your assignments, refer to How to Submit Assignments in the course Introduction.

Notes

Grade 12 Essential Mathematics (40S)

Module 2
Geometry and Trigonometry

Learning Activity Answer Keys

Module 2:
Geometry and Trigonometry

Learning Activity 2.1

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. If the area of a circle equals 16π m^2, what does the radius of a circle equal?
2. $\angle A$ and $\angle B$ are complementary angles. If $\angle A = 62°$, what is the measure of $\angle B$?
3. If the perimeter of a square is 20 m, what is the area of the square?
4. Evaluate for $g = -4$: $5g - 13$
5. $\angle C$ and $\angle D$ are supplementary angles. If $\angle C = 62°$, what is the measure of $\angle D$?

Answers:

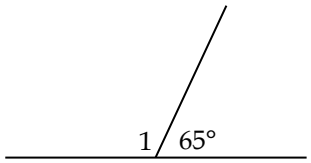
1. 4 (Area = $\pi r^2 = 16\,\pi$; $r^2 = 16$, $r = \sqrt{16} = 4$)
2. 28° ($\angle B = 90° - 62° = 28°$)
3. 25 m^2 (20 m = 5 m + 5 m + 5 m + 5 m; Area of the square = $5 \times 5 = 25$ m^2)
4. -33 ($5(-4) - 13 = -20 - 13 = -33$)
5. 118° ($\angle D = 180° - 62° = 118°$)

Part B: Angle Measurements

Part B: Angle Measurement

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. State why $\angle 1 = 115°$ in the diagram below.

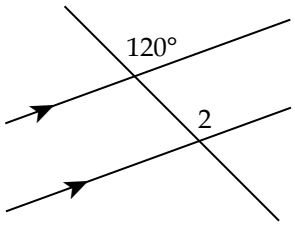


Answer:

$\angle 1$ is the supplement of an angle whose measure is 65°.

$\angle 1 = 180° - 65° = 115°$

2. State the property that explains why $\angle 2 = 120°$.

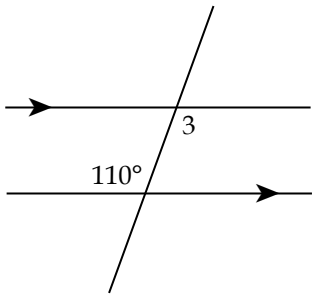


Answer:

The lines are parallel and cut by a transversal.

Thus, $\angle 2 = 120°$ because they are **corresponding angles**.

3. State the property that explains why $\angle 3 = 110°$.

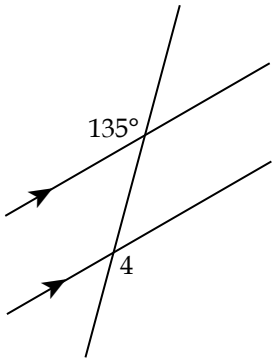


Answer:

The lines are parallel and cut by a transversal.

Therefore, $\angle 3 = 110°$ because they are **interior alternate angles**.

4. State the property that explains why $\angle 4 = 135°$.



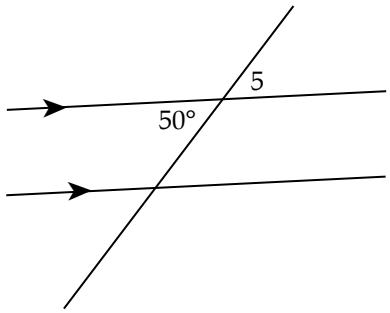
Answer:

The lines are parallel.

$\angle 4$ is an exterior alternate angle to the angle whose measure is 135°.

Therefore, $\angle 4 = 135°$ because they are **exterior alternate angles**.

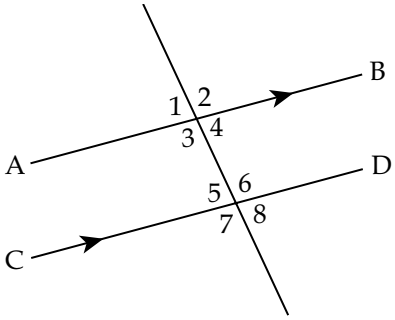
5. State the property that explains why $\angle 5 = 50°$.



Answer:

Since any two intersecting lines create equal vertically opposite angles, $\angle 5$ is 50° because they are **vertically opposite angles**.

6. Use what you know about angle properties and pairs of parallel lines cut by a transversal to find the measure of each angle. State a reason for each answer. You are given that $\overline{AB}$ is parallel to $\overline{CD}$ and $\angle 5 = 80°$.



Answer:

$\angle 4 = 80°$ interior alternate to 5

$\angle 7 = 100°$ supplementary to 5

$\angle 8 = 80°$ vertically opposite to 5

$\angle 3 = 100°$ corresponding to 7

$\angle 2 = 100°$ vertically opposite to 3

$\angle 1 = 80°$ corresponding to 5

$\angle 6 = 100°$ corresponding to 2

All acute angles are 80° and all obtuse angles are 100°.

Note: Measurements of acute angles are between 0° and 90°, and measurements of obtuse angles are between 90° and 180°.

Learning Activity 2.2

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. $\angle A$, $\angle B$, and $\angle C$ are all angles in a triangle. If $\angle A = 40°$ and $\angle B = 30°$, what is the measure of $\angle C$?
2. If $4x - 3x + 8x + 2x = 121$, then $6x - 2 = ?$
3. During the Red River Ex, the number of visitors doubled each day. If the Red River Ex opened on Friday with 350 visitors, how many visitors were there on Sunday?
4. Evaluate for $y = 5$: $\left(\frac{30}{y}\right) - 7$
5. How many 15 m^3 containers can you fill with 300 m^3 of sand?

Answers:

1. 110° ($\angle C = 180° - 40° - 30° = 110°$)
2. 64 ($11x = 121$; $x = 11$; $6x - 2 = 6(11) - 2 = 66 - 2 = 64$)
3. 1400 visitors (Saturday = 350 × 2 = 700 visitors; Sunday = 700 × 2 = 1400 visitors)
4. -1 $\left(\left(\frac{30}{5}\right) - 7 = 6 - 7 = -1\right)$
5. 20 containers $\left(\frac{30}{15} = 2; \frac{300}{15} = 20 \text{ containers}\right)$

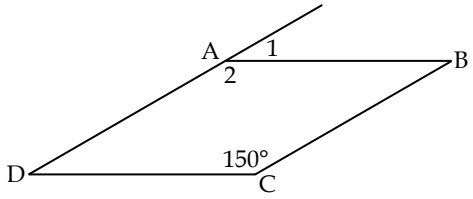
Part B: Quadrilaterals

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

Don't forget that you can ask your learning partner or tutor/marker for help if you are having a hard time understanding the material.

1. Given parallelogram ABCD, state the measure of ∠1.

   a)



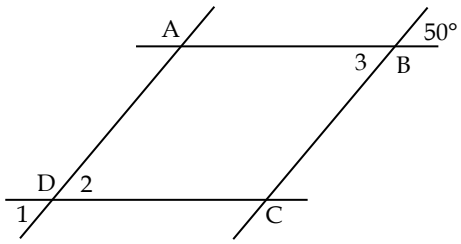
   Answer:

   Since ABCD is a parallelogram, ∠2 = ∠C = 150°.

   But ∠1 + ∠2 = 180°.

   ∴ ∠1 = 30°.

   b)



   Answer:

   ∠3 = 50° (vertically opposite angles)

   But ∠2 = ∠3 since ABCD is a parellogram.

   Therefore, ∠2 = 50°.

   Hence, ∠1 = 50° (∠1 and ∠2 are vertically opposite angles).

2. Identify all the possible types of quadrilaterals described by each statement:

   a) A quadrilateral has opposite sides parallel, and at least one interior angle is 35°.

   b) A quadrilateral has one pair of opposite sides parallel, but the parallel sides are not the same length.

   c) A quadrilateral has one pair of opposite sides parallel and the same length.

   d) A quadrilateral has opposite sides parallel, and at least one 90° interior angle.

   e) A quadrilateral has both pairs of opposite sides parallel, at least two consecutive sides the same length, and at least one 90° angle.

   f) A quadrilateral has opposite sides parallel, consecutive angles equal, and consecutive sides not the same length.

   g) A quadrilateral has diagonals that are perpendicular to each other, but not the same length.

   h) A quadrilateral has diagonals that are the same length, but not perpendicular to each other.

   Answers:

   a) parallelogram, rhombus

   b) trapezoid

   c) parallelogram, rectangle, square, rhombus

   d) square, rectangle

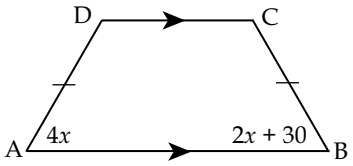
   e) square

   f) rectangle

   g) rhombus

   h) rectangle, isosceles trapezoid

3. Use your knowledge of trapezoids to solve for x.



Answer:

$\overline{AD} = \overline{BC}$.

Therefore, this is an isosceles trapezoid. Thus, the base angles are equal.

$\angle BAD = \angle ABC$ (Substitute the values for $\angle BAD$ and $\angle ABC$.)

$4x = 2x + 30$ (Subtract $2x$ from both sides.)

$4x - 2x = 2x - 2x + 30$ (Simplify by combining like terms.)

$2x = 30$ (Divide both sides by 2.)

$x = 15$

4. The diagram below displays a rhombus. Using what you know about rhombuses, find the measurements of:

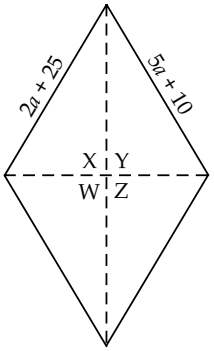
a) $\angle W$

b) $\angle X$

c) $\angle Y$

d) $\angle Z$

e) a



Answer:

Rhombuses have the property of perpendicular diagonals. As $\angle W$, $\angle X$, $\angle Y$, and $\angle Z$ are all formed by perpendicular diagonals, they all equal 90°.

To find a, you need to remember that rhombuses have equal sides. Therefore,

$2a + 25 = 5a + 10$ (Subtract $2a$ from both sides.)

$2a - 2a + 25 = 5a - 2a + 10$ (Simplify by combining like terms.)

$25 = 3a + 10$ (Subtract 10 from both sides.)

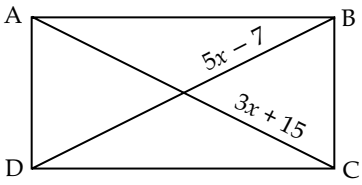
$25 - 10 = 3a + 10 - 10$ (Simplify.)

$15 = 3a$ (Divide both sides by 3.)

$5 = a$

Therefore, the value for a is 5.

5. Given rectangle ABCD, find the value of x.



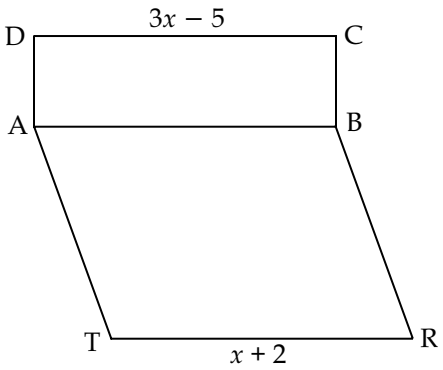
Answer:

Since ABCD is a rectangle, diagonals $\overline{AC} = \overline{BD}$, and consequently $\frac{1}{2}\overline{AC} = \frac{1}{2}\overline{BD}$.

Since diagonals of a parallelogram bisect each other . . .

$$5x - 7 = 3x + 15$$
$$2x = 22$$
$$x = 11$$

6. Find the value of x if ABCD is a rectangle and ABRT is a parallelogram.



Answer:

As ABRT is a parallelogram, $\overline{TR}$ and $\overline{AB}$ are opposite parallel sides and equal. Therefore:

$\overline{TR} = \overline{AB}$ Substitute the given value for $\overline{TR}$.

$x + 2 = \overline{AB}$

As ABCD is a rectangle, $\overline{AB}$ and $\overline{CD}$ are opposite parallel sides and equal. Therefore:

$\overline{AB} = \overline{CD}$ (Substitute the value found for $\overline{AB}$.)

$x + 2 = \overline{CD}$ (Substitute the given value for $\overline{CD}$.)

$x + 2 = 3x - 5$ (Subtract x from both sides.)

$x - x + 2 = 3x - x - 5$ (Simplify.)

$2 = 2x - 5$ (Add 5 to both sides.)

$2 + 5 = 2x - 5 + 5$ (Simplify.)

$7 = 2x$ (Divide both sides by 2.)

$\frac{7}{2} = x$

Therefore, the value for x is $\frac{7}{2}$ or 3.5.

Learning Activity 2.3

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. $\angle A$ and $\angle B$ are vertically opposite angles. If $\angle A = 124°$, what is the measure of $\angle B$?
2. $\angle A$ and $\angle B$ are alternate interior angles. If $\angle A = 172°$, what is the measure of $\angle B$?
3. Sam's age is 125% of Jacob's age. If Jacob is 20, what is Sam's age?
4. The perimeter of a rectangle with sides a, b, c, and d is 40 m. If sides a and c are 16 m long, what are the lengths of sides b and d?
5. What is the radius of a circle with an area of 36π m^2?

Answers:

1. 124° ($\angle A = \angle B = 124°$—Vertically opposite angles are equal.)
2. 172° ($\angle A = \angle B = 172°$—Alternate interior angles are equal.)
3. Sam is 25 years old. (100% of 20 is 20; 25% of 20 is 5; 125% of 20 is 25)
4. 4 m (If sides a and c are equal, then sides b and d must be equal as rectangles have two pairs of equal sides (40 m − 16 m − 16 m = 8 m).

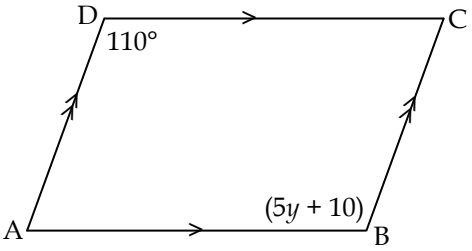
   $$\frac{8 \text{ m}}{2} = 4 \text{ m}$$

   Sides b and d are both 4 m long.)
5. 6 m ($A = \pi r^2 = 36\pi$; $r^2 = 36$; $r = 6$ m)

Part B: Parallelograms

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Find the value for y and the measures of angles C and A in the figure below.



Answer:

Opposite angles of a parallelogram are equal.

Therefore $\angle B = \angle D$

$5y + 10 = 110$ (Subtract 10 from both sides.)

$5y = 100$ (Divide by 5.)

$y = 20$

Now, consecutive angles of a parallelogram are supplementary. Therefore,

$\angle C + \angle D = 180°$ (Substitute the value for $\angle D$.)

$\angle C + 110° = 180°$ (Subtract 110° from both sides.)

$\angle C = 70°$.

$\angle C$ and $\angle A$ are opposite angles of a parallelogram.

Therefore, $\angle C = \angle A$.

Therefore, $\angle A = 70°$.

2. ∠A and ∠X are consecutive angles of a parallelogram.

   a) If ∠A = 40°, what is the measure of ∠X?

   Answer:

   ∠A and ∠X are consecutive angles and are therefore supplementary.

   ∠A + ∠X = 180° (Substitute the value for ∠A.)

   40° + ∠X = 180° (Subtract 40° from both sides.)

   ∠X = 140°

   b) If ∠X = 37°, what is the measure of ∠A?

   Answer:

   A and ∠X are consecutive angles and are therefore supplementary.

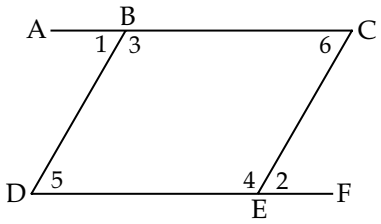
   ∠A + ∠X = 180° (Substitute the value for ∠X.)

   ∠A + 37° = 180° (Subtract 37° from both sides.)

   ∠A = 143°

3. Given: Parallelogram BCED

   Prove that ∠1 must equal ∠2.



   Answer:

   ∠3 = ∠4 (since they are opposite angles of parallelogram BCED)

   ∠2 + ∠4 is 180° (since they are supplementary)

   ∠1 + ∠3 is 180° (since they are supplementary)

   ∠1 = ∠2 (since both sums are 180° and ∠3 = ∠4)

4. In quadrilateral XWZY, which angles are consecutive with ∠W? Select the correct answer.

   a) ∠Y and ∠Z

   b) ∠X and ∠Z

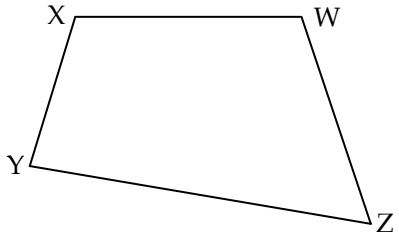
   c) ∠X and ∠Y and ∠Z

   d) ∠X and ∠Y

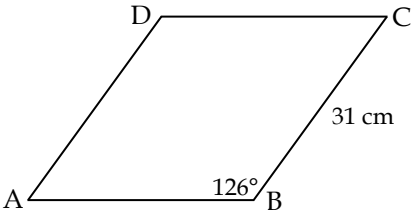
   Answer:

   Correct answer is (b).

   All polygons are named clockwise or counterclockwise by their vertices. ∠X and ∠W are consecutive and ∠Z and ∠W are consecutive.



5. Find the measures in the following rhombus.



$\overline{AB}$ = _____

$\overline{CD}$ = _____

$\overline{AD}$ = _____

∠ABC = _____

∠BCD = _____

∠ADC = _____

∠BAD = _____

Answer:

$\overline{BC} = 31$ cm

Therefore, $\overline{AB} = \overline{BC} = \overline{CD} = \overline{DA} = 31$ cm.

$\angle ABC = \angle ADC = 126^o$ (opposite angles of a rhombus)

$\angle ABC + \angle BCD = 180^o$ (consecutive angles of a rhombus)

$\angle ABC = 126^o$

Therefore, $126^o + \angle BCD = 180^o$

And $\angle BCD = 180^o - 126^o = 54^o$

And $\angle BCD = \angle BAD = 54°$ (opposite angles of a rhombus)

Learning Activity 2.4

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. $\angle A$ and $\angle B$ are consecutive angles in a parallelogram. If $\angle B = 37°$, what is the measure of $\angle A$?
2. $\angle A$ and $\angle B$ are both base angles in an isosceles trapezoid. If $\angle A = 57°$, what is the measure of $\angle B$?
3. A Manitoba yoga centre distributes 42 yoga mats for each yoga session. After 6 yoga sessions, how many mats have they distributed?
4. How many sides does a hexagon have?
5. If $12 \times 16 = 192$, what is 14×16?

Answers:

1. 143° (Consecutive angles in a parallelogram add up to 180°. $\angle A = 180° - 37° = 143°$)
2. 57° (Base angles in an isosceles trapezoid are equal. $\angle B = \angle A = 57°$)
3. 252 ($6 \times 40 + 6 \times 2 = 240 + 12 = 252$ yoga mats)
4. 6 sides
5. 224 ($16 \times 2 = 32$; $14 \times 16 = 192 + 32 = 224$)

Part B: Applications of Triangles

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Complete the chart. It will be helpful in answering the following questions.

   Answers:

Polygon	Number of Sides	Minimum Number of Triangles	Sum of the Angles
Triangle	3	1	180°
Quadrilateral	4	2	360°
Pentagon	5	3	540°
Hexagon	6	4	720°
Heptagon	7	5	900°
Octagon	8	6	1080°
Decagon	10	7	1440°

2. ABCDEF is a hexagon with $\angle A = \angle B = \angle C = 100°$. $\angle D = 130°$. The other two angles are equal. Find the measurements for $\angle E$ and $\angle F$.

   Answer:

   From the chart you completed in question 1, you observe that the sum of the angles in a hexagon is 720°.

   Therefore, $\angle A + \angle B + \angle C + \angle D + \angle E + \angle F = 720°$.

   Substitute the known values:

   $100° + 100° + 100° + 130° + \angle E + \angle F = 720°$

   You also know $\angle E = \angle F$, thus,

   $100° + 100° + 100° + 130° + \angle E + \angle E = 720°$

   Complete the calculation:

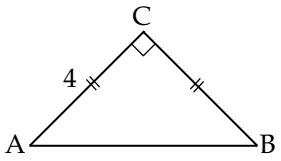
   $430° + 2\angle E = 720°$

   $2\angle E = 290°$

   $\angle E = 145°$

   $\angle F = \angle E = 145°$

3. In the isosceles right triangle shown below, find the measurements for a, c, $\angle$B, and $\angle$A.



Answer:

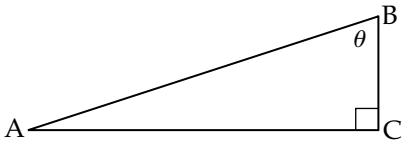
$a = 4$

$c^2 = 4^2 + 4^2$

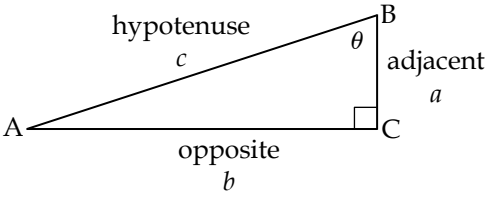
$c = \sqrt{32} = 5.66$

$\angle B = \angle A = 45°$

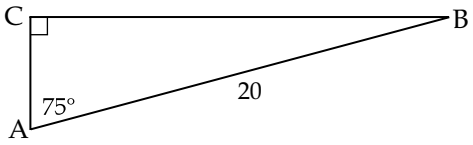
4. a) Label the sides of the triangle with the following: a, b, c, opposite, adjacent, and hypotenuse.



Answer:



b) Calculate the value of *a*.



Answer:

a is side $\overline{BC}$, which is opposite

hypotenuse is 20

$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

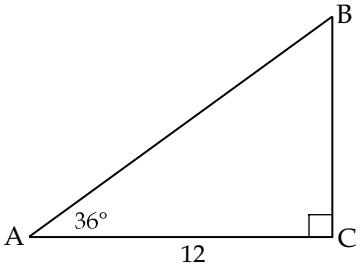
$$\sin 75° = \frac{a}{20} \qquad \text{(Multiply both sides by 20.)}$$

$20 \times \sin 75^{o} = a$

$20 \times 0.966 = a$

$a = 19.32$

c) Find the length of the hypotenuse.



Answer:

b = 12 = adjacent
c = hypotenuse

$$\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$

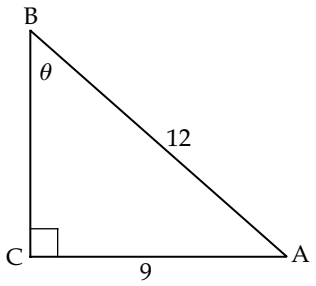
$$\cos 36° = \frac{12}{c} \qquad \text{(Multiply both sides by } c\text{.)}$$

$c \times \cos 36° = 12$ (Divide both sides by cos 36°.)

$$c = \frac{12}{\cos 36°} = \frac{12}{0.809} = 14.8$$

Therefore, the hypotenuse equals 14.8.

d) Find the value of θ, which is $\angle$B.



Answer:

b = 9 = opposite side
c = 12 = hypotenuse

$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\sin\theta = \frac{9}{12} = 0.75$$

$\theta = \sin^{-1}(0.75) = 48.6^{o}$

Therefore, $\angle$B = 48.6^{o}.

5 a) Calculate the sum of the angles of a 9-sided polygon.

Answer:

The 9-sided figure can be divided into 7 triangles.

Use the formula:

Sum of the angles in a polygon = # of triangles in a polygon × 180°

Sum = 7 × 180° = 1260°

b) Calculate the sum of the angles of an 11-sided polygon.

Answer:

The 11-sided figure can be divided into 9 triangles.

Use the formula:

Sum of the angles in a polygon = # of triangles in a polygon × 180°

Sum = 9 × 180° = 1620°

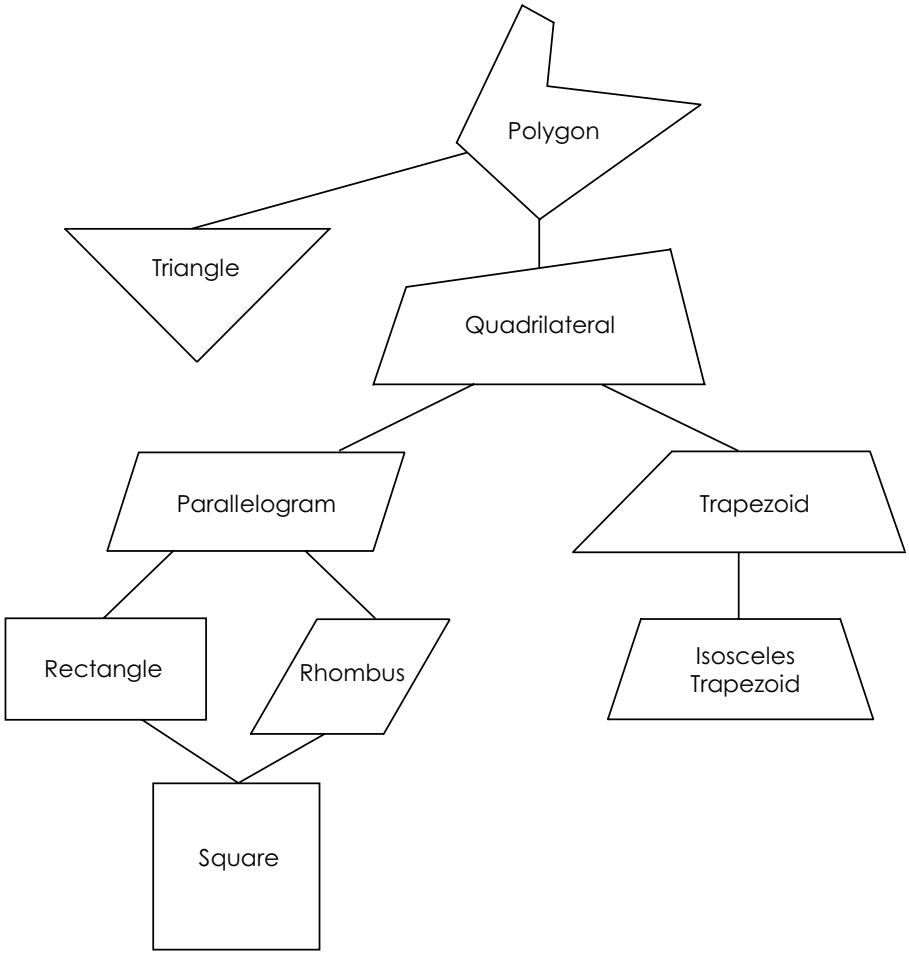
6. Complete a chart that shows the relationship among all of the following:

   Polygon
   Triangle
   Quadrilateral
   Parallelogram
   Rectangle
   Rhombus
   Square
   Trapezoid
   Isosceles Trapezoid

It may be helpful for you to include this diagram on your resource sheet (after you have checked your answers!) in order for you to remember the relationship among different types of polygons.

Answer:

Relationships between Polygons



Learning Activity 2.5

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. $\angle A$, $\angle B$, and $\angle C$ are all angles in an isosceles triangle. If $\angle A = 40°$ and $\angle B$ and $\angle C$ are base angles in the triangle, what is the measure of $\angle C$?
2. Which polygon has all equal sides and all interior angles equal to 90°?
3. $\angle A$ and $\angle B$ are opposite interior angles in a parallelogram. If $\angle A = 38°$, what is the measure of $\angle B$?
4. Evaluate: 20% of 315
5. You currently have $623 in your chequing account. You then spend $123 from your chequing account on clothes. You then deposit a cheque worth $142 into your chequing account. What is the final balance of your chequing account?

Answers:

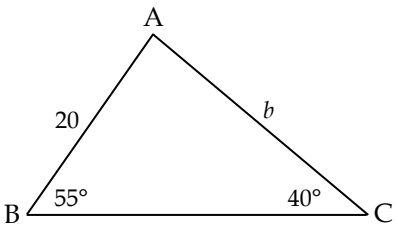
1. 70° ($180° - 40° = 140°$; If $\angle B$ and $\angle C$ are base angles in an isosceles triangle, they are equal. $\frac{140°}{2} = 70°$; $\angle C = 70°$)
2. Square
3. 38° ($\angle B = \angle A = 38°$—opposite interior angles in a parallelogram are equal)
4. 63 (10% of 315 is 31.5, so 20% is 2×31.5)
5. $642 ($623 − $123 = $500; $500 + $142 = $642 is the final balance in your chequing account)

Part B: The Sine Law

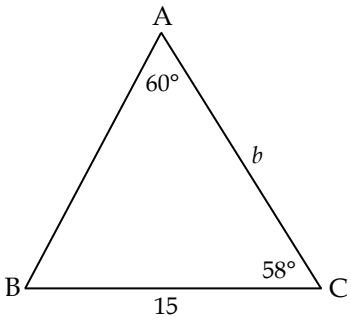
Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Find the length of side b.

a)



b)



Answers:

a) $$\frac{b}{\sin 55°} = \frac{20}{\sin 40°}$$

$$b = \frac{20 \sin 55°}{\sin 40°}$$

$$b = \frac{20(0.81915)}{0.64279}$$

$$b = 25.5$$

b) $\angle B = 180° - (60 + 58)° = 62°$

$$\frac{b}{\sin 62°} = \frac{15}{\sin 60°}$$

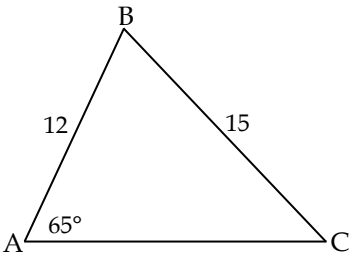
$$b = \frac{15 \sin 62°}{\sin 60°}$$

$$b = \frac{15(0.88295)}{0.86603}$$

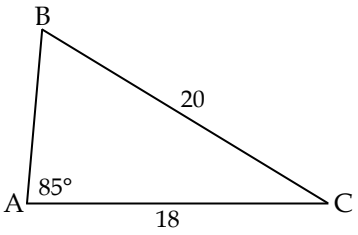
$$b = 15.3$$

2. Find the measurement of angle C.

a)



b)



Answers:

a) $\dfrac{\sin \angle C}{12} = \dfrac{\sin 65°}{15}$

$$\sin \angle C = \frac{12 \sin 65°}{15}$$

$$\sin \angle C = \frac{12(0.90631)}{15}$$

$$\sin \angle C = 0.72505$$

$$\angle C = 46.5°$$

b) $\dfrac{\sin \angle B}{18} = \dfrac{\sin 85°}{20}$

$$\sin \angle B = \frac{18 \sin 85°}{20}$$

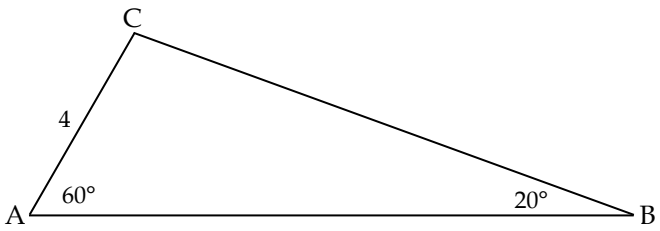
$$\sin \angle B = \frac{18(0.9962)}{20}$$

$$\sin \angle B = 0.89658$$

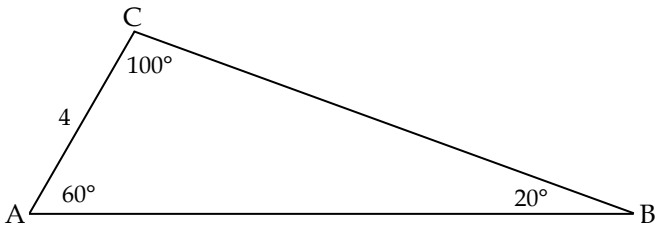
$$\angle B = 63.7°$$

$$\therefore \angle C = 180° - (85 + 63.7)° = 31.3°$$

3. Find the length of $\overline{AB}$.



Answer:



$\angle ACB = 180° - (60° + 20°) = 100°$

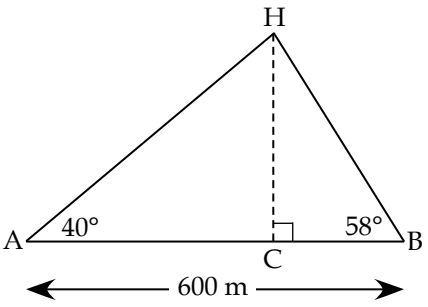
By the Law of Sines:

$$\frac{AB}{\sin 100°} = \frac{4}{\sin 20°}$$

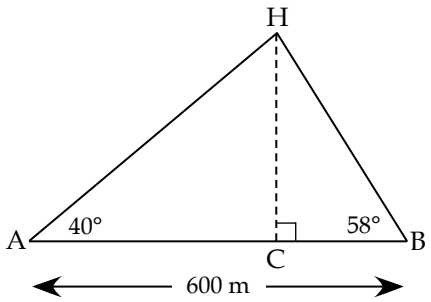
$$AB = \frac{4 \sin 100°}{\sin 20°}$$

$$AB = \frac{4(0.98481)}{0.34202} = 11.5$$

4. Alf and Beth are both looking at a hot air balloon. For Alf the angle of elevation is 40^{o}, and for Beth the angle of elevation is 58^{o}. How high is the balloon above ground if the distance between Alf and Beth is 600 metres? In the diagram, A represents Alf, B represents Beth, H represents the hot air balloon, and HC is the distance of the balloon above the ground.



Answer:



$\angle AHB = 180° - (40° + 58°) = 82°$

Find $\overline{AH}$:

$$\frac{\overline{AH}}{\sin 58°} = \frac{600}{\sin 82°}$$

$$\overline{AH} = \frac{600 \sin 58°}{\sin 82°} = 513.8 \text{ m}$$

Find $\overline{CH}$ using ΔAHC (AHC is a right-angled triangle.)

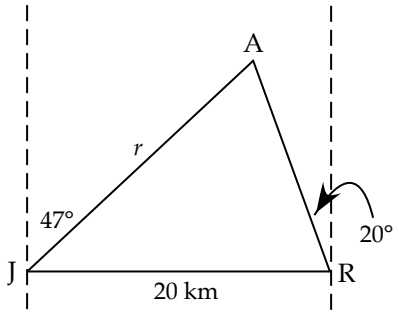
$$\sin 40° = \frac{\overline{CH}}{513.8}$$ (Use trig ratio to solve right triangle.)

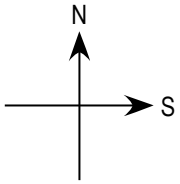
$$\overline{CH} = 513.8 \sin 40° = 330 \text{ m}$$

Height = 330 metres.

5. Fire ranger Jamal is 20 km due west of fire ranger Raj. They spot a fire and report the sightings as follows:
   - Jamal reports that the fire is N 47° E of his station.
   - Raj reports that the fire is N 20° W of his station.

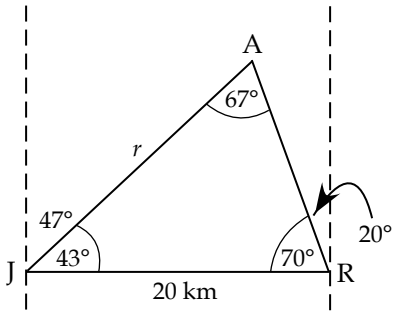
   How far is the fire from Jamal's station?





Write the values of ∠AJR and ∠ARJ into the diagram before you solve the problem.

Answer:



$$\frac{r}{\sin 70°} = \frac{20}{\sin 67°}$$

$$r = \frac{20 \sin 70°}{\sin 67°} = \frac{20(0.93969)}{0.92050} = 20.42$$

∴ The fire is 20.4 km from Jamal's station.

Learning Activity 2.6

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. $\angle A$, $\angle B$, and $\angle C$ are all angles in an equilateral triangle. What are the measures of $\angle A$, $\angle B$, and $\angle C$?
2. A right-angled triangle has side lengths of 7.3 cm, 12.0 cm, and 9.5 cm. Which side length is the measure of the hypotenuse?
3. The ratio of the area of two squares is 100:64. What is the ratio of the side lengths in lowest terms?
4. Calculate the amount of tax on a $550 item with 12% tax.
5. Juanita invests $2500 for 1 year. The investment has an interest rate of 5%. How much will her investment be worth after one year?

Answers:

1. 60° (All angles in an equilateral triangle are equal.

   $\frac{180°}{3} = 60°$

   $\angle A$, $\angle B$, and $\angle C = 60°$)

2. 12.0 cm (The hypotenuse is always the longest side of the triangle. Therefore, the measure of the hypotenuse is 12.0 cm.)

3. 5:4 ($A_1 : A_2 = 100 : 64$; Therefore $L_1 : L_2 = \sqrt{100} : \sqrt{64} = 10 : 8 = 5 : 4.$)

4. $66 (Tax is 12%. $100 × 12% = $12; $50 × 12% = $6; 5 × $12 + $6 = $66 tax on a $550 item.

5. $2625 after one year (Since 10% of 2500 = 250; then 5% of 2500 = 125.)

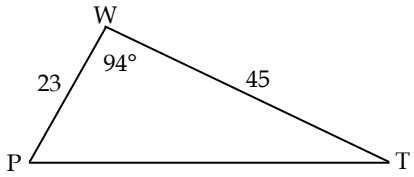
   The investment will be worth $2500 + $125 = $2625 after one year.

Part B: The Cosine Law

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Which formula should you use to solve the following problems—the Sine Law or the Cosine Law? Do not solve the problems.

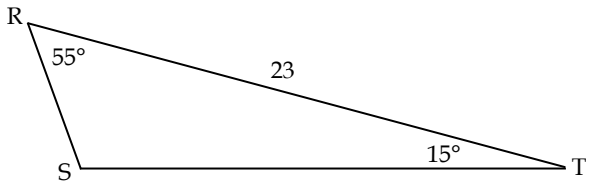
   a) Find the length of *w*.



   Answer:

   Cosine Law (Since you don't know any angle **and** its opposite side.)

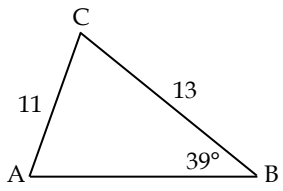
   b) Find the length of *t*.



   Answer:

   Sine Law (Since you have two angles, you can find angle S and you know the opposite side, *s*.)

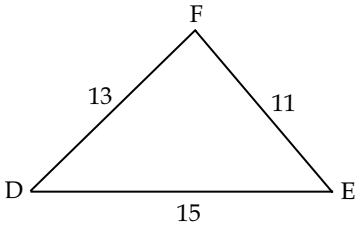
   c) Find the measure of ∠A.



   Answer:

   Sine Law (Since you know both side *b* and angle B.)

d) Find the measure of ∠D.

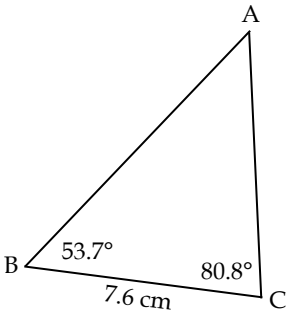


Answer:

Cosine Law (Since you don't know both a side and its opposite angle.)

2. Find the measure of the side or angle indicated.

a) Find side *b*.



Answer:

Step 1: $\angle A = 180° - 53.7° - 80.8°$

$\angle A = 45.5°$

Step 2: $\dfrac{7.6}{\sin 45.5^o} = \dfrac{b}{\sin 53.7^o}$

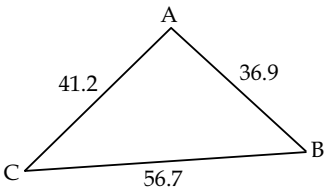
Cross-multiply to get rid of the denominators:

$b \sin 45.5^o = 7.6 \sin 53.7^o$ (Divide to get the *b* by itself.)

$$b = \frac{7.6 \sin 53.7^o}{\sin 45.5^o}$$

$b = 8.6$

b) Find angle A.



Answer:

$$a^2 = b^2 + c^2 - 2bc\cos\angle A$$

$$56.7^2 = 41.2^2 + 36.9^2 - 2(41.2)(36.9)\cos\angle A$$

$$56.7^2 - 41.2^2 - 36.9^2 = -2(41.2)(36.9)\cos\angle A$$

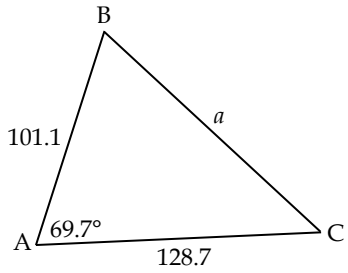
$$155.84 = -3040.56\cos\angle A$$

$$\frac{155.84}{-3040.56} = \cos\angle A$$

$$\angle A = \cos^{-1}(-0.05125)$$

$$\angle A = 92.9^{\circ}$$

c) Find side *a*.



Answer:

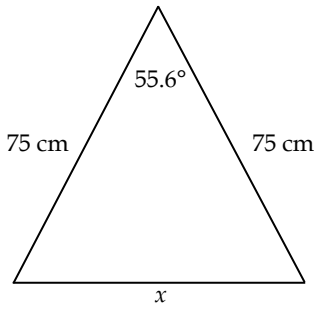
$a^2 = b^2 + c^2 - 2bc\cos\angle A$

$a^2 = 128.7^2 + 101.1^2 - 2(128.7)(101.1)\cos 69.7^{\circ}$

$a^2 = 17\,756.5$

$a = 133.3$

3. The arms of a "jaws" machine used for prying open crushed vehicles in accidents are 75 cm long. The jaws are joined at one end and open at various angles. If the angle formed by the arms is 55.6°, how far apart are the tips?



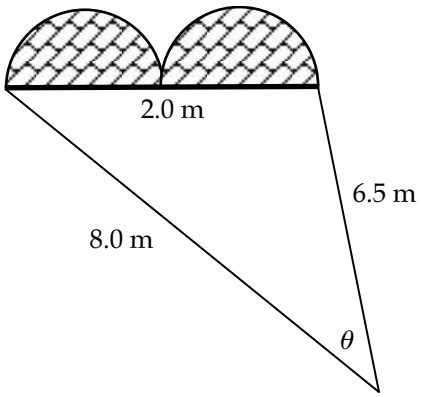
Answer:

$x^2 = 75^2 + 75^2 - 2(75)(75) \cos 55.6°$

$x^2 = 4894.12$

$x = 70.0$ cm

4. The posts of a hockey goal are 2.0 m apart. A player attempts to score by shooting the puck along the ice from a point 6.5 m from one post and 8.0 m from the other post. Within what angle, θ, must the shot be made? (Give your answer to the nearest degree.)



Answer:

$2^2 = 6.5^2 + 8.0^2 - 2(6.5)(8) \cos \theta$

$4 = 42.25 + 64 - 104 \cos \theta$ (Subtract 42.25 and 64.)

$4 - 42.25 - 64 = -104 \cos \theta$

$-102.25 = -104 \cos \theta$ (Divide by -104.)

$0.98317 = \cos \theta$ (Use $\cos^{-1}$ to find θ.)

$10.5° = \theta$

Grade 12 Essential Mathematics (40S)

Module 3
Business Finance

Module 3:
Business Finance

Introduction

Thus far in your studies of Essential Mathematics, you have learned about many aspects of finance. In Grade 10 you explored wages and deductions; in Grade 11 you learned about credit, interest, and budgeting; and in this Grade 12 course you have already looked at home finance. This module looks at finance, but focuses on the aspects of money management that relate to small businesses. You will learn about various options related to small businesses, the choices one has to make related to these options, and the things you should think about when you report income tax.

Note: To complete some of the activities in this module, you are required to perform some research in an interview or online.

Assignments in Module 3

When you have completed the assignments for Module 3, submit your completed assignments to the Distance Learning Unit either by mail or electronically through the learning management system (LMS). The staff will forward your work to your tutor/marker.

Lesson	Assignment Number	Assignment Title
	Cover Assignment	Marginal Income Tax Rates
2	Assignment 3.1	Profitability of a Small Business
3	Assignment 3.2	Income Tax

Resource Sheet

When you write your midterm examination, you are encouraged to take a Midterm Examination Resource Sheet with you into the examination. This sheet will be one letter-sized page, 8½ " by 11", with both sides in your handwriting or typewritten. You will submit it with your examination, but you do not receive any marks for it.

Many students have found that preparing a resource sheet is an excellent way to review. It provides you with a summary of the important facts of each module. You should complete a resource sheet for each module to help with your studying and reviewing. Lesson summaries and module summaries are included for you to use as a guide.

You may use the following list of instructions to help you with preparing your resource sheet for the material in Module 3. On this sheet, you should record mathematics terms and definitions, formulas, sample questions, or a list of places where you often make mistakes. You should also identify special areas that require extra attention or review by writing the page numbers.

After you have completed each module's resource sheet, you may summarize the sheets from Modules 1, 2, 3, and 4 to prepare your Midterm Examination Resource Sheet. The midterm examination for this course is based on Modules 1 to 4.

Resource Sheet for Module 3

As you go through the lessons of this module, you may want to consider the following suggestions regarding the creation of a resource sheet.

1. List all the important mathematics terms, and define them if necessary.
2. List all the formulas and perhaps a sample problem that shows how each formula is used.
3. If necessary, write the solutions to some problems, showing in detail how you did the calculations.
4. Copy any questions that represent the key points of the lesson, and perhaps include the solutions as well.
5. Identify the problems you found most difficult, and copy the page numbers onto the resource sheet so that you can review them before writing the examination. You may also copy the problems and the solutions onto your resource sheet, and later write them onto your Midterm Examination Resource Sheet.
6. Write any comments, ideas, shortcuts, or other reminders that may be helpful during an examination.

Module 3 Cover Assignment: Marginal Income Tax Rates

Do you know what is meant by "marginal income tax rates?" The purpose of the following cover assignment is to introduce you to this concept.

Canada uses the marginal income tax rate for federal income tax purposes. Your marginal tax rate is the tax you pay on your last dollar of income earned. For example, the marginal tax rate for a Manitoban who has earned $30,000 so far this year is approximately 25%. This means that when more money is earned, 25¢ of every dollar will go to pay income tax.

In Canada, the marginal tax rate goes up for those with higher incomes. This is unlike a flat tax rate, where every earner pays the same rate of tax regardless of his or her income.

Notes

Module 3 Cover Assignment

Marginal Income Tax Rates

Total: 10 marks

Income tax on money you earn is taxed according to the taxation bracket it falls into. The following table gives an individual's marginal taxation rates for salary earned in 2012 in four provinces. Each value given in the table is the percent of your salary in the given range that is to be paid in taxes.

The ranges in the chart apply exactly to federal tax but vary somewhat for provincial tax. The two taxes are combined to give the marginal tax rates shown.

	$7,800–$42,707	**$42,707–$85,414**	**$85,414–$132,406**	**$132,406+**
Alberta	25.0%	32.0%	36.0%	39.0%
Manitoba	25.8%	34.75%	43.4%	46.4%
Ontario	20.05%	31.15%	37.16%	40.16%
Saskatchewan	26.0%	35.0%	39.0%	44.0%

Source: http://www.cra-arc.gc.ca/tx/ndvdls/fq/txrts-eng.html#federal. Reproduced under the terms for non-commercial reproduction, as cited at http://www.cra-arc.gc.ca/cpyrght-eng.html.

1. In general, what happens to the taxation rate as salary increases? *(1 mark)*

2. According to the table, what province has the lowest marginal taxation rate for a salary of $36,581? *(1 mark)*

3. According to the table, what province has the highest marginal taxation rate for a salary of $50,689? *(1 mark)*

continued

Module 3 Cover Assignment: Marginal Income Tax Rates (continued)

4. According to the table, if you lived in Saskatchewan, what percent of your annual salary of $62,456 would you pay in income tax on your last dollar earned? *(1 mark)*

   _____

5. According to the table, if you lived in the province of Ontario, what percent of any salary you earned over $132,406 would you pay in income tax? *(1 mark)*

   _____

6. According to the table, how much would you pay in income tax if you earned $10,000 and lived in the province of Manitoba? Assume you pay no tax on any income less than $7,800. Show your calculations. *(1 mark)*

7. According to the table, how much would you pay in income tax if you earned $20,000 and lived in Manitoba? Assume that you pay no tax on any income less than $7,800. Show your calculations. *(1 mark)*

continued

Module 3 Cover Assignment: Marginal Income Tax Rates (continued)

8. According to the table, how much would you pay in income tax if you earned $50,000 and lived in the province of Manitoba? Assume that you pay no tax on any income less than $7800. Show your calculations. *(2 marks)*

9. Near the end of the year when Laura's annual earnings are about $100,000, she is considering working overtime. She anticipates earning an additional $240 gross pay for the overtime work. How much will she pay in additional taxes on the overtime earnings? *(1 mark)*

Notes

Lesson 1: Introduction to the Business World

Lesson Focus

In this lesson, you will

- ❑ be introduced to the world of business, and some of the terminology and practices associated with business
- ❑ identify expenses in operating a small business
- ❑ explore the meaning of entrepreneurship
- ❑ consider the feasibility of a business

Lesson Introduction

At this point in your life, you may or may not have had a part-time or full-time job. If you have worked for a business, did you ever think about how it functions? This lesson will introduce you to some of the language used in the business world, as well as some of the characteristics of a business. You will also learn about entrepreneurship and its role in Canadian history.

All about Business

What exactly is business? (The following section has a number of definitions that you should include in your resource sheet.)

Business is the production and sale of goods or services. **Goods** are articles of merchandise that are bought or produced by a business and sold to customers for profit. **Services** are helpful acts such as home cleaning, nursing, or dental care.

There are always two types of people who are part of the world of business—the producers and the consumers. The **producers** are the people and businesses that make goods and provide services. Alternately, the **consumers** are the people who purchase the goods and services. The businesses and people in the community, province, country, and the world focus on providing goods and services to each other. This means that sometimes a business is classified as a producer (when selling goods or services), and at other times the same business becomes a consumer (when purchasing goods or services). This back-and-forth relationship allows businesses to earn an income, which they spend on other goods and services.

Business Purposes

Goods and services can be re-categorized based on the human element—are the goods and services *required* or do we just *desire* them? **Needs** are essential things that people must have to live, such as food, clothing, and shelter. **Wants** are things that people enjoy having, and potentially make life easier, but are not necessary for survival. In the table below, sort some of the goods and services you often use based on whether it is a need or a want.

Needs	Wants

Ask a friend. Are your friend's needs and wants the same as yours?

Needs	Wants

Ask your parents, an aunt, or an uncle. Are your parents', your aunt's, or your uncle's needs and wants the same as yours?

Needs	Wants

Ask your grandparents, a great uncle, or a great aunt. Are your grandparents', your great uncle's, or your great aunt's needs and wants the same as yours?

Needs	Wants

Why might these different people have different needs and wants?

As people get older, their needs and wants typically change. Some reasons for this include the following:

- Increased income
- Changes in technology
- Increased environmental concerns
- Increased family responsibilities
- Changes in priorities

Can you think of other reasons?

Before you read the next few pages, select a small business to keep in mind. You should be at least somewhat familiar with the business, and hopefully know the owner. The purpose for doing this is to try to relate the following points to this business.

Large and Small Business Considerations

There are many aspects of a business that must be considered when analyzing its set-up and potential. Some aspects that you will focus on in this course are working conditions, sustainable development, and business expenses. A discussion of entrepreneurship is found at the end of this lesson.

Working Conditions

In a large company such as a car dealership, you may be hired as a sales person in the Marketing Department, a computer operator in the Finance Department, or a mechanic in the Service Department. You do not experience the variety of assignments you would likely get in a smaller business. You may consider this an advantage or disadvantage, depending on your preferences.

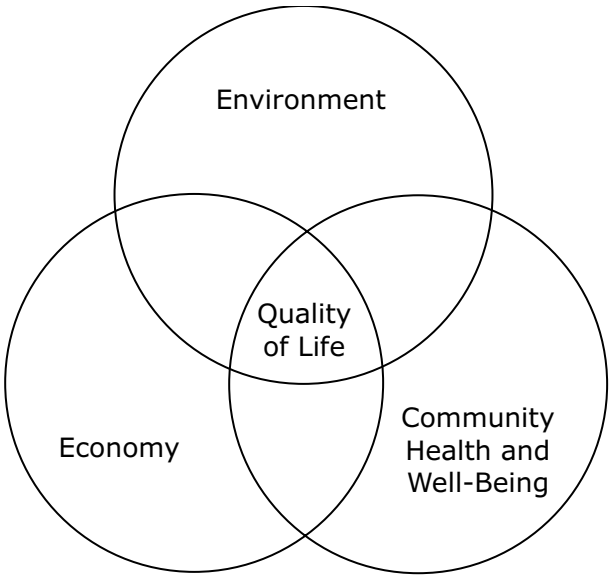
One advantage of being an employee in a larger organization is benefits. These benefits may include a pension plan, a dental plan, or sick benefits. Many businesses offer sick benefits so that workers do not come to work when they are ill. This may be an allowance for one sick day per month with pay, and this is covered by an insurance policy that the employer purchases. The dental plan is also an insurance package the employer can purchase to cover the dental costs incurred by employees and their families. A pension plan is another benefit that may not be something you are looking for now but will be very valuable to you in the future.

Alternately, small businesses offer employees or business owners a variety of tasks on the job. If you are a grain farmer, you have to be the manager (making decisions), the accountant (paying the bills), the producer (planting the crops), the sales manager (selling the grain), and the human resource manager (hiring farm helpers).

In a small business operation, you will not have the same benefits as in a larger company. For example, if you miss a day's work after getting the flu, you may not get paid. If the flu continues for a few days, your paycheque would be smaller at the end of the week. This is often one of the disadvantages of working in a small business. One advantage of working in a small business is the flexibility in hours and variety of tasks that would not be available to you as an employee in a larger company.

Sustainable Development

Companies today have responsibilities not only to their employees, but also to their communities and the environment. As the topic of environmental health has been studied over the last half-century, it has become clear that there must be changes to the way we do business in order to help maintain the environment. The following diagram lists the three principles of sustainable development that must be considered in a business to contribute toward a good quality of life for all.



The integration of these components requires thoughtfulness and creativity. Manitoba has adopted a set of principles and guidelines that can be used as a checklist to help determine if your business is sustainable. These include the following:

Principles

- Integration of environmental and economic decisions
- Stewardship
- Shared responsibility and understanding
- Conservation and enhancement
- Rehabilitation
- Global responsibility

Guidelines

- Efficient use of resources
- Public participation
- Access to information
- Integrated decision making and planning
- Waste minimization and substitution
- Research and innovation

Manitobans have also been encouraged to do the following:

- Use renewable resources (including hydroelectric, solar, and wind power)
- Reduce dependency on non-renewable resources (including oil and natural gas)
- Find new and innovative ways to protect the environment for future generations

Business Expenses

The key to any successful business is that revenue must exceed expenses. Controlling expenses within a business is a very important task for a business person, whether the business is big or small. In general, the expenses required to run a business can be divided into two categories: business expenses and capital expenses. **Business expenses** are the costs incurred for the purposes of earning income such as travel expenses (including fuel), salaries, and rent. **Capital expenses** are expenditures that create a lasting benefit in a company and include the costs of assets of the business, such as equipment or property.

Large businesses will have many expenses due to the size of the business, such as the cost of employees, the cost to manage finances, and the costs of buildings. For the purposes of this course, you will focus on small business expenses. The following is a list of some expenses that a small business owner can expect to incur:

1. **Office Expenses**—Every business needs space to operate and equipment to run the operation. If the space is rented, it would be considered a business expense; if the space is purchased, it would be considered a capital expense. The same is true for equipment in the office (such as a computer).
2. **Loan Expenses**—In many cases, individuals will need to borrow money in order to operate their business. The cost of borrowing this money is interest, which is another capital expense of running the business.
3. **Marketing Expenses**—In general, marketing expenses can be identified as any cost that leads to the sale of a product or service. These costs might be advertising, packaging, promotions, or a salesperson's commission. The marketing of a product or service is very important because if no one knows about it, they will not want to buy it.
4. **Administrative Expenses**—These expenses apply to the actual running of the office. If a business owner bought a photocopy machine for the office, it would be considered a capital expense. Other office expenses, such as postage, pens, and paper, would fall into the business expense category.
5. **Operating Expenses**—These expenses are required to get a business off the ground and to continue its functions from day to day. Operating expenses include insurance costs, acquiring licenses, and costs of utilities such as heat, electricity, phone, and Internet.

Entrepreneurship

A small business owner is an entrepreneur. Entrepreneurship is the recognition of business opportunities (needs, wants, or problems) and the use of resources to implement ideas for new, thoughtfully planned ventures. In other words, entrepreneurs create new businesses by inventing new products, procedures, or services using innovative ideas. They can contribute to society in a number of ways, including the following:

- Creating new products that are easier or safer to use
- Finding new production methods that are more efficient or more environmentally friendly
- Creating new jobs in the community by hiring workers
- Solving a problem—perhaps a medical or environmental problem—that improves the lives of people in a community

Canadians have a history of entrepreneurship. Some of the items or activities invented by Canadians include:

Pablum	First electrical car	5-pin bowling
Kerosene	Jetliner	Table hockey
Cobalt bomb	Pulp newsprint	Zipper
Acrylics	Computerized Braille	Pacemaker
Carbide	Panoramic camera	First patented light bulb
Acetylene	IMAX	First heart valve operation
Disintegrating plastic	Telephone	Paint roller
Basketball		

Note: If you have access to the Internet or a public library, research one of the above items or activities. When was it invented? Why? Is there a story related to entrepreneurship? Share the information with your learning partner.

Feasibility

The first thing you, as an entrepreneur, must do before jumping into a new business venture is to determine if the business idea is feasible. There are several questions that must be answered before determining the feasibility of a business in your community. Are there enough potential customers in the community who will be interested in the goods or service you wish to provide? Consider the competition. Are other businesses offering a similar product or is the product you plan to offer more attractive than the competition? Do you have the money needed to start the business or, if not, can you qualify for a loan from the bank? Do you have the knowledge required to run the business or do you feel you need to take a course or do some reading to become more confident? Once you have considered these questions, you will be in a better position to determine whether or not the business idea is feasible in your community.

The following learning activity focuses on the material you have read about in this lesson. Although there are no calculations in this lesson, it is important that you understand the content, so ask your learning partner for clarification if there is something that you do not understand. These questions or similar ones may also appear in an assignment or on the examination, so it is a good idea to practice now! Don't forget to check your answers at the end of this module.

Learning Activity 3.1

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. You are buying lunch for yourself and a friend. You bought two drinks for $2.50 each, one pizza to share for $15, and two individual salads for $5.25 each. You give the cashier $40. The cashier gives you $10 in change. Is this the correct change?
2. Evaluate: $\left[\frac{(3 \times 4)}{12 + 6}\right]$
3. 15% of 3560 is 534. What is 45% of 3560?
4. There are two lunch specials that capture your interest. One costs $9, but is 25% off the total cost after buying an additional drink for $2. The second lunch costs $7.50 and a drink is an additional $1. If you wish to buy a drink with your lunch, which lunch special is the better deal?
5. Calculate the taxes on a $325 item.

Part B: Understanding Business Principles

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Define business.
2. What are the two categories of goods and services? Provide two examples of each.
3. List two advantages of working for a small business.

continued

Learning Activity 3.1 (continued)

4. What are the three principles that contribute to sustainable development?
5. Choose a feasible business idea for your community (for example, a hot-dog stand or a lawn maintenance company), and list six or more specific expenses related to that company.

Lesson Summary

This lesson provided you with some very basic introductory information about business. One specific focus of the lesson was entrepreneurship.

If you are interested in entrepreneurship and like the idea of pitching ideas to an investor, you may enjoy watching a show like CBC's *Dragon's Den*. This show features several successful Canadian entrepreneurs and business investors.

Check your answers for the previous learning activity. If you do not understand some of the answers, be sure to ask your learning partner or tutor/marker for clarification. The rest of this module focuses on small business.

Notes

Lesson 2: Profitability of a Small Business

Lesson Focus

In this lesson, you will

- ❑ learn to generate options that might improve the profitability of a small business
- ❑ determine the break-even point for a small business
- ❑ explain factors, such as seasonal variations and hours of operation, which might affect the profitability of a small business

Lesson Introduction

The owner of a business must keep a close eye on its finances. Although having expenses exceed revenue at the beginning of the life of a new business is common, a business cannot continue to operate if it continually loses money. There are several factors that will influence the viability of a business. This lesson focuses on some of those factors, including location, competition, seasonal variations, and profitability.

Factors Affecting Business Viability

Business Location

Where should a successful business be located? Some experts suggest that location is vital to the success of any business. Depending on the type of business, location may or may not be an important consideration. While many start-up mistakes can be corrected later on, a poor choice of location can be very difficult to correct.

Ideally, a suitable business location should be as convenient as possible for the consumers of the product or services. Depending on the business, it might be best located in a high traffic area, have access to adequate free parking, and have plenty of room for the business. A new business owner should also ensure that the site meets zoning regulations that may be necessary for the business.

In fact, some business owners may not need to consider their location as an important factor (for example, web-based businesses or mobile businesses based in the home). Home-based businesses are a popular way for an entrepreneur to start a new business because work space is available in the home at no extra cost. Homes may be equipped with sewing machines, telephones, computers, or other equipment that may be required to start a business. The type of location chosen for a business ultimately depends on the needs of the business.

Competition

Competition occurs when two or more businesses are selling the same goods or service to the same customers. An example of this would be different pizza restaurants in one area of a city.

Competition is important to the marketplace for a number of reasons. It forces businesses to be more efficient in order to keep costs and prices down. Competition also encourages companies to improve the quality of their goods or services in order to maintain customers and to attract new ones. It also requires businesses to advertise their product so that consumers are more aware of the goods and services that are being offered. An entrepreneur who is starting a new business needs to be aware of the competition of other businesses that offer the same or similar goods or services to the same customers. Analyzing the competition before beginning a business is a good idea. An entrepreneur might analyze the competition by

- reading local newspapers, listening to the radio, and watching television advertisements to determine what products and services are available to customers
- gathering information about the quality and prices of the products or services of competing businesses to determine how your product or service can be made desirable to customers

Seasonal Variations and Hours of Operation

In business, **seasonal variation** refers to the cyclical pattern of changes in demand for goods and services. The reasons for seasonal variations are changes in the environment or changes in cultural factors that cause people to have different needs at different times in a cycle. For example, a resort located in a tourist area of Canada will sell much more ice cream in the summer than in the winter. In fact, many of the businesses in resort towns will adjust their **hours of operation** to match the peak times that the resort experiences. As well, a seller of Christmas trees will have a limited number of weeks of operation.

Businesses affected by seasonal variation need to identify the effects of the seasons to help in the business planning. These seasonal variations will cause temporary increases or decreases in the demands on staffing requirements, inventory, and hours of operation. In some cases, the business may even close its doors during the "off-season." In addition to these considerations, businesses need to know if the variations they have experienced can be expected every season.

Profitability of a Business

A common theme in business is to have the right product, at the right place, at the right time, and at the right price. If all of these things occur a business is likely to make a profit. **Profit** is the money a business has left over after paying all of its expenses.

When a business purchases a product to resell at a profit, the cost of goods sold must be considered. **Revenue** is the amount of money collected from the sale of goods or services. The gross profit is calculated by subtracting the cost of goods sold from the revenue. The equation is shown below:

Gross Profit = Revenue − Cost of Goods Sold

You may want to add information regarding profitability of a business to your resource sheet.

Example 1

The basketball team at your school is planning a pizza lunch as a fundraiser. The team plans to purchase 15 extra large pizzas at $10.99 each. Each pizza will have 12 slices and each slice will sell for $2.00. Assuming all of the pizza slices are sold, how much profit will the team make?

Solution

Number of slices = 15 pizzas × 12 slices = 180 slices

Revenue = 180 slices × $2.00 per slice = $360.00

Cost of Goods Sold = 15 pizzas × $10.99 each = $164.85

Gross Profit = Revenue − Cost of Goods Sold

Gross Profit = $360.00 − $164.85

Gross Profit = $195.15

To find the net or overall profit, a business must subtract all expenses from the revenue, such as the cost for the gas to pick up the pizzas and cost of any napkins or paper plates.

Example 2

Julia is a registered massage therapist who has started a business out of her home. She has also realized that if she travels in her van to a client's home, she can provide massage therapy to those who are unable to find transportation to her home. Julia charges $50 per hour for massages in her home and $80 per hour for massages when she travels to a client's home. Below is a summary of Julia's revenue and expenses on average for a week. Calculate Julia's net profit per week.

Revenue:

On average Julia has 18 clients come to her home for a one-hour massage, and she travels to the homes of nine clients for one-hour massages.

Expenses:

- **Travel:** Julia travels on average 200 km per week at a cost of $1.65 per km for gas and mileage on her vehicle.
- **Equipment and supplies:** Julia spends $102 per week on average to keep her equipment updated and to replace supplies.
- **Laundry:** Julia spends $76 on average per week to launder items required for her business.

Solution:

Note that Julia's Cost of Goods Sold is zero since she is not selling anything that she had to initially buy, so her gross profit will be the same as her revenue. However, you were asked to calculate her Net Profit, so you need to consider the expenses listed.

Revenue = 18 clients × 50 + 9 clients × 80

Revenue = 900 + 720

Total Revenue = $1,620

Expenses = 200 × 1.65 + 102 + 76

Expenses = 330.00 + 102 + 76

Total Expenses = $508

Net Profit = 1620 − 508 = $1,112

You may want to add information regarding profitability of a business to your resource sheet.

How to Increase the Profitability of a Business

Once a business has been in operation for a while, business owners often look for ways to increase their profit. There are many ways to increase the profitability of a business and, generally speaking, the goal is to increase revenue and reduce expenses.

If you consider the previous example, Julia could simply charge more for her massages to increase her revenue, and she could look at ways to reduce her expenses, such as doing her own laundry rather than sending it out. Any combination of an increase in revenue and a decrease in expenses will improve the profitability of her business.

Of course, it is not always as simple as raising prices. Business owners need to be careful when they attempt to charge more for their goods and services, as they may lose business in the process. The same can be said for reducing expenses. By cutting corners to reduce expenses, the quality of the product or service may be diminished. As a result, a business may lose some customers and the goal of increasing profit may not be realized.

There are other ways that business owners can increase their profits without increasing prices or decreasing expenses. Increasing the volume of sales of the businesses product will increase the profit.

Here are two ways to increase the volume of sales:

- advertise or promote the business in order to generate new customers
- create new products or services within the current business in order to attract new consumers

You may want to add information to your resource sheet regarding how to increase the profitability of a business.

The Break-Even Point

When an entrepreneur starts a business, he or she generally does so in order to make a profit, not just to break even. At the break-even point, there will be no profit, but there will also be no loss. When setting goals for the company, it is helpful for the business owner to know how many products must be sold in order to break even; this is called a **break-even point**. Alternatively, a business owner might like to determine how much should be charged for a product in order to break even; this is also a **break-even point**.

To calculate the number of sales required to break even, divide the total cost of production by the selling price of each product.

$$\text{Break-Even Point} = \frac{\text{Total Production Costs}}{\text{Selling Price}}$$

To calculate the selling price required to break even, divide the total cost of production by the number of items you expect to sell.

$$\text{Break-Even Point} = \frac{\text{Total Production Costs}}{\text{Number of Products Sold}}$$

Example 3

A business will produce 300 pictures and sell them in a month. The total cost of producing each picture has been determined to be $4.50.

a) How many pictures must be sold in a month at $8.00 each in order to reach the break-even point?

b) How much profit will the business make if it sells all 300 pictures at $8.00 each?

Solution:

a) $$\text{Break-Even Point} = \frac{\text{Total Production Costs}}{\text{Selling Price}}$$

$$\text{Break-Even Point} = \frac{300 \times 4.50}{8.00}$$

$$\text{Break-Even Point} = \frac{1350}{8}$$

$$\text{Break-Even Point} = 168.75$$

The break-even point is 168.75, so 169 products must be sold to break even.

b) All money received for any pictures sold over the 168.75 break-even point is strictly profit, so if all 300 pictures are sold, the profit will come from the sale of the 131.25 pictures remaining, after subtracting the 168.75 required to break even.

$131.25 \times \$8.00 = \$1{,}050.00$

or

Profit = Revenue − Expenses

Profit = $300 \times \$8.00 - 300 \times \$4.50$

Profit = $\$2{,}400 - \$1{,}350$

Profit = $\$1{,}050$

Example 4

Breanne is starting a business making and selling jewelry. She has spent a total of $75 for the beads and $150 for the metal to form the bracelets and $40 for other supplies. With the supplies she purchased, Breanne can make 80 bracelets, which she hopes to sell in one month.

a) How much does Breanne need to charge for each bracelet to break even?

b) If she wants to earn $500 from the business in one month, how much must she charge?

Solution:

a) $$\text{Break-Even Point} = \frac{\text{Total Production Costs}}{\text{Number of Bracelets}}$$

$$\text{Break-Even Point} = \frac{75 + 150 + 40}{80}$$

$$\text{Break-Even Point} = \frac{265}{80}$$

$$\text{Break-Even Point} = 3.3125$$

The break-even point is $3.31, which is the cost per bracelet required to break even.

b) This can be calculated by adding $500 to the total production costs and calculating the new break-even point. It is a good idea for an entrepreneur to add a salary to the businesses expenses. That way, the business can break even but the entrepreneur will still be paid a reasonable wage for his or her work.

$$\text{Break-Even Point} = \frac{\text{Total Production Costs}}{\text{Number of Bracelets}}$$

$$\text{Break-Even Point} = \frac{75 + 150 + 40 + 500}{80}$$

$$\text{Break-Even Point} = \frac{765}{80}$$

$$\text{Break-Even Point} = 9.5625$$

The break-even point for the business is now $9.56 per bracelet, but at that price Breanne will earn $500 from the business

You may want to add information regarding break-even points to your resource sheet.

Complete the following learning activity in order to check your understanding of these concepts related to profitability of a small business. Be sure to check your answers, and ask your learning partner if you have any questions. Also, if you find that you always have to look back in the lesson for information, you may want to add that information to your resource sheet. It may also be useful for an assignment or for the examination.

Learning Activity 3.2

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. You have a spending limit of $200 on your debit card. You have previously bought two shirts for $30 each and three pairs of jeans for $40 each. You have just seen a pair of sunglasses that you would really like to buy for $25. Do you have enough money on your debit card to buy these sunglasses?
2. Write this fraction as a decimal and a percent: $\frac{4}{16}$
3. You have recently set up a hot-dog selling business. Your net sales are $2500 and the cost of goods sold is $2225. What is your gross profit?
4. Continue the pattern: 0.125, 0.250, 0.375, ____ , ____
5. Evaluate: $2 \times 3 \times 14$

continued

Learning Activity 3.2 (continued)

Part B: Profitability

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. State two reasons that competition is important to the economy.
2. List three products or business activities that exhibit strong seasonal variation.
3. Kyle and Alex have started a T-shirt business called "T's R US" and they predict that each shirt will cost $8.75 to produce. They plan to make 500 T-shirts and would like to pay themselves a salary of $400 each. How much should be charged per T-shirt for the business to break even?
4. Sarah owns a hot-dog stand that she operates in downtown Winnipeg at lunchtime, five days a week, from the beginning of April to the end of October. The details of her business follow:
   - Wieners cost $2.25 for a package of 8 and buns cost $1.50 for a package of 8. She buys 4 packages each day for 5 days.
   - Condiments cost $15 per week.
   - Other costs such as propane and signage costs are, on average, $8 per week.
   - Hot dogs are sold at $2.00 each.

   a) Calculate the number of hot dogs that must be sold to break even each week.

   b) What will be the weekly profit if Sarah sells 30 hot dogs each day?

   c) Calculate the gross profit as a percentage of revenue from sales after selling 30 hot dogs each day.

   d) List two ways Sarah could increase the profitability of the business.

Lesson Summary

In this lesson, you learned that the profitability of a small business is affected by revenue and expenses. Generally speaking, profitability can be improved by increasing revenue and by reducing expenses. A business owner needs to be aware of a break-even point for the number of sales required or the break-even point for the cost per item required before a profit is made. You also learned about other factors that might affect the profitability of a small business, such as seasonal variations and hours of operation.

In the next lesson, you "switch gears" to look at income tax. Because the topics are so different, it might be a good idea to complete the assignment following this current lesson before continuing on.

In the next lesson, you will need to have a copy of the T1 General return form for income taxes. You can use either the T1 General return attached to the end of Lesson 3, print a more recent form from the Canada Customs and Revenue Agency website (see www.cra-arc.gc.ca/formspubs/t1gnrl/mb-eng.html), or, if you do not have access to the Internet, you can call the Canada Customs and Revenue Agency to ask them to mail a copy to you (1–800–959–2221). If you are going to order a T1 General return form via the mail, you should phone and order it right away so you have it when you need it.

It is now time to complete Assignment 3.1. If any material seems challenging to you, be sure to ask your tutor/marker or learning partner for help. Also, make sure your resource sheet is up to date with all definitions and sample solutions for some of the more difficult questions.

Assignment 3.1

Profitability of a Small Business

Total: 30 marks

Note to Students: If you feel that you are missing information at any point during this assignment, you should know that you are welcome to refer back to the lessons for help. You may also consider adding that information to your resource sheet.

1. a) In your own words, describe the terms *producer* and *consumer*. *(2 marks)*

b) Choose a specific company, and describe how this company behaves as

- a producer
- a consumer *(2 marks)*

continued

Assignment 3.1: Profitability of a Small Business (continued)

2. a) Identify four expenses that might be associated with a window-washing business. *(4 marks)*

b) Would a window-washing business be feasible for you as an entrepreneur in your community? Explain. *(2 marks)*

continued

Assignment 3.1: Profitability of a Small Business (continued)

3. Lucia has her own jewelry business, and sells jewelry at summer events such as music festivals. She has produced 460 pieces of jewelry. It cost her $6 to make each piece, and she will sell each piece for $15.

   Calculate

   a) her cost of goods sold *(1 mark)*

   b) her revenue from sales if she sells 415 pieces of her jewelry *(1 mark)*

   c) her gross profit after selling 415 pieces of jewelry *(1 mark)*

   d) the gross profit as a percentage of revenue from sales after selling 415 pieces *(1 mark)*

   e) the number of pieces of jewelry she must sell to reach her break-even point *(2 marks)*

continued

Assignment 3.1: Profitability of a Small Business (continued)

4. The feasibility of a business depends on many factors. Identify two factors that may affect the following business, and explain how these factors may affect the business. State whether the business is affected positively or negatively.

   Thieng lives in a large city and operates a tutoring business. His students live in many different parts of the city, and he tutors the students in their homes. *(2 marks)*

5. Identify two general factors that influence the profitability of a business. Give a specific example of each factor. *(3 marks)*

6. Describe how a factor such as seasonal variation might affect a hot-dog stand business. *(1 mark)*

continued

Assignment 3.1: Profitability of a Small Business (continued)

7. Dennis is starting a business selling the paintings of local artists. The artists will work in his basement, and Dennis will provide the paint and supplies required at a cost of $12.50 for each painting. He bought easels for $290 and spent $75 on advertising through a website. He has agreed to pay the artists $120 for each painting.

   a) If Dennis plans to sell 13 paintings, how much does he need to charge per painting to break even? *(3 marks)*

   b) What will Dennis's profit be if he can sell the paintings for $200 each? *(2 marks)*

   c) List two options Dennis can consider that would improve the profitability of his business. State which of the two options you prefer, and explain why. *(3 marks)*

Notes

Lesson 3: Income Tax

Lesson Focus

In this lesson, you will

- ❑ be introduced to some common income tax terminology
- ❑ look at the T4 information slip, formally known as the T4 Statement of Remuneration Paid
- ❑ identify deductions that can be claimed under business expenses and the receipts that need to be retained
- ❑ explore the major sections of the T1 General income tax return

Lesson Introduction

Unlike the previous two lessons, this lesson will not be focusing on small businesses specifically, but income tax in general. Income tax is a crucial part of Canadian taxation, and you must file an income tax return if you are a paid employee or the owner of a business. If you are a high school student with a job, you will probably receive a tax refund in the spring (once you file) because you overpaid during the year. Recall from Grade 10 Essential Mathematics that income tax is one of the deductions on your paycheques.

Even if you have filed an income tax return, you may not have completed the paperwork on your own. The purpose of this lesson is to provide an overview of income tax and how it is calculated. You will look at some of the forms required to complete an income tax return. If you are at least somewhat aware of how the amount you pay for income tax is calculated, you may save a significant amount of money with appropriate financial planning. Reducing taxes paid is a goal for large and small businesses alike.

The Basics of Taxation

Taxes have been part of Canadian life ever since Louis XIV of France introduced an export tax on beaver and moose pelts in 1650. With the passage of the *British North America (BNA) Act* in 1867, the Government of Canada was given the right to raise money (revenue) by any system of taxation it deemed necessary. For the next 50 years, the Government of Canada raised funds through indirect taxation methods such as sales taxes, customs duties, and excise taxes. In 1917, to help pay for World War I, the federal government introduced a personal income tax.

The Province of Manitoba also instituted a personal income tax. In 1941, the federal government began collecting income tax for the Province of Manitoba together with its federal income tax. After the federal government collects the tax, it forwards Manitoba its portion.

Personal income tax supplies the federal and provincial governments with much of their incoming revenue. The federal and provincial governments do not necessarily collect income tax from everyone, but most working people must file (fill out and submit) an income tax return. This income tax return is due by April 30 each year.

Terminology

The following terms will help you understand the language used in the taxation forms. You may want to include some of these terms in your resource sheet.

- **Balance owing:** The amount owed by a client if the total payable is more than the total credits as listed on the client's return.
- **Canada Child Tax Benefit:** A tax-free monthly payment that is fully indexed to the cost of living to help with the cost of raising children under age 18, based on the family's net income.
- **Dependant:** A child or relative who depends on someone else for support (financially).
- **Goods and Services/Harmonized Sales Tax (GST/HST) Credit:** A credit for people who have low incomes, which offsets all or part of the GST/HST payments they have made throughout the year.
- **Net income:** The amount of income after certain deductions have been subtracted from the *total income* on the return.
- **Non-refundable tax credits:** These are credits that reduce the amount of income tax you owe, without refunding any money to you if the credits are more than your income. Federal credits reduce federal income tax payable, and provincial credits reduce provincial income tax payable.
- **Refundable tax credits:** These are credits that reduce the amount of income tax you owe, refunding the difference to you if the credits are more than your income.
- **Registered Education Savings Plan (RESP):** These are plans that help people save for a child's post-secondary education. Investment income from money deposited into the plan is not taxed, but when it is used, the student must claim the money as income.

- **Registered Pension Plan (RPP):** This is a pension plan registered by the Canada Customs and Revenue Agency (CCRA), funded jointly by the employer and employees. The employees do not have to pay income tax on their contributions.
- **Registered Retirement Savings Plan (RRSP):** People voluntarily contribute money into this plan to create a fund for their retirement. The money contributed is not taxed until it is withdrawn.
- **Taxable income:** This is the amount of income left after certain allowable deductions have been subtracted from the *net income* on which your income tax is based.

Who Must File an Income Tax Return?

All residents of Canada are required to pay both federal and provincial income tax on income they earn from anywhere in the world. Individuals residing in Canada must pay income tax even if they are not Canadian citizens. All Canadian residents must file an income tax return if they earn "taxable income." Part-time residents of Canada must also file a tax return if they earn "taxable income" while in Canada. Canadian residents who do not earn enough income to have a "taxable income" may still have to file a tax return for the following reasons:

- to apply for the goods and services tax/harmonized sales tax credit
- to begin or continue to receive Child Tax Benefit payments
- to receive a refund of income tax deducted by an employer
- to receive a refund of Employment Insurance or Canada Pension Plan overpayments
- to carry forward the unused portion of tuition and education amounts
- to claim income from the sale of a property or other capital gain (such as an inheritance)
- to pay back Old Age Security or Employment Insurance benefits

All individuals must file a tax return if the Canada Customs and Revenue Agency specifically requests one.

What Do You Need to File an Income Tax Return?

To file an income tax return, you need an income tax return form. Although there are a number of income tax returns, this course will focus on the individual income tax return, known as the T1 General income tax return. A copy of the 2010 T1 General return is included at the end of this lesson. Also, a booklet called *General Income Tax Forms 2002* is included with the materials for this module. In addition to the T1 General return, the booklet contains a number of schedules, provincial information, and other forms. You do not have to complete all the schedules or forms when filing your income tax return—you only complete those that apply to you.

In addition to the correct forms, you need a social insurance number (SIN) in order to file an income tax return. Your SIN is a nine-digit number used by the federal government to identify you. To get a SIN card, contact the Human Resources Development Canada office near you or go online to www.hrdc.gc.ca/sin. You *must* include your SIN wherever it is requested on any income tax forms. Otherwise, you may have to pay a $100 penalty.

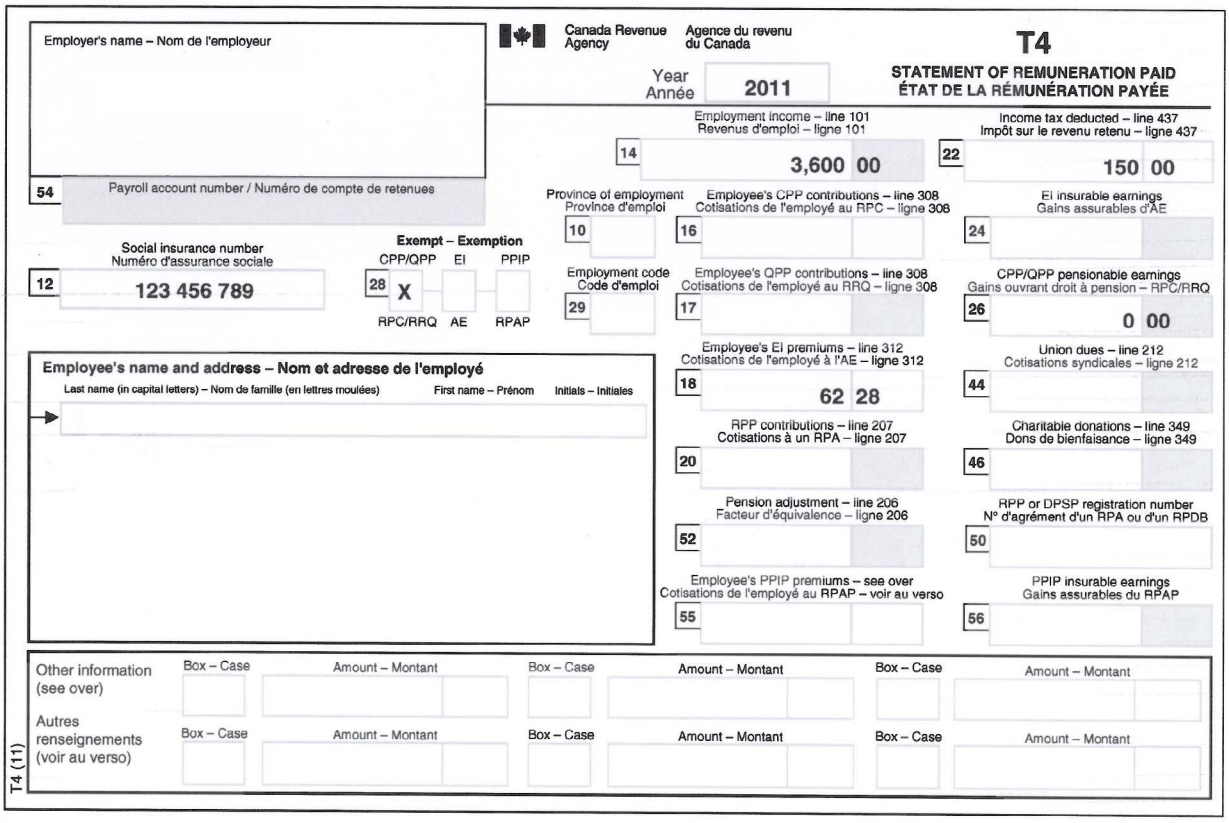
Once you complete your first return, the government will send you an income tax package for each succeeding year. If you do not receive an income tax package in the mail, you can always pick up a package from any Canada Post branch or at any Canada Customs and Revenue Agency (CCRA) office. You can also file your return online.

In this course, you can refer to the 2010 form or the current year's online form when looking at a T1 General income tax return. You will not be asked to complete any tax forms for the assignment or the examination, but it is a good idea to become familiar with them. Understanding the income tax system may be helpful when you prepare a personal budget or business financial plan. Also, you will save some money if you can complete the tax forms yourself.

You need to complete many forms and schedules when you prepare an income tax return, but in this course you will look at only a few of them.

T4 Statement of Remunerations Paid

Anyone receiving employment income should receive a **T4 Statement of Remuneration Paid**, which is commonly known as the **T4 slip**. Employers are required by law to provide each employee with a statement of earnings and deductions for tax purposes. Each year, around the middle of February, employers provide employees (as well as the taxation department) with this information for the previous year.



T4 Slip: Reproduced under the terms for non-commercial reproduction, as cited at http://www.cra-arc.gc.ca/cpyrght-eng.html.

The T4 slip provides the following information (look at the T4 slip above to identify each of the following):

- the name of the employer
- the name of the employee (i.e., your name)
- the employee's social insurance number
- the gross annual income earned by the employee (box 14)
- the CPP and EI deductions for the year (boxes 25 and 18)
- the income tax deducted (box 22)
- any amounts the employer withheld for pension plans, donations, or union/professional dues

For most people, the T4 slip is the most important form required when they prepare their income tax return.

You should keep a file for income tax receipts and other forms. Failure to submit receipts may lead to deductions being disallowed or a delay in the processing of your return until the proper receipts have been submitted.

Receipts for Small Businesses

If you are employed by someone else, you will receive a T4 slip with information to be entered on your income tax form. If you own a small business, you will need to keep receipts in order to claim deductions on your income tax form.

The details of your small business will be entered on a form named T2125. The specific expenses you can claim as deductions will depend on your business, but the following list of expenses gives you an idea of what you can claim. To claim these income tax deductions, you are required to keep receipts.

Expenses that can be claimed if they are related directly to the business include the following:

- Advertising
- Meals and entertainment (as they apply to the business marketing)
- Bad debts (clients who owe you money but didn't pay you)
- Insurance for your business
- Business tax, fees, licences
- Office expenses
- Supplies
- Telephone and utilities
- Motor vehicle expenses (the fraction of total kilometres travelled for business)

If your business is run out of your home, you can also claim a portion (the fraction of your home that is office space) of the following expenses in your home:

- Heat
- Electricity
- Insurance
- Maintenance
- Mortgage interest
- Property taxes

To claim any of these expenses on your income tax form, you will need to have receipts. After completing the T2125 form, you will enter the business income (or loss) on your T1 General Income Tax form in the Total Income section under Self-Employment Income.

T1 General Return

When doing your own taxes, the first thing you have to do is (a) get the forms sent to you by CCRA, (b) print the forms provided by the CCRA website, or (c) use income tax software to enter in your information. If you have ever looked at the T1 General income tax return, it can be overwhelming. After completing this part of the lesson, you will hopefully feel less anxiety when looking at income tax forms. The purpose of this section is to provide you with an overview of the four main parts of the T1 General return. If you need more information that is beyond the scope of this course, you may find it in the *General Income Tax and Benefit Guide* or online at www.cra-arc.gc.ca.

At this point, you should have your copy of the T1 General return beside you so that you can refer to it as needed. A copy of the 2010 T1 General income tax return is provided at the end of this lesson. The T1 General forms do not change very much from year to year, but if you want a more recent copy, you can obtain this form from the Canada Customs and Revenue Agency website (see www.cra-arc.gc.ca/formspubs/t1gnrl/mb-eng.html). If you do not have access to the Internet, you can pick up a copy at the local post office, or call Canada Customs and Revenue Agency and ask them to mail a copy to you (1-800-959-2221).

As you work through this section of the lesson, keep your resource sheet with you so that you can jot down important information.

The T1 General return has four sections, each on its own page. Although the line numbers that identify what goes where may change slightly from year to year, the format and content remain relatively unchanged.

Section 1: Identification

This page is used by the tax department to identify you, the taxpayer, as well as to get some information from you. Some of the items on this page include the following (try to identify the following items on the first page of the T1 General return):

- Your name and address
- Social insurance number
- Marital status
- Elections Canada information
- GST/HST credit application

The **Elections Canada** box is only relevant to people who are aged 18 and older. Its purpose is to update the National Registry of Electors. You should note that if you say "no" to being added to the list, you are still eligible to vote—you do not forfeit your right to vote.

The **goods and services tax/harmonized sales tax (GST/HST) credit application** section at the bottom of the page is intended for people with low or moderate incomes. They can apply for a GST/HST rebate, which is paid four times a year to people who qualify. The purpose of this rebate is to refund some money to low-income people for money they pay for GST/HST. To be eligible for this credit, the applicant must meet one of the following criteria:

- Be 19 years or older
- Have a spouse
- Be a parent

Section 2: Total Income

On this page, you need to record the amount of income you received from all sources during the previous year. Try to identify the locations on the tax form where the information should be recorded.

Sources of income that may apply to you include the following:

- Employment (shown on a T4 slip)
- Employment Insurance (income you receive while unemployed)
- Investment income (this pertains to you if you have money invested that earns interest or dividends—you will need to complete and submit a Schedule 4 form)
- Self-employment income (income or loss from small business)

If your income is from **employment**, you will use the information from your T4 slip (shown previously) to complete this page.

As discussed earlier, if your income is from **self-employment**, you will need to report the expense details. When operating a business, you have to keep track of all your business transactions (income and expenses). It is very important to keep all the receipts you receive when making purchases for your business. Many business owners hire an accountant to keep track of all business transactions. The accountant then completes the appropriate income tax return for the business owner.

You need to provide written statements showing proof for each income entry. Also, for business incomes such as rental or self-employment incomes, you need to complete other forms (such as form T2125) and schedules that show expenses, depreciation, and other financial details of the business—details that are beyond the scope of this course. However, you should understand that *keeping accurate records and all receipts is very important* when you complete an income tax return.

Section 3: Net Income and Taxable Income

The amount of income tax you must pay depends on your taxable income, and not on your total income calculated in the previous section. Page 3 of the T1 General income tax return is used to calculate first the net income, and then the taxable income. This page can be summarized with the formula:

Taxable Income = Total Income − Deductions

This section of the tax return identifies numerous deductions from total income. Try to identify the locations on the tax form where the following deductions should be recorded:

- Payments to registered pension plans (money deposited into a pension plan for your retirement)
- Union or professional dues
- Some child care expenses
- Moving expenses (if you are moving to a location closer to your place of work)
- Business losses (there are a variety of investment expenses and business losses listed in this section)
- Various allowances for a variety of personal or occupational expenses, too numerous to list here

Scanning this page to identify the deductions is a good idea, because some of these deductions may apply to you now or in the future. *If you do not claim a deduction when your income tax return is completed, you will pay more income tax than necessary.*

Section 4: Refund or Balance Owing

Try to identify the locations on the tax form where the following entries occur. On this page, you calculate your **refund or balance owing**, which is the amount you owe for

- Federal income tax (after completing Schedule 1)
- Provincial income tax (after completing Form 428: Manitoba Tax)

You also record your **tax credits**. Tax credits include the following:

- The amount of income tax you have already paid, probably as deductions from your paycheque
- The amounts you have paid for CPP (Canada Pension Plan) and EI (Employment Insurance) (These were most likely deducted from your paycheques, and the amounts should be recorded on your T4 slip.)

- If you are self-employed, "CPP Contributions on Self-Employment and Other Earnings" (You must complete Schedule 8, and then send this amount along with your income tax payment.)
- Some of your medical expenses
- Sometimes there are special tax rebates offered by the government that apply to certain individuals (An example of a rebate could be for people who install energy-saving devices in their homes.)
- Special rebates (See the explanation below.)

You now calculate your **refund** or **balance owing**. The formula for this is

Total Payable − Tax Credits = Refund OR Balance Owing

- If the above answer is positive, you need to pay this amount to the Receiver General (the government agency that receives income tax payments) by April 30
- If the above answer is negative, you will receive a refund of this amount from the tax department

When you file (send in) a T1 General income tax return, you must include numerous other information pages called Schedules, where you explain specific transactions in greater detail. You will also need to include various papers with tax information (such as the T4 slip) and receipts with your tax return.

This concludes the section on income taxes. The purpose of this section is to provide an overview of income tax calculations.

The learning activity that follows is designed to help you start thinking about income taxes—both personally and for a possible small business in your future. Be sure to ask your learning partner or tutor/marker for help if you are unsure of an answer. Also, remember that the answers to the learning activities in this module can be found at the back of the module, so feel free to answer the question and then compare it with the answer provided.

Learning Activity 3.3

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. A small gas station has a gross income of $12,600 in one day. One-third of the sales came from items other than gasoline. How much money did the gas station receive for items other than gasoline in one day?
2. Write the next elements in this set of letters: A, E, F, H, I, K, L, M, ___ , ___
3. There are 52 weeks in a year, so how many weeks are in three years?
4. You have decided to take a trip to Sydney, Australia. Your mom wants to know what time she should call you. Sydney, Australia is 17 hours ahead of Brandon, your home town. If you want your mom to call you between 4 pm and 9 pm Australia time, what time would this be in Brandon?
5. The area of your property is 120 m^2. If the dimensions of your house are 10 m × 8 m, what is the area of your yard that is not taken up by your house?

Part B: Thinking With Taxes

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. For those who run a small business out of their home, identify receipts for at least three expenses that must be kept for income tax purposes.
2. For a small business that is not run out of the home, identify at least three deductions that can be claimed by the business that cannot be claimed under personal expenses.
3. Identify the four major sections of the T1 General income tax form.

Lesson Summary

This lesson provided you with a brief overview of income tax, including some of the vocabulary of income tax. You learned about deductions that can be claimed if you own a small business and the corresponding receipts that need to be kept. You were introduced to the T4 slip and the four sections of the T1 General income tax return.

The questions on the following assignment deal with income tax. You may refer back to the lesson when answering questions, or ask your tutor/marker or learning partner for help.

Canada Revenue Agency | Agence du revenu du Canada

T1 GENERAL 2011

Income Tax and Benefit Return

Complete all the sections that apply to you in order to benefit from amounts to which you are entitled.
For more information, see the guide. 8

Identification

Attach your personal label here. Correct any wrong information.
If you are not attaching a label, print your name and address below.

First name and initial

Last name

Mailing address: Apt No – Street No Street name

PO Box | RR

City | Prov./Terr. | Postal code

Information about your residence

Enter your province or territory of residence on **December 31, 2011:**

Enter the province or territory where you **currently** reside if it is not the same as your mailing address above:

If you were self-employed in 2011, enter the province or territory of self-employment:

If you **became** or **ceased** to be a **resident of Canada** for income tax purposes **in 2011**, enter the date of:

entry Month Day or **departure** Month Day

Information about you

Enter your social insurance number (SIN) if it is not on the label or if you are not attaching a label:

Enter your date of birth: Year Month Day

Your language of correspondence: English Français
Votre langue de correspondance :

Marital status

Tick the box that applies to your marital status on December 31, 2011:

1 ☐ Married 2 ☐ Living common-law 3 ☐ Widowed
4 ☐ Divorced 5 ☐ Separated 6 ☐ Single

Information about your spouse or common-law partner (if you ticked box 1 or 2 above)

Enter his or her SIN if it is not on the label or if you are not attaching a label:

Enter his or her first name:

Enter his or her net income for 2011 to claim certain credits:

Enter the amount of Universal Child Care Benefit (UCCB) from line 117 of his or her return:

Enter the amount of UCCB repayment from line 213 of his or her return:

Tick this box if he or she was self-employed in 2011: 1 ☐

Person deceased in 2011

If this **return** is for a **deceased person**, enter the date of death: Year Month Day

Do not use this area

Elections Canada (see the Elections Canada page in the tax guide for details or visit **www.elections.ca**)

A) Are you a Canadian citizen? ..... Yes ☐ 1 No ☐ 2

Answer the following question **only if you are a Canadian citizen.**

B) As a Canadian citizen, do you authorize the Canada Revenue Agency to give your name, address, date of birth, and citizenship to Elections Canada to update the National Register of Electors?..... Yes ☐ 1 No ☐ 2

Your authorization is valid until you file your next return. Your information will only be used for purposes permitted under the *Canada Elections Act,* which include sharing the information with provincial/territorial election agencies, members of Parliament and registered political parties, as well as candidates at election time.

Goods and services tax/harmonized sales tax (GST/HST) credit application

See the guide for details.

Are you applying for the GST/HST credit?..... Yes ☐ 1 No ☐ 2

Do not use this area 172 171

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T1 General 2011: Reproduced under the terms for non-commercial reproduction, as cited at http://www.cra-arc.gc.ca/cpyrght-eng.htmll.

The guide contains valuable information to help you complete your return.
When you come to a line on the return that applies to you, go to the line number in the guide for more information.

Please answer the following question:

Did you own or hold foreign property at any time in 2011 with a total cost of more than CAN$100,000? (see the "Foreign income" section in the guide for details) ..... 266 Yes ☐ 1 No ☐ 2

If **yes**, complete and attach Form T1135 to your return.

If you had dealings with a non-resident trust or corporation in 2011, see the "Foreign income" section in the guide.

As a resident of Canada, you have to report your income from all sources both inside and outside Canada.

Total income

Employment income (box 14 of all T4 slips)			101	
Commissions included on line 101 (box 42 of all T4 slips)	102			
Other employment income			104 +	
Old Age Security pension (box 18 of the T4A(OAS) slip)			113 +	
CPP or QPP benefits (box 20 of the T4A(P) slip)			114 +	
Disability benefits included on line 114 (box 16 of the T4A(P) slip)	152			
Other pensions or superannuation			115 +	
Elected split-pension amount (**attach** Form T1032)			116 +	
Universal Child Care Benefit (UCCB)			117 +	
UCCB amount designated to a dependant	185			
Employment Insurance and other benefits (box 14 of the T4E slip)			119 +	
Taxable amount of dividends (eligible **and** other than eligible) from taxable Canadian corporations (**attach** Schedule 4)			120 +	
Taxable amount of dividends other than eligible dividends, included on line 120, from taxable Canadian corporations	180			
Interest and other investment income (**attach** Schedule 4)			121 +	
Net partnership income: limited or non-active partners only (**attach** Schedule 4)			122 +	
Registered disability savings plan income			125 +	
Rental income Gross	160	Net	126 +	
Taxable capital gains (**attach** Schedule 3)			127 +	
Support payments received Total	156	Taxable amount	128 +	
RRSP income (from all T4RSP slips)			129 +	
Other income Specify:			130 +	
Self-employment income				
Business income Gross	162	Net	135 +	
Professional income Gross	164	Net	137 +	
Commission income Gross	166	Net	139 +	
Farming income Gross	168	Net	141 +	
Fishing income Gross	170	Net	143 +	
Workers' compensation benefits (box 10 of the T5007 slip)	144			
Social assistance payments	145 +			
Net federal supplements (box 21 of the T4A(OAS) slip)	146 +			
Add lines 144, 145, and 146 (see Line 250 in the guide).	=		▶147 +	
Add lines 101, 104 to 143, and 147. This is your **total income**.			150 =	

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Attach your Schedule 1 (federal tax) and Form 428 (provincial or territorial tax) here. Also attach here any other schedules, information slips, forms, receipts, and documents that you need to include with your return. 3

Net income

Enter your **total income** from line 150.		150
Pension adjustment (box 52 of all T4 slips and box 034 of all T4A slips)	206	
Registered pension plan deduction (box 20 of all T4 slips and box 032 of all T4A slips)	207	
RRSP deduction (see Schedule 7, and **attach** receipts)	208 +	
Deduction for elected split-pension amount (**attach** Form T1032)	210 +	
Annual union, professional, or like dues (box 44 of all T4 slips, and receipts)	212 +	
Universal Child Care Benefit repayment (box 12 of all RC62 slips)	213 +	
Child care expenses (**attach** Form T778)	214 +	
Disability supports deduction	215 +	
Business investment loss Gross 228 Allowable deduction	217 +	
Moving expenses	219 +	
Support payments made Total 230 Allowable deduction	220 +	
Carrying charges and interest expenses (**attach** Schedule 4)	221 +	
Deduction for CPP or QPP contributions on self-employment and other earnings (**attach** Schedule 8)	222 +	
Exploration and development expenses (**attach** Form T1229)	224 +	
Other employment expenses	229 +	
Clergy residence deduction	231 +	
Other deductions Specify:	232 +	
Add lines 207 to 224, 229, 231, and 232.	233 =	▶ –
Line 150 minus line 233 (if negative, enter "0") This is your **net income before adjustments**.		234 =
Social benefits repayment (if you reported income on line 113, 119, or 146, see Line 235 in the guide). Use the federal worksheet to calculate your repayment.		235 –
Line 234 minus line 235 (if negative, enter "0") If you have a spouse or common-law partner, see Line 236 in the guide. This is your net income.		236 =

Taxable income

Canadian Forces personnel and police deduction (box 43 of all T4 slips)	244	
Employee home relocation loan deduction (box 37 of all T4 slips)	248 +	
Security options deductions	249 +	
Other payments deduction (if you reported income on line 147, see Line 250 in the guide)	250 +	
Limited partnership losses of other years	251 +	
Non-capital losses of other years	252 +	
Net capital losses of other years	253 +	
Capital gains deduction	254 +	
Northern residents deductions (**attach** Form T2222)	255 +	
Additional deductions Specify:	256 +	
Add lines 244 to 256.	257 =	▶ –
Line 236 minus line 257 (if negative, enter "0") This is your taxable income.		260 =

Use your taxable income to calculate your federal tax on Schedule 1 and your provincial or territorial tax on Form 428.

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4

Refund or balance owing

Net federal tax: enter the amount from line 58 of Schedule 1 (**attach** Schedule 1, even if the result is "0")	420	
CPP contributions payable on self-employment and other earnings (**attach** Schedule 8)	421 +	
Employment Insurance premiums payable on self-employment and other eligible earnings (**attach** Schedule 13)	430 +	
Social benefits repayment (amount from line 235)	422 +	
Provincial or territorial tax (**attach** Form 428, even if the result is "0")	428 +	
Add lines 420, 421, 430, 422, and 428. This is your total payable.	435 =	•

Total income tax deducted	437	•
Refundable Quebec abatement	440 +	•
CPP overpayment (enter your excess contributions)	448 +	•
Employment Insurance overpayment (enter your excess contributions)	450 +	•
Refundable medical expense supplement (use the federal worksheet)	452 +	•
Working Income Tax Benefit (WITB) (**attach** Schedule 6)	453 +	•
Refund of investment tax credit (**attach** Form T2038(IND))	454 +	•
Part XII.2 trust tax credit (box 38 of all T3 slips)	456 +	•
Employee and partner GST/HST rebate (**attach** Form GST370)	457 +	•
Tax **paid** by instalments	476 +	•
Provincial or territorial credits (**attach** Form 479 if it applies)	479 +	•
Add lines 437 to 479. These are your total credits.	482 =	▶ –
Line 435 minus line 482 This is your refund or balance owing.		=

If the result is negative, you have a **refund**. If the result is positive, you have a **balance owing**.

Enter the amount below on whichever line applies.

Generally, we do not charge or refund a difference of $2 or less.

Refund 484 •

Balance owing 485 •

Amount enclosed 486 •

Attach to page 1 a **cheque** or **money order** payable to the Receiver General, or make your payment online (go to **www.cra.gc.ca/mypayment**). Your payment is due no later than April 30, 2012.

Direct deposit – Start or change (see Line 484 in the guide)

You do not have to complete this area every year. Do not complete it this year if your direct deposit information has not changed.
Income tax refund, GST/HST credit, WITB advance payments, and any other deemed overpayment of tax – To start direct deposit or to change account information, complete lines 460, 461, and 462 below.

Notes: To deposit your **CCTB** payments (including certain related provincial or territorial payments) into the **same** account, also tick box 463. To deposit your **UCCB** payments into the **same** account, also tick box 491.

Branch number	Institution number	Account number	CCTB	UCCB
460 (5 digits)	461 (3 digits)	462 (maximum 12 digits)	463 ☐	491 ☐

I certify that the information given on this return and in any documents attached is correct, complete, and fully discloses all my income.

Sign here

It is a serious offence to make a false return.

Telephone – – Date

490 **For professional tax preparers only**

Name:

Address:

Telephone: – –

Do not use this area 487 ☐ 488 ☐ •

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Privacy Act, Personal Information Bank number CRA PPU 005

Assignment 3.2

Income Tax

Total: 3 marks

Note to Students: Remember that you can go back to the lesson at any point during the assignment in order to refresh your memory. You may also add to your resource sheet as you work through this assignment if you find that you are missing any information.

1. For a business that is ***not*** run out of your home, which of the following receipts should be kept in order to be claimed as a deduction on your small business income tax form? *(1 mark)*
   a) gas for your vehicle
   b) property insurance
   c) heating costs
   d) property taxes

2. Which of the following expenses can be used as a deduction on **both** a business and a personal income tax form? *(1 mark)*
   a) meals and entertainment
   b) charitable donations
   c) motor vehicle expenses
   d) insurance

continued

Assignment 3.2: Income Tax (continued)

3. Place the four major sections of the T1 General income tax form in the order they appear on the form. The sections are: Refund or Balance Owing; Total Income; Identification; Net Income and Taxable Income. *(1 mark)*

Module 3 Summary

You have completed Module 3! Do you realize that there is only one more module before your midterm examination? If there is anything you do not understand, be sure to ask questions and clarify your understanding of the material in this module before moving on.

This module focused on some factors that affect the likelihood of success or failure for a small business. You performed some financial calculations that are typically done by business owners or their accountants. Also, you were introduced to the four parts of a T1 General income tax return, and some of the deductions that apply to the owner of a business.

After learning the information in this module, you may be seriously interested in considering the start-up of a new small business. If so, it is suggested that you talk to an accountant or a financial advisor at a financial institution to get some further advice. You also might be interested in taking courses related to entrepreneurship, accounting, or business management.

Did you know that the Canada Customs and Revenue Agency (CCRA) works with community volunteers to help people who do not know how to file their own income tax returns and cannot afford to pay someone else to do it for them? If you are interested in getting involved with helping other people with their income tax returns, call 1-800-959-8281 or check it out online at www.ccra.gc.ca/volunteer. Training and reference kits are provided, and you can always call for help if you need it.

The next module (the last one before the midterm examination) focuses on probability. Probability is part of our daily lives, but is surprisingly misunderstood by many people. Two topics that you will study are the differences between odds and probability, and how to predict gain or loss in situations that involve chance.

Although this language may be foreign to you, or perhaps all too familiar, you will take a close look at this area of mathematics and better understand it.

Submitting Your Assignments

It is now time for you to submit the Module 3 Cover Assignment and Assignments 3.1 and 3.2 to the Distance Learning Unit so that you can receive some feedback on how you are doing in this course. Remember that you must submit all the assignments in this course before you can receive your credit.

Make sure you have completed all parts of your Module 3 assignments and organize your material in the following order:

- ❑ Module 3 Cover Sheet (found at the end of the course Introduction)
- ❑ Module 3 Cover Assignment: Marginal Income Tax Rates
- ❑ Assignment 3.1: Profitability of a Small Business
- ❑ Assignment 3.2: Income Tax

For instructions on submitting your assignments, refer to How to Submit Assignments in the course Introduction.

Grade 12 Essential Mathematics (40S)

Module 3
Business Finance

Learning Activity Answer Keys

Module 3:
Business Finance

Learning Activity 3.1

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. You are buying lunch for yourself and a friend. You bought two drinks for $2.50 each, one pizza to share for $15, and two individual salads for $5.25 each. You give the cashier $40. The cashier gives you $10 in change. Is this the correct change?
2. Evaluate: $\left[\frac{(3 \times 4)}{12 + 6}\right]$
3. 15% of 3560 is 534. What is 45% of 3560?
4. There are two lunch specials that capture your interest. One costs $9, but is 25% off the total cost after buying an additional drink for $2. The second lunch costs $7.50 and a drink is an additional $1. If you wish to buy a drink with your lunch, which lunch special is the better deal?
5. Calculate the taxes on a $325 item.

Answers:

1. No, $9.50 is the correct amount of change. ($40 − $2.50 − $2.50 − $15 − $5.25 − $5.25 = $40 − $5 − $15 − $10.50 = $40 − $30.50 = $9.50)
2. $\frac{2}{3}\left(\frac{(3 \times 4)}{12 + 6} = \frac{12}{18}\text{; divide by } \frac{6}{6} \text{ to get } \frac{2}{3}\right)$
3. $1602 (3 × 15 = 45; 45% of 3560 = 534 × 3 = 1602)
4. Lunch special #1 is the better deal. (Lunch special #1: $9 + $2 = $11; $10 × 0.25 = $2.50; $1 × 0.25 = $0.25; $11 × 0.25 = $2.75; $11 − $2.75 = $8.25. Lunch special #2 = $8.50)
5. $39 (Taxes are 12%. 10% of 325 = $32.50; 1% of 325 = $3.25; 12% of 325 = 32.50 + 6.50 = $39)

Part B: Understanding Business Principles

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Define business.

   Answer:

   Business is the production and sale of goods or services.

2. What are the two categories of goods and services? Provide two examples of each.

   Answer:

   Needs (e.g., anything required for life [food, water, shelter])

   Wants (e.g., anything that is a luxury [iPods, computers, TV, cars])

3. List two advantages of working for a small business.

   Answer:

   Two advantages would be

   - flexibility in hours
   - you get to participate in various tasks instead of specializing

4. What are the three principles that contribute to sustainable development?

   Answer:

   Three principles are

   - environment
   - economy
   - community health and well-being

5. Choose a feasible business idea for your community (for example, a hot-dog stand or a lawn maintenance company) and list six or more specific expenses related to that company.

   Answer:

   Answers will vary depending on the company chosen. Here are two examples:

   - hot-dog stand: expenses include purchase of barbeque and cart, supplies (such as hot dogs, buns, and condiments), propane, signage, vehicle maintenance costs, and business license fee
   - lawn maintenance company: expenses include purchase of equipment (such as lawnmower, weed wacker, edger, and rakes), purchase of trailer or truck, supplies (such as disposal bags, advertising costs—newspaper, neighbourhood), vehicle maintenance costs, and business license fee

Learning Activity 3.2

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. You have a spending limit of $200 on your debit card. You have previously bought two shirts for $30 each and three pairs of jeans for $40 each. You have just seen a pair of sunglasses that you would really like to buy for $25. Do you have enough money on your debit card to buy these sunglasses?
2. Write this fraction as a decimal and a percent: $\frac{4}{16}$
3. You have recently set up a hot-dog selling business. Your net sales are $2500 and the cost of goods sold is $2225. What is your gross profit?
4. Continue the pattern: 0.125, 0.250, 0.375, ____ , ____
5. Evaluate: $2 \times 3 \times 14$

Answers:

1. No, you do not have enough to buy a $25 pair of sunglasses. ($200 − $30 − $30 − $40 − $40 − $40 = $20)
2. 0.25 or 25% $\left(\frac{4}{16} = \frac{1}{4} = 0.25 = 25\%\right)$
3. $275 (Gross profit = net sales − cost of goods sold = $2500 − $2225 = $275)
4. 0.5, 0.625
5. 84 (6×14 is $6 \times 10 + 6 \times 4 = 60 + 24 = 84$)

Part B: Profitability

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. State two reasons that competition is important to the economy.

   Answer:

   Answers may vary. Possible solutions include:

   - Competition forces businesses to be more efficient.
   - Competition helps to keep prices down for consumers.
   - Competition encourages companies to improve the quality of their goods and services.
   - Competition encourages businesses to advertise their product.

2. List three products or business activities that exhibit strong seasonal variation.

   Answer:

   Answers may vary. Possible solutions include:

   - Christmas trees are purchased mostly during the month of December.
   - Ice cream and cold drinks have a much wider appeal in the summer.
   - There is seasonal variation in the demand for clothing. In particular, there is a much higher demand for warm clothing in the winter.
   - Local bus transportation has both a heavy daily and weekly variation in the number of commuters.
   - Demand for hotels and other facilities in tourist locations is much higher during their respective tourist seasons (e.g., beaches in summer, ski hills in winter).
   - The demand for school supplies is much higher when schools are open than when schools are closed for holidays and student vacation.
   - Demand for toys is very high during Christmas and other festive occasions when people exchange gifts.

3. Kyle and Alex have started a T-shirt business called "T's R US" and they predict that each shirt will cost $8.75 to produce. They plan to make 500 T-shirts and would like to pay themselves a salary of $400 each. How much should be charged per T-shirt for the business to break even?

   Answer:

$$\text{Break-Even Point} = \frac{\text{Total Production Costs}}{\text{Number of Shirts}}$$
$$= \frac{8.75 \times 500 + 400 + 400}{500}$$
$$= \frac{5175}{500}$$
$$= 10.35$$

   Kyle and Alex should charge $10.35 for each T-shirt.

4. Sarah owns a hot-dog stand that she operates in downtown Winnipeg at lunchtime, five days a week, from the beginning of April to the end of October. The details of her business follow:
   - Wieners cost $2.25 for a package of 8 and buns cost $1.50 for a package of 8. She buys 4 packages each day for 5 days..
   - Condiments cost $15 per week.
   - Other costs such as propane and signage costs are, on average, $8 per week.
   - Hot dogs are sold at $2.00 each.

   a) Calculate the number of hot dogs that must be sold to break even each week.

      Answer:

$$\text{Break-Even Point} = \frac{\text{Total Weekly Production Cost}}{\text{Price per Hot Dog}}$$
$$= \frac{2.25 \times 4 \times 5 + 1.50 \times 4 \times 5 + 15 + 8}{2.00}$$
$$= \frac{98.00}{2.00}$$
$$= 49$$

      She must sell 49 hot dogs each week to break even.

b) What will be the weekly profit if Sarah sells 30 hot dogs each day?

Answer:

Total Weekly Production Cost = $98.00 as above.

Total Revenue = 30 hot dogs × 5 days × $2.00 each = $300

Weekly Profit = 300 − 98 = $202.00

c) Calculate the gross profit as a percentage of revenue from sales after selling 30 hot dogs each day.

Answer:

$$\% \text{ Gross Profit} = \frac{\text{weekly profit}}{\text{weekly revenue}} \times 100$$

$$\% \text{ Gross Profit} = \frac{202.00}{300.00} \times 100 = 67.3\%$$

d) List two ways Sarah could increase the profitability of the business.

Answer:

- Increase revenue by charging more per hot dog or by selling more hot dogs after advertising.
- Decrease expenses by buying cheaper hot dogs, buns, and condiments.

Learning Activity 3.3

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. A small gas station has a gross income of $12,600 in one day. One-third of the sales came from items other than gasoline. How much money did the gas station receive for items other than gasoline in one day?
2. Write the next elements in this set of letters: A, E, F, H, I, K, L, M, ___ , ___
3. There are 52 weeks in a year, so how many weeks are in three years?
4. You have decided to take a trip to Sydney, Australia. Your mom wants to know what time she should call you. Sydney, Australia is 17 hours ahead of Brandon, your home town. If you want your mom to call you between 4 pm and 9 pm Australia time, what time would this be in Brandon?
5. The area of your property is 120 m^2. If the dimensions of your house are 10 m × 8 m, what is the area of your yard that is not taken up by your house?

Answers:

1. $\$4,200 \left(\frac{1}{3} \times 12,000 + \frac{1}{3} \times 600 = 4000 + 200\right)$
2. N, T (The pattern is letters made from only straight lines.)
3. 156 ($50 \times 3 + 2 \times 3 = 150 + 6 = 156$)
4. Your mom could call you between 11 pm and 4 pm Brandon time. (17 hours before 4 pm is 11 pm; 17 hours before 9 pm is 4 am)
5. 40 m^2 ($10 \times 8 = 80$ m^2; $120 - 80 = 40$ m^2 is the area of your yard that is not taken up by your house)

Part B: Thinking With Taxes

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. For those who run a small business out of their home, identify receipts for at least three expenses that must be kept for income tax purposes.

   Answer:

   You will need receipts showing the annual costs required for heat, electricity, house insurance, maintenance, mortgage interest, and property taxes.

2. For a small business that is not run out of the home, identify at least three deductions that can be claimed by the business that cannot be claimed under personal expenses.

   Answer:

   A small business owner may claim expenses for advertising, meals and entertainment (that apply to the business), bad debts, insurance for the business, business taxes and fees, office expenses, business supplies, telephone and utilities, and motor vehicle expenses (that apply to the business).

3. Identify the four major sections of the T1 General income tax form.

   Answer:

   The four sections are:

   - Identification
   - Total Income
   - Net Income and Taxable Income
   - Refund or Balance Owing

Notes

Grade 12 Essential Mathematics (40S)

Module 4
Probability

Module 4: Probability

Introduction

In this module, you will study probability. You may already know that the chances of winning or losing money when gambling (which includes buying lottery tickets) are based on probabilities. You should also know that probabilities are used to determine

- insurance costs (Autopac, fire insurance, life insurance …)
- many business decisions
- medical procedures
- decisions in education (which courses are the best ones to take)
- weather forecasting

And the list goes on and on.

You may also hear probabilities presented in the media. For example, if you eat certain foods, you may have an increased or decreased chance of suffering certain physical ailments. During elections, data is collected in surveys and used to predict the probability of a politician being elected.

As you gain a better understanding of probability, you should be able to make better decisions in situations involving chance. You should also be better prepared to determine the validity of information presented in the media, including advertising.

If you are having trouble learning the concepts in this module, be sure to ask for help. You can call your tutor/marker or ask your learning partner if you need clarification on any of the topics.

Assignments in Module 4

When you have completed the assignments for Module 4, submit your completed assignments to the Distance Learning Unit either by mail or electronically through the learning management system (LMS). The staff will forward your work to your tutor/marker.

Lesson	Assignment Number	Assignment Title
	Cover Assignment	Applying Probability to Games
2	Assignment 4.1	Expressing Probability and Odds
4	Assignment 4.2	Applications of Probability

Resource Sheet

When you write your midterm examination, you are encouraged to take a Midterm Examination Resource Sheet with you into the examination. This sheet will be one letter-sized page, 8½ " by 11", with both sides in your handwriting or typewritten. You will submit it with your examination, but you do not receive any marks for it.

Many students have found that preparing a resource sheet is an excellent way to review. It provides you with a summary of the important facts of each module. You should complete a resource sheet for each module to help with your studying and reviewing. Lesson summaries and module summaries are included for you to use as a guide.

You may use the following list of instructions to help you with preparing your resource sheet for the material in Module 4. On this sheet, you should record mathematics terms and definitions, formulas, sample questions, or a list of places where you often make mistakes. You should also identify special areas that require extra attention or review by writing the page numbers.

After you have completed each module's resource sheet, you may summarize the sheets from Modules 1, 2, 3, and 4 to prepare your Midterm Examination Resource Sheet. The midterm examination for this course is based on Modules 1 to 4.

Resource Sheet for Module 4

As you go through the lessons of this module, you may want to consider the following suggestions regarding the creation of a resource sheet.

1. List all the important mathematics terms, and define them if necessary.
2. List all the formulas and perhaps a sample problem that shows how each formula is used.
3. If necessary, write the solutions to some problems, showing in detail how you did the calculations.
4. Copy any questions that represent the key points of the lesson, and perhaps include the solutions as well.
5. Identify the problems you found most difficult, and copy the page numbers onto the resource sheet so that you can review them before writing the examination. You may also copy the problems and the solutions onto your resource sheet, and later write them onto your Midterm Examination Resource Sheet.
6. Write any comments, ideas, shortcuts, or other reminders that may be helpful during an examination.

Writing Your Midterm Examination

You will write the midterm examination when you have completed Module 4 of this course. The midterm examination is based on Modules 1 to 4, and is worth 12.5 percent of your final mark in the course. To do well on the midterm examination, you should review all the work you complete in Modules 1 to 4, including all the learning activities and assignments. You will write the midterm examination under supervision.

Notes

Module 4 Cover Assignment: Applying Probability to Games

A game is considered fair if every player has an equal chance of winning. After learning the rules of a game of chance, you may think about whether it sounds fair or not. After playing the game, you will be in a better position to decide whether or not it was fair.

In this cover assignment, you will be given the rules of a game of chance. Before playing, think about whether it sounds fair. Then re-evaluate your thinking after playing the game and recording the points scored by each player.

Notes

Module 4 Cover Assignment

Applying Probability to Games

Total: 10 marks

Play this game 30 times with a partner (you could ask your learning partner), and record your results in the table provided on the following page. You can be Player A and your partner can be Player B.

The game involves choosing marbles from a box. Place two white marbles and two black marbles in a box. Without looking in the box, player A randomly chooses two of the marbles and replaces them in the box. If the two chosen marbles are of the same colour, player A wins one point. If the two chosen marbles are each a different colour, player B wins one point. Player B then chooses two marbles. If the two chosen marbles are of the same colour, player A wins one point. If the two chosen marbles are a different colour, player B wins one point. Player A and Player B take turns choosing marbles.

Does the game seem to be fair?

a) Give an answer based on the points you recorded in the table.

b) Give an answer based on your analysis of the game and what you think would happen if you tried 10,000 times. Justify your answer.

continued

Module 4 Cover Assignment: Applying Probability to Games (continued)

Game	Player A's Points	Player B's Points
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
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20		
21		
22		
23		
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25		
26		
27		
28		
29		
30		

Lesson 1: Expressing Probability

Lesson Focus

In this lesson, you will

- ❑ represent the probability of an event on a probability scale
- ❑ express probability as a fraction, ratio, decimal, percent, or statement
- ❑ apply probability to real-life problems

Lesson Introduction

Probability is the chance or likelihood that a particular event will occur. You may have previously studied the probability of certain events. For example, if you flip a coin, it is equally likely to land "heads" or "tails." We say that the probability of the coin landing "heads" is 1 out of 2.

In some cases, such as the coin toss, it is easy to predict the probability of an outcome. This type of probability is called "theoretical probability." In some other cases, it is very difficult or impossible to predict the likelihood of some event happening. For example, it is difficult to predict how likely a basketball player is to score when shooting from the free-throw line. If, however, you know that the player scored 70 times out of the previous 100 shots, you could conclude that the player has a 70 percent chance of scoring. This type of probability is called "experimental probability."

Probability

Probability is the chance of an event occurring. An **event** is a possible outcome in a situation where more than one outcome is possible. For example, if you flip a coin, a possible event is the coin landing "heads." The probability of an event must be greater than or equal to 0 and less than or equal to 1. The following formula can help you to find the probability of an event.

$$\text{Probability of an event} = \frac{\text{number of ways the event can occur}}{\text{total number of possible outcomes}}$$

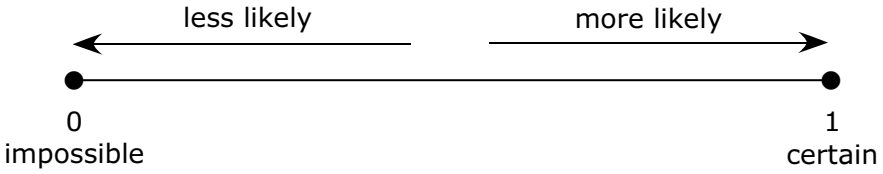
Include this formula on your resource sheet.

This is a mathematical way of describing probability. Probability can also be described using a probability scale.

Probability Scale

A probability scale allows you to rate events based on their probabilities of occurring. The following is an example of a probability scale.

The values of 0 and 1 can be added to the ends of the probability scale as follows.



The number of ways an event can occur is always less than or equal to the total number of possible outcomes. Using the probability formula, you can see that this implies that probability is always a numerical value from 0 to 1. The less likely an event is to occur, the closer its probability will be to 0. The more likely an event is to occur, the closer its probability is to 1.

A probability of 0 indicates that the event is impossible, while a probability of 1 indicates the event is certain.

Example 1

Place the following events on a probability scale.

a) The sun will rise in the east next Sunday. Represent this event by A.

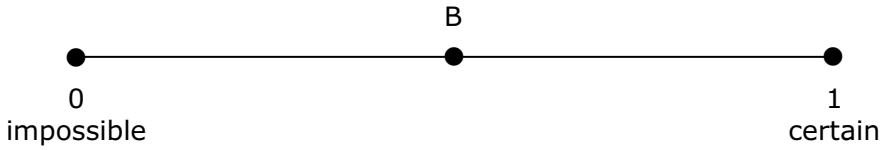
b) The next baby born in your local hospital will be a boy Represent this event by B.

c) Somewhere in Manitoba, the temperature will reach at least 4° C once next year during the month of January. Represent this event by C.

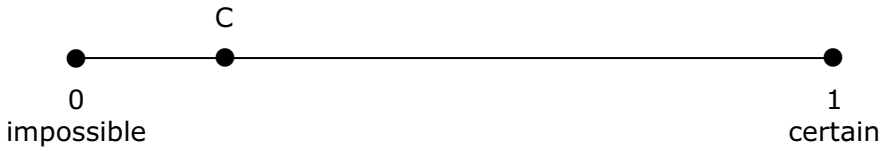
Solution

a) Since it is certain the sun will rise in the east next Sunday, the event is represented on a probability scale as follows.

b) Since the next baby born in your local hospital is as likely to be a boy as a girl, the event is represented on a probability scale as follows.



c) Since the probability of the temperature reaching at least 4° C once during the month of January somewhere in Manitoba is unlikely but not impossible, the event is represented on a probability scale as follows.



The fact that the probability of an event is greater than or equal to 0 and less than or equal to 1 can be expressed by

$0 \leq P(\text{event}) \leq 1$

The notation **P(event)** is a convenient way of expressing the probability of an event such as P(sun rises in East), P(boy), or P(4°C).

Since an event has to either occur or not occur, the probability of an event occurring and the probability of an event not occurring must add up to 1. This can be expressed in the following formula.

P(event occurring) + P(event not occurring) = 1

Include this formula on your resource sheet.

Therefore, if you know the probability of an event occurring, you can subtract this probability from 1 to find the probability of the event not occurring.

Example 2

If the probability of it snowing on December 22nd is $\frac{1}{3}$, what is the probability of it not snowing on December 22nd?

Solution

Using the above formula, you know that

P(snowing) + P(not snowing) = 1

$\frac{1}{3}$ + P(not snowing) = 1

Therefore, the probability of it not snowing on December 22nd is

$$P(\text{not snowing}) = 1 - \frac{1}{3} = \frac{2}{3}$$

Probability scales are just one way to express probability.

Expressing Probability

Probability can be expressed in the following ways:

- Ratio
- Fraction
- Decimal
- Percent
- Statement

Consider the following example.

Example 3

Express the probability of three coins all landing heads in the following ways:

a) A ratio

b) A fraction

c) A decimal

d) A percent

Solution

There are eight possible outcomes:

HHH, HHT, HTT, TTT, TTH, THH, THT, HTH

Note that HHH is one of the eight possible outcomes.

a) The colon (:) is used to express a ratio. The number of ways an event can occur is written before the colon. After the colon, you write the number of possible outcomes. In this situation, the number of ways three coins all land on heads can only occur one way. The number of possible outcomes of flipping three coins is eight. Therefore, the probability can be written as the following ratio:

$$P(\text{HHH}) = 1:8$$

b) To express probability as a fraction, you just need to substitute the values in to the probability formula.

$$\text{Probability of an event} = \frac{\text{number of ways the event can occur}}{\text{total number of possible outcomes}}$$

$$P(\text{HHH}) = \frac{1}{8}$$

c) To express probability as a decimal, you need to convert the fraction you just found into a decimal. To do this, you enter the number 1 on your calculator, press the ÷ key, and then enter the number 8.

P(HHH) = 0.125

d) To express probability as a percent, you need to convert the decimal number you just found into a percent. To do this, you need to multiply the decimal number by 100.

P(HHH) = (0.125 × 100) = 12.5%

The chance that three coins will all land heads is 1 in 8.

Example 4

Determine the probability of one coin landing heads when flipping three coins. Write your answer in the following ways:

a) A ratio

b) A fraction

c) A decimal

d) A percent

Solution

There are eight outcomes:

HHH, HHT, HTT, TTT, TTH, THH, THT, HTH.

Having only one coin land heads occurs three times: HTT, TTH, THT.

The event can occur three ways. There are eight possible outcomes. The probabilities are as follows:

a) P(H) = 3 : 8

b) $P(\text{H}) = \frac{3}{8}$

c) P(H) = 3 ÷ 8 = 0.375

d) P(H) = (0.375 × 100) = 37.5%

The chance that only one out of three coins will land heads is 3 in 8.

You may wonder why there are different ways of expressing probability. When comparing probabilities, fractions are often used because the numerator can be the number of elements in the event and the denominator can be the total number without any extra work. When comparing probabilities, decimals and percentages are also used because decimals and percentages are easier to compare than fractions.

Application Problems

Probability is useful in city planning, sports, and daily habits. The following examples will help you to understand the ways of expressing and determining probability.

Example 5

A city is interested in knowing how many of its roads and sidewalks need to be repaired. A city engineer randomly inspects 38 city roads and finds 4 that need to be repaired. He also finds that 6 of the 45 city sidewalks he inspects need to be repaired.

a) What is the probability a city road has to be repaired? Express this probability as a decimal.

b) What is the probability a city sidewalk has to be repaired? Express this probability as a decimal.

c) How do the roads and sidewalks of the city compare in this respect?

Solution

a) The probability a road has to be repaired = $\frac{4}{38}\left(\text{or reduce to } \frac{2}{19}\right)$.

To express $\frac{4}{38}$ as a decimal you first enter the number 4 on your calculator, press the ÷ key and then enter the number 38. The probability a road has to be repaired = 0.11 (rounded to the nearest hundredth).

b) The probability a sidewalk has to be repaired = $\frac{6}{45}\left(\text{or reduce to } \frac{2}{15}\right)$.

The probability a sidewalk has to be repaired = 0.13 (rounded to the nearest hundredth).

c) City sidewalks are more likely to need to be repaired than city roads.

Note: The problem assumes that the sample taken by the engineer is both large enough and random enough to represent the roads and sidewalks in the city.

Example 6

During the regular playing season, 10 out of 84 games in a particular soccer league go into overtime.

a) What is the probability that a particular game will go into overtime?

b) Based on this probability, how many of the league's 16 playoff games will go into overtime?

c) Would you expect the probability of playoff games going into overtime to be the same as regular season games? Explain.

Solution

a) The probability of a particular game going into overtime = $\frac{10}{84}\left(\text{or reduce to } \frac{5}{42}\right)$.

b) This type of problem can be solved using ratio and proportion.

Let x = the number of overtime games.

Then

$$\frac{10}{84} = \frac{x}{16}$$

$$84x = (16)(10)$$

$$84x = 160$$

$$\frac{84x}{84} = \frac{160}{84}$$

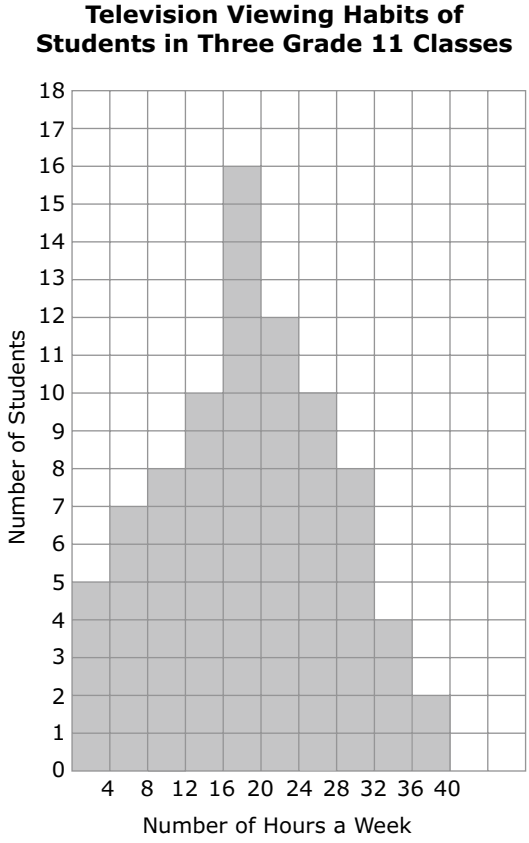
$$x = 1.90$$

Based on this probability, the league can expect 2 of its playoff games to go into overtime.

c) You would expect the probability of playoff games going into overtime to be greater than regular season games. The teams playing in playoff games are more likely to be evenly matched.

Example 7

The following bar graph indicates the number of hours a week that students in three Grade 11 classes watch television.



Determine the probability of each of the following events.

a) A student in these classes watches 12–16 hours of television a week.

b) Students in these classes watch between 16–28 hours of television a week.

c) A student in these classes watches more than four hours of television a week.

d) Based on the probability calculated using this data, how many Grade 11 students out of 500 students would you expect to watch 12–16 hours of television per week?

Solution

a) The total number of students surveyed = 5 + 7 + 8 + 10 + 16 + 12 + 10 + 8 + 4 + 2 = 82.

The probability a student in these classes watches between 12–16 hours of television a week = $\frac{10}{82}$.

b) The number of students in these classes who watch between 16–28 hours of television a week = 16 + 12 + 10 = 38.

The probability that a student in these classes watches between 16–28 hours of television a week = $\frac{38}{82}$.

c) The number of students in these classes who watch between 0–4 hours of television a week = 5.

The number of students in these classes who watch more than 0–4 hours of television a week = 82 − 5 = 77.

The probability that a student in these classes watches more than 0–4 hours of television a week = $\frac{77}{82}$.

d) 10 out of 82 or 12.1% of students watch 12–16 hours.
500 × 0.121 = 60.97
61 Grade 11 students watch 12–16 hours of television per week.

Learning Activity 4.1

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Convert this fraction to a decimal, a percent, and a ratio: $\frac{1}{8}$

2. Write this ratio as a fraction: 3 : 7.

3. Add these two fractions: $\frac{3}{16} + \frac{2}{4}$

4. Name the numerator and the denominator in this fraction: $\frac{8}{37}$

5. For every 100 people in the world, 34 have A-positive blood type. Write this as a fraction in lowest terms.

continued

Learning Activity 4.1 (continued)

Part B: Expressing Probability

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Place the following events on a probability scale.
   a) You will live for 100 years. Represent this event by A.
   b) In the first week of November, it will snow at least once in Thompson, Manitoba. Represent this event by B.
   c) The sun will rise in the west tomorrow. Represent this event by C.
   d) The next baby born in your local hospital will be a girl. Represent this event by D.
   e) You will finish this module in less than three weeks. Represent this event by E.

2. Rewrite each of the following statements without using the words "chance," "probability," or "likelihood."
   a) The probability of team A winning the baseball game on Saturday is 0.8.
   b) There is a 50% chance of rain on Monday.
   c) The probability of a person living to age 90 is 0.02.

3. The probability of being born in a particular month is about 1 in 12. Express this ratio as a fraction, a decimal, a percent, and in words.

4. Determine the probability of not being born in a particular month. Express this ratio as a fraction, a decimal, a percent, and in words.

5. During a municipal election, 308 voters are registered at one polling station and 272 voters are registered at a second polling station. At the first polling station 148 voters cast their ballots. At the second polling station 131 voters cast their ballots.
   a) What is the probability voters at the first polling station cast their ballots? Express this probability as a percent.
   b) What is the probability voters at the second polling station cast their ballots? Express this probability as a percent.

continued

c) At which polling station were the voters more likely to cast their ballots?

d) Based on the probability at the first polling station, if 400 voters register next year, how many voters will cast a ballot?

6. A batting average is expressed as a 3-digit number out of 1000. A player's batting average is the probability of the total number of hits compared to the total number of official times the player is at bat. For example, if a batter has 15 hits in 60 official times at bat, her probability of a hit would be 15 ÷ 60 = 0.250. Her batting average is 250.

   a) What is the batting average of player A who has 18 hits in 70 official times at bat?

   b) What is the batting average of player B who has six hits in 25 official times at bat?

   c) Which of the two players has the higher batting average?

   d) Explain what a batting average of 125 means.

   e) If a batter's average is 275, how many hits would you expect this batter to have in 100 official times at bat?

Lesson Summary

In this lesson, you reviewed some of the basics of probability, including the probability formula. You also learned how to express probability in different forms, including ratio, fraction, decimal, and percent. In the next lesson, you will study odds and how odds relate to probability. If you have any questions about this lesson, be sure to ask your learning partner or tutor/marker for help.

Notes

Lesson 2: Comparing Probability and Odds

Lesson Focus

In this lesson, you will

- ❑ learn the difference between probability and odds
- ❑ determine the odds in favour of an event occurring
- ❑ determine the odds against an event occurring
- ❑ determine the probability of an event if you are given odds in favour of an event occurring
- ❑ determine the probability of an event if you are given odds against an event occurring
- ❑ determine the probability of an event based on a data set

Lesson Introduction

In the previous lesson, you studied different ways of expressing probability. You learned that probability is the likelihood of an event occurring. Another way of expressing the likelihood of an event occurring is "odds." In this lesson, you will study odds and the relationship between probability and odds. Probabilities and odds both provide the same information about chance, but in quite different ways. Probabilities are most frequently used by mathematicians and scientists, and odds are most often used to explain the chances of winning or losing in games of chance, such as betting at horse races. Also, the media usually use probabilities instead of odds because probabilities, when written in percent form, are easier for most readers to understand.

Odds Versus Probability

The likelihood of an event occurring is not always expressed as a probability. The likelihood of an event occurring can also be expressed as the **odds in favour** of it occurring. The probability of an event occurring and the odds in favour of it occurring are not the same. Consider the following formulas:

$$\text{Probability of an event} = \frac{\text{number of ways the event can occur}}{\text{total number of possible outcomes}}$$

$$\text{Odds in favour of an event} = \frac{\text{number of ways the event can occur}}{\text{number of ways the event cannot occur}}$$

In the above formulas, the numerators are the same; however, the denominators are different. Therefore, the values you obtain for the probability of an event occurring and the odds in favour of an event occurring are different. There is also a formula for the **odds against an event** occurring.

$$\text{Odds against an event} = \frac{\text{number of ways the event cannot occur}}{\text{number of ways the event can occur}}$$

The odds in favour of an event occurring and the odds against an event occurring have the terms reversed. Another important distinction between probability and odds is that odds are not written as decimals or percents, just as fractions or ratios.

Include these formulas on your resource sheet.

Consider the following example.

Example 1

Imagine you are randomly choosing a letter from the alphabet.

a) Determine the probability of choosing a vowel (include Y as a vowel).

b) Determine the odds in favour of choosing a vowel.

c) Determine the odds against choosing a vowel.

Solution

a) There are 26 letters in the alphabet. The vowels are A, E, I, O, U, and Y. Therefore, there are six vowels and 20 consonants (or non-vowels) in the alphabet. Recall the probability formula:

$$\text{Probability of an event} = \frac{\text{number of ways the event can occur}}{\text{total number of possible outcomes}}$$

$$\text{P(Vowel)} = \frac{6}{26}$$

b) To find the odds in favour of choosing a vowel, use the "odds in favour of an event" formula.

$$\text{Odds in favour of an event} = \frac{\text{number of ways the event can occur}}{\text{number of ways the event cannot occur}}$$

The number of ways the event can occur is 6.

The number of ways an event cannot occur is equal to the total number of events minus the number of ways the event can occur. As the total number of events is equal to 26 and the number of ways the event can occur is equal to 6, $26 - 6 = 20$. Therefore, the number of ways the event cannot occur is equal to 20.

You could also count all the consonants in the alphabet. This would also equal 20.

$$\text{Odds in favour of choosing a vowel} = \frac{6}{20} \text{ (written as a ratio, } 6:20)$$

From (a) and (b), observe that the denominator in the fraction for probability is different than the denominator in the fraction for odds.

c) To find the odds against choosing a vowel, use the "odds against an event" formula.

$$\text{Odds against an event} = \frac{\text{number of ways the event cannot occur}}{\text{number of ways the event can occur}}$$

$$\text{Odds against choosing a vowel} = \frac{20}{6} \text{ (written as a ratio, } 20:6)$$

From (b) and (c), you may observe that the odds in favour of an event and the odds against an event have the terms reversed.

Example 2

Roll a six-sided number cube (a die) and determine the following:

a) the probability of rolling a number less than three

b) the odds of rolling a number less than three

c) the odds against rolling a number less than three

Solution

a) Out of the six possible outcomes, 1, 2, 3, 4, 5, and 6, there are two outcomes, 1 and 2, that are less than three.

The probability of rolling a number less than three is $2:6$ or $1:3$.

This can also be written as: P(rolling less than three) = $\frac{2}{6} = \frac{1}{3}$.

b) There are two outcomes of rolling a number less than three: 1 and 2. There are four outcomes that are three or greater: 3, 4, 5, 6. Therefore, the number of ways the event can occur is two, and the number of ways the event cannot occur is four. Using the odds in favour of an event formula, the odds in favour of rolling a number less than three are equal to $\frac{2}{4}$, which can be reduced to $\frac{1}{2}$. Odds can also be represented as a ratio. Therefore, the odds in favour of rolling a number less than three are $2:4$. Since a ratio is often reduced to its lowest terms, the ratio $2:4$ is reduced to $1:2$.

c) The odds against rolling a number less than three are $2:1$. This is the reversed ratio of the odds in favour of rolling a number less than three.

Note the following differences between the probability of an event occurring and the odds of it occurring.

- The probability of an event occurring is always a fraction between 0 and 1.
- The odds of an event occurring can be greater than 1 or less than 1, but not less than 0 (not negative).
- The sum of the probability of an event occurring and the probability of an event not occurring is equal to 1.
- The terms of the odds in favour of an event occurring and the odds against an event occurring are reversed.

Determining Probability When Given Odds

When you are given the odds in favour of an event occurring and the odds against an event occurring, it is sometimes useful to find the probability. It is easier to find the probability when the odds in favour of an event and the odds against an event are written as fractions.

Consider the probability and odds formulas.

$$\text{Probability of an event} = \frac{\text{number of ways the event can occur}}{\text{total number of possible outcomes}}$$

$$\text{Odds in favour of an event} = \frac{\text{number of ways the event can occur}}{\text{number of ways the event cannot occur}}$$

$$\text{Odds against an event} = \frac{\text{number of ways the event cannot occur}}{\text{number of ways the event can occur}}$$

To find probability, you need to know the number of ways the event can occur and the total number of possible outcomes. From the odds formulas, note that the number of ways the event can occur is the numerator in the odds in favour of an event formula. The number of ways the event can occur is also the denominator in the odds against an event formula. Therefore, you can get the number of ways the event can occur from either of these formulas.

You may recall that the number of ways the event can occur plus the number of ways the event cannot occur is always equal to the total number of possible outcomes. Therefore, to find the total number of possible outcomes, you need to add the number of ways the event can occur to the number of ways the event cannot occur. In both the odds formulas, this is the same as adding the numerator to the denominator.

Thus, the steps to find probability when you are given odds are as follows:

1. Convert the odds ratios to fractions.
2. Find the number of ways the event can occur by taking the numerator from the odds in favour of an event fraction or by taking the denominator from the odds against an event fraction.
3. Find the total number of possible events by adding the numerator to the denominator in either the odds in favour of an event fraction or the odds against an event fraction.
4. Write the probability as a fraction by writing the value you found in Step 2 as the numerator and the value you found in Step 3 as the denominator.

It may be helpful to add these steps (either copied directly or in your own words) to your resource sheet.

Consider the following example.

Example 3

The odds in favour of picking a green marble out of a bag of multicoloured marbles are $5:1$.

a) Find the odds against picking a green marble out of the bag.

b) Find the probability of picking a green marble out of the bag.

Solution

a) The odds in favour of an event and the odds against an event always have their terms reversed. The reverse of $5:1$ is $1:5$. Therefore, the odds against picking a green marble out of the bag are $1:5$.

b) To find the probability, follow the steps to find probability when you are given odds.

   i) Writing $5:1$ as a fraction gives the odds in favour of an event = $\frac{5}{1}$.

   Writing $1:5$ as a fraction gives the odds against an event = $\frac{1}{5}$.

   ii) The numerator from the odds in favour of an event fraction is 5 (of course, the denominator from the odds against an event fraction is also 5).

   iii) Add the numerator to the denominator in either fraction to get 6, which is the total number of ways for an event to occur.

   iv) Putting 5 as the numerator in your new probability fraction and 6 as the denominator in your new probability fraction, the probability equals $\frac{5}{6}$.

   Therefore, P(selecting the green marble) = $\frac{5}{6}$.

Example 4

The odds in favour of the Winnipeg Blue Bombers winning their next game are 2:3.

a) Find the probability of the Winnipeg Blue Bombers winning their next game.

b) Express this probability as a percent.

c) Find the odds against the Winnipeg Blue Bombers winning their next game.

Solution

a) To find the probability, follow the steps to find probability when you are given odds.

   i) Writing 2: 3 as a fraction gives the odds in favour of an event = $\frac{2}{3}$.

   ii) The number of ways the event can occur is equal to 2.

   iii) The total number of possible outcomes is equal to 3 + 2 = 5.

   iv) Therefore, the probability of the Winnipeg Blue Bombers winning their next game is $\frac{2}{5}$.

b) P(winning) = $\frac{2}{5} = 2 \div 5 = 0.4$

   P(winning) = $0.4 \times 100 = 40\%$

c) Recall that the odds in favour of an event occurring and the odds against an event occurring ratios have their terms reversed. Therefore, the odds against the Winnipeg Blue Bombers winning their next game are 3:2.

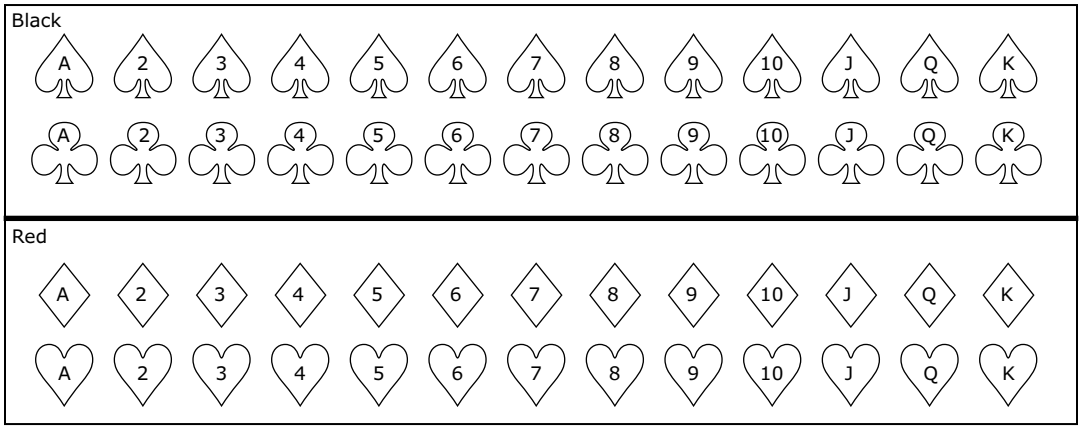
You have learned that you can determine probability when you are given the odds in favour of an event or the odds against an event. You can also determine probability when you are given a set of data.

Determining Probability When Given a Data Set

A **data set**, or a set of data, is a collection of information about a specific topic, or in this case a specific event. In the cover assignment, you were asked to collect data while playing a game. This is an example of a data set. Determining probability from a data set involves counting all the possible outcomes, and also counting the number of times each possible outcome occurs.

Consider the following example.

Example 5



Olivia and Ethan conducted an experiment to find the probability of drawing certain types of cards from a standard deck of 52 cards, as shown above. They drew cards 200 times from the full deck of cards each time, and this is the data set they obtained when they recorded the kinds of cards that were drawn each time. All of the following questions should be answered based on this data set.

	Frequency
Red	107
Queen	20
Red Jack	6
Face Card	45
King of Spades	5
Black Odd #	47

a) What is the probability of drawing a red card? Write your answer in percent form.

b) What is the probability of drawing a Queen? Write your answer in decimal form.

c) What is the probability of drawing a red Jack? Write your answer as a ratio.

d) What are the odds in favour of drawing a face card?

e) What are the odds in favour of drawing a King of Spades?

f) What are the odds against drawing a black odd number?

Solution

a) Recall the probability formula:

$$\text{Probability of an event} = \frac{\text{number of ways the event can occur}}{\text{total number of possible outcomes}}$$

$$P(\text{red}) = \frac{107}{200} = 107 \div 200 = 0.535$$

$$P(\text{red}) = 0.535 \times 100 = 53.5\%$$

b) $P(\text{Queen}) = \frac{20}{200} = 20 \div 200 = 0.1$

c) $P(\text{red jack}) = \frac{6}{200} = 6{:}200 \text{ or } 3{:}100 = 0.03$

d) Recall the odds-in-favour formula:

$$\text{Odds in favour of an event} = \frac{\text{number of ways the event can occur}}{\text{number of ways the event cannot occur}}$$

In data sets, the number of ways the event can occur is represented by the number of times the event did occur. The number of ways the event cannot occur is represented by the number of the times the event did not occur.

Odds in favour of drawing a face card =

$$\frac{45}{200-45} = \frac{45}{155} = \text{or } 45{:}155 = 9{:}31$$

e) Odds in favour of drawing a King of Spades =

$$\frac{5}{200-5} = \frac{5}{195} \text{or } 5{:}195 = 1{:}39$$

f) Recall the odds-against formula:

$$\text{Odds against an event} = \frac{\text{number of ways the event cannot occur}}{\text{number of ways the event can occur}}$$

$$\text{Odds against drawing a black odd number} = \frac{200-47}{47} = \frac{153}{47} \text{ or } 153{:}47$$

You have seen how to determine the odds for and against an event when given probability or a data set. You have also seen how to determine probability when given a data set. Complete the following learning activity, as this will help you to understand the lesson. Don't forget to use the answer key to check your answers.

Learning Activity 4.2

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. What is 7% of 200?
2. Evaluate: $\left(\frac{5}{7}\right) - \left(\frac{2}{14}\right)$
3. Convert this fraction to a percent and a ratio in lowest terms: $\frac{3}{12}$.
4. Write two fractions that are equivalent to $\frac{4}{9}$.
5. One out of five people do not like the colour blue. Write this value in percent and decimal form.

continued

Learning Activity 4.2 (continued)

Part B: Probability and Odds

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Each letter of the word MATHEMATICAL is on a different card. All the cards are the same size. The cards are placed face down and shuffled. Write your answers to these questions as ratios.
   a) Determine the probability of drawing an M.
   b) Determine the odds in favour of drawing an M.
   c) Determine the probability of not drawing an M.
   d) Determine the odds against drawing an M.

2. A six-sided number cube (a die) is rolled. Find the following:
   a) the probability of rolling a number greater than 2
   b) the odds in favour of rolling a number greater than 2
   c) the probability of not rolling an even number
   d) the odds against rolling an even number

3. A card is drawn from a standard deck of 52 playing cards. Find the following:
   a) the probability of drawing a diamond
   b) the odds in favour of drawing a diamond
   c) the probability of drawing an ace
   d) the odds against drawing an ace

4. Determine the probabilities (as a percent) of the following events occurring:
   a) the odds in favour of an event are 1:2
   b) the odds against an event are 4:1
   c) the odds in favour of an event are 99:1
   d) the odds against an event are 1:1

continued

Learning Activity 4.2 (continued)

5. The probability of a soccer game in a particular league going into overtime is 0.125. Find the following:
   a) the odds in favour of a game going into overtime
   b) the odds in favour of a game not going into overtime
   c) If the teams in the league play 100 games in a season, about how many games would you expect to go into overtime?
6. Explain the difference between probability and odds.

Lesson Summary

In this lesson, you studied probability and odds, and the differences between them. Understanding probability and odds will help you understand media reports and advertising that deal with events that involve chance. Understanding odds is especially important when dealing with games of chance.

Following this lesson is your first assignment for this module. It focuses on questions dealing with probability and odds. Remember to ask your learning partner or tutor/marker for help if you need to clarify some of the information taught in this lesson.

Assignment 4.1

Expressing Probability and Odds

Total: 47 marks

1. The probability of being born on a particular day of a year that is not a leap year is 1 in 365. Express this ratio as a fraction, a decimal, a percent, and in words. *(4 marks)*

2. Consider the following three statements made by a salesperson to promote a product.
   - It is effective 99% of the time.
   - There is a one-in-a-million chance it won't be effective.
   - It usually is effective.

   Do all these statements mean the same thing? Explain. *(3 marks)*

continued

Assignment 4.1: Expressing Probability and Odds (continued)

3. The probability of winning a particular 6-49 lottery is approximately 1 in 14 000 000. The probability of being hit by lightning once in your lifetime is approximately 1 in 600 000. *(2 marks)*

   a) Are you more likely to win the 6-49 lottery or to be hit by lightning?

   b) How many times more likely is one than the other?

4. The probability a person is left-handed is 1 in 10. The city of Winnipeg has a population of approximately 650 000 people. Approximately how many left-handed people live in Winnipeg? *(2 marks)*

continued

Assignment 4.1: Expressing Probability and Odds (continued)

5. Canned Air offers its passengers a choice of two different types of meals on its dinner flights: vegetarian lasagna or meat lasagna. On its flights last year, approximately 18 000 out of 30 000 passengers chose the meat lasagna. *(4 marks)*

   a) What is the probability of a particular passenger choosing the meat lasagna?

   b) Based on this probability, how many vegetarian lasagna meals should Canned Air order for a dinner flight on which there are 228 passengers booked?

continued

Assignment 4.1: Expressing Probability and Odds (continued)

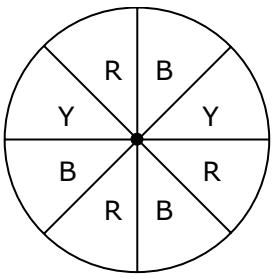
6. If you are living in Canada at present, the probabilities for having a certain hair colour are given in the following chart. *(6 marks)*

Colour	Ratio	Decimal	%
Brown	7:10		
Blonde	1:7		
Black	1:10		
Red	1:21		

a) Express each of these probabilities as a decimal and a percent.

b) In a class of 40 students, how many students would you expect to have red hair?

7. Find the following, using the given spinner. *(4 marks)*



a) the probability of spinning to the letter R

b) the odds in favour of spinning to the letter R

c) the probability of spinning to the letter Y

d) the odds against spinning to the letter Y

continued

Assignment 4.1: Expressing Probability and Odds (continued)

8. There are 4 white, 14 blue, and 5 green marbles in a bag. A marble is selected from the bag without looking. Find the odds of the following: *(4 marks)*

   a) the odds against selecting a green marble

   b) the odds in favour of not selecting a green marble

   c) the odds in favour of the marble selected being either a white or a blue marble

   d) Describe the similarities or differences of the odds stated above.

   _____

   _____

   _____

   _____

9. Noah and Emma roll a die 50 times. They count how many times each of the following events occurs. *(6 marks)*

	Frequency
Rolling less than 5	34
Rolling a 4	7
Rolling an even number	24

   a) Determine the probability of rolling less than 5. Express this as a percent.

   b) Determine the odds against rolling a 4.

   c) Determine the odds in favour of rolling an even number. Express this as a ratio.

continued

Assignment 4.1: Expressing Probability and Odds (continued)

10. According to Statistics Canada, there are 17 041 000 youth between the ages of 15 and 24 in Canada. Out of these youth, 1 274 300 are employed full-time while 1 177 000 are employed part-time, and the rest are not employed.

    In your answers, express the probabilities as percents, and express the odds as ratios. *(12 marks)*

    a) What is the probability of being employed full-time, based on these statistics, if you are between the ages of 15 and 24?

    b) What is the probability of being employed part-time, based on these statistics, if you are between the ages of 15 and 24?

    c) What is the probability of not being employed at all, based on these statistics, if you are between the ages of 15 and 24?

    d) What is the probability of being employed, either full-time or part-time, based on these statistics, if you are between the ages of 15 and 24?

    e) What are the odds in favour of being employed either full-time or part-time if you are between the ages of 15 and 24?

    f) What are the odds against being employed either full-time or part-time if you are between the ages of 15 and 24?

Lesson 3: Expected Value

Lesson Focus

In this lesson, you will

- ❑ complete an expected value chart
- ❑ calculate the expected value of a simple game
- ❑ solve problems involving expected value
- ❑ make decisions based on expected value

Lesson Introduction

In the previous lesson, you studied probability and odds. In this lesson, you will apply your knowledge of probability to calculate "expected value." Expected value involves the likelihood of a gain or loss in a situation that involves chance (probability). This is relevant in business, insurance, games of chance, and many other situations in your everyday life.

In this lesson, you will look at your expected value in gambling games such as lotteries to determine whether or not the games are fair. You will also look at examples of expected value in business and multiple choice tests.

What is Expected Value?

Expected value involves the likelihood of a gain or a loss in a situation that involves chance. Expected value is generally used to determine the likelihood of financial gains or losses. A situation where you would use expected value is when you spend money in slot machines or VLTs. If you put 50¢ into a slot machine 100 times, how much money would the government expect you to receive?

Determining Expected Value

To determine **expected value**, follow these steps:

1. Find the probability of the required events.
2. Find the gain or loss associated with each event. This can also be called the **payoff** of each event.
3. Multiply the probability of each event by its payoff.
4. Find the sum of the probability of each event multiplied by its payoff. This is the **expected value**.

The following examples will help to clarify this calculation.

Determining expected value when you play a game of chance (gamble)

Example 1

Consider the following game. You have a 1 in 5 chance of winning the game and a 4 in 5 chance of losing. The game costs $1 each time you play. If you win the game, you receive $4. If you lose the game, you receive nothing. Find the expected value of the game.

Solution

You may find it helpful to complete the following chart when finding expected value:

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff

In this example, there are two events: winning the game and losing the game. The probability of winning the game is $\frac{1}{5}$ and the probability of losing the game is $\frac{4}{5}$.

Therefore, your chart would look like this:

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
winning the game	$\frac{1}{5}$				
losing the game	$\frac{4}{5}$				

If you win the game, you win \$4. If you lose the game, you win nothing. This is indicated by \$0. It costs \$1 to play the game. Enter this information into the expected value chart as follows:

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
winning the game	$\frac{1}{5}$	\$4	\$1		
losing the game	$\frac{4}{5}$	\$0	\$1		

If you win the game, your payoff is \$4 − \$1 = \$3. If you lose the game, your payoff is \$0 − \$1 = −\$1. Enter this information into the expected value chart as follows:

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
winning the game	$\frac{1}{5}$	\$4	\$1	\$3	
losing the game	$\frac{4}{5}$	\$0	\$1	–\$1	

Since you will win \$3 one time out of five, the probability × payoff is $\left(\frac{1}{5}\right)\times(\$3)$ in the event that you win. Since you will lose \$1 four times out of five, the probability × payoff is $\left(\frac{4}{5}\right)\times(-\$1)$ in the event you lose. Enter this information into the expected value chart as follows:

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
winning the game	$\frac{1}{5}$	\$4	\$1	\$3	$\left(\frac{1}{5}\right)\times(\$3)$
losing the game	$\frac{4}{5}$	\$0	\$1	−\$1	$\left(\frac{4}{5}\right)\times(-\$1)$

To find the expected value of the game, find the sum of the two probabilities multiplied by their payoffs.

$$\text{Expected value} = \left(\frac{1}{5}\right) \times (\$3) + \left(\frac{4}{5}\right) \times (-\$1)$$
$$= 0.6 - 0.8$$
$$= -\$0.20$$

The expected value (EV) of −$0.20 means that if you played this game many times, on average, you would lose $0.20 or 20¢ for each time you played.

If you played this game 10 times, you would expect to lose

Expected value = 10 × ($0.20) = $2

If you played this game 20 times, you would expect to lose

Expected value = 20 × ($0.20) = $4

If you played this game 100 times, you would expect to lose

Expected value = 100 × ($0.20) = $20

However, if you play the game only once, you would either gain $3 or lose $1.

Don't forget to add the steps for finding expected value to your resource sheet. Copying down a completed example (such as Example 1) would also be a good idea.

In general, the following is true about expected value in games:

- If you play any game with an expected value < 0, you can expect to lose money.
- If you play any game with an expected value = 0, you can expect to break even. This is called a **fair game**.
- If you play any game with an expected value > 0, you can expect to gain money.

Games on VLTs and games such as lotteries always have an expected value that is negative so they can make money for the organization running the game (at the player's expense).

Example 2

Consider the following game. It costs \$3 each time you play. You have a 1 in 10 chance of winning \$25, a 1 in 5 chance of winning \$5, and a 7 in 10 chance of receiving nothing.

a) Find the expected value.

b) If you play this game many times, will you gain or lose money?

c) Is this a fair game?

Solution

a) The expected value chart for this game can be completed as follows:

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
winning \$25	$\frac{1}{10}$	\$25	\$3	\$25 − \$3 = \$22	$\left(\frac{1}{10}\right) \times (\$22)$
winning \$5	$\frac{1}{5}$	\$5	\$3	\$5 − \$3 = \$2	$\left(\frac{1}{5}\right) \times (\$2)$
winning nothing	$\frac{7}{10}$	\$0	\$3	\$0 − \$3 = −\$3	$\left(\frac{7}{10}\right) \times (-\$3)$

The expected value of the game is the sum of these probabilities times their payoffs.

$$\begin{aligned}\text{Expected value} &= \left(\frac{1}{10}\right) \times (\$22) + \left(\frac{1}{5}\right) \times (\$2) + \left(\frac{7}{10}\right) \times (-\$3) \\ &= \$2.20 + \$0.40 - \$2.10 \\ &= +\$0.50\end{aligned}$$

The expected value of the game is +\$0.50.

b) Because the expected value of the game is positive, if you play this game many times, you can expect to gain money.

c) This is not a fair game because the expected value isn't zero. However, you may choose to play this game because the expected value is greater than zero. This means that on average you will not lose money.

Example 3

In order to raise money for cancer research at the St. Boniface Hospital, the St. Boniface Hospital Foundation decides to have a charity lottery. The grand prize is $15,000. There are also 10 additional prizes of $500. Each ticket costs $15. Only 10 000 tickets will be sold.

a) What is the expected value if you buy one ticket?

b) Is this a fair game? Why do you think it is/is not?

c) How much will the St. Boniface Hospital Foundation gain or lose from this charity event?

d) Why would the number of tickets sold be limited to 10 000?

Solution

a) Your expected value chart should look like this:

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
winning $15,000	$\frac{1}{10\,000}$	$15,000	$15	$15,000 − $15 = $14,985	$\left(\frac{1}{10\,000}\right) \times (\$14,985)$
winning $500	$\frac{10}{10\,000}$	$500	$15	$500 − $15 = $485	$\left(\frac{10}{10\,000}\right) \times (\$485)$
winning nothing	$\frac{9989}{10\,000}$	$0	$15	$0 − $15 = −$15	$\left(\frac{9989}{10\,000}\right) \times (-\$15)$

To find the probability of winning nothing, you need to subtract the probabilities of winning $15,000 or $500 from 1.

$$\begin{aligned} \text{P(winning nothing)} &= 1 - \left(\frac{1}{10\,000}\right) - \left(\frac{10}{10\,000}\right) \\ &= \frac{10\,000}{10\,000} - \left(\frac{1}{10\,000}\right) - \left(\frac{10}{10\,000}\right) \\ &= \frac{9989}{10\,000} \end{aligned}$$

The expected value is

$$\begin{aligned} \text{EV} &= \left(\frac{1}{10\,000}\right) \times (\$14,985) + \left(\frac{10}{10\,000}\right) \times (\$485) + \left(\frac{9989}{10\,000}\right) \times (-\$15) \\ &= \$1.4985 + \$0.485 - \$14.9835 \\ &= -\$13 \end{aligned}$$

b) This is not a fair game because on average you will lose $13. This game is unfair for ticket buyers because the St. Boniface Hospital Foundation needs to raise money. If this game was fair, the charity event would not raise any money.

c) To find the answer to this question, you need to find the amount the foundation takes in from ticket purchases. You also need to find the amount the foundation gives out in prizes.

The foundation takes in $\$15 \times 10{,}000 = \$150{,}000$

The foundation gives out $\$15{,}000 + 10 \times \$500 = \$15{,}000 + \$5000 = \$20{,}000$

Overall, the foundation makes $\$150{,}000 - \$20{,}000 = \$130{,}000$

Note: The total expected value can also be calculated another way:

EV per ticket = −$13.00

EV for 10000 tickets = 10000 × −$13.00) = −$130 000

Therefore, the foundation earns $130 000.

d) The St. Boniface Hospital Foundation might give out probabilities for winning the prizes. For example, the probability of winning the grand prize is 1 in 10,000. In order for these probabilities to be accurate, they need to limit the number of tickets sold. If they sold more tickets, the probability of winning a prize would go down. If they sold fewer tickets, the probability of winning a prize would go up.

Example 4

Nicholas decides that he doesn't need to go to school anymore. Instead, he is going to win the lottery by choosing 7 random numbers and a bonus number. The draws for this lottery are on Wednesday and Friday. Therefore, Nicholas wants to buy two tickets a week to increase his chances of winning. Nicholas buys two $5 tickets every week for a year. The probabilities of winning a prize based on a $5 ticket are shown below. On average, how much will Nicholas have won or lost after the year is over?

Matches Needed to Win	Prize	Probability
7 of 7	$20,000,000	1 : 28,633,528
6 of 7 + Bonus	$50,000	1 : 4,090,504
6 of 7	$25,000	1 : 99,768.4
5 of 7	$500	1 : 1,583.6
4 of 7	$20	1 : 71.3
3 of 7 + Bonus	$20	1 : 76.7
3 of 7	$5	1 : 8.1
2, 1 of 7	$0	0.84775635

Solution

The expected value chart should look like this:

Event	Probability	Prize	Cost of Playing	Payoff
7 of 7	1 : 28,633,528	$20,000,000	$5	$19,999,995
6 of 7 + Bonus	1 : 4,090,504	$50,000	$5	$49,995
6 of 7	1 : 99,768.4	$25,000	$5	$24,995
5 of 7	1 : 1,583.6	$500	$5	$495
4 of 7	1 : 71.3	$20	$5	$15
3 of 7 + Bonus	1 : 76.7	$20	$5	$15
3 of 7	1 : 8.1	$5	$5	$0
2, 1 of 7	0.84775635	$0	$5	−$5

$$\begin{aligned}\text{EV} &= \$19,999,995 \times \left(\frac{1}{28,633,528}\right) + \$49,995 \times \left(\frac{1}{4,090,504}\right) \\ &\quad + \$24,995 \times \left(\frac{1}{99,768.4}\right) + \$495 \times \left(\frac{1}{1,583.6}\right) + \$15 \times \left(\frac{1}{71.3}\right) \\ &\quad + \$15 \times \left(\frac{1}{76.7}\right) + (\$0) \times \left(\frac{1}{8.1}\right) + (-\$5) \times (0.84775635) \\ &= -\$2.56\end{aligned}$$

Since he buys two tickets per week, after one year, or 52 weeks, Nicholas will have, on average,

$52 \times 2 \times (-\$2.56) = -\$266.24$, which is a loss of $266.24.

Nicholas has a very slim chance of making money from this lottery. This lottery is taking more than half the money he spends on tickets. Therefore, the more he plays, the more he loses in this lottery.

The lottery is a fairly simple game to play. Other games at casinos, such as Blackjack, are more complicated. Lottery corporations use these complications to hide the probabilities involved in winning a game. However, these games are designed to make money for the lottery corporations. Even though there might be a big payout every so often, the lottery corporation is earning a lot of money from the people who gamble.

Determining Expected Value in Business

As you have seen, expected value can be widely used in games. However, expected value is also useful in making business decisions.

You may find it easier to continue using expected value charts to complete the questions. However, these charts are optional. Use them only if you find them helpful in finding expected value.

Example 5

Based on past experience, a building contractor sets her probability of winning a contract at 0.30. The contract is worth $25,000, and she determines it will cost her $2400 to prepare a contract proposal.

a) Find the expected value of the contract proposal.
b) Is it financially a good idea for her to bid on the contract?
c) What other factors might she consider before deciding whether to bid on the contract?

Solution

a) Since the probability of winning the contract is 0.30, the probability of not winning the contract is $1 - 0.30 = 0.70$.

The expected value chart can be completed as follows:

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
winning the contract	0.30	$25,000	$2400	$25,000 − $2400 = $22,600	(0.30) × ($22,600)
not winning the contract	0.70	$0	$2400	$0 − $2400 = −$2400	(0.70) × (−$2400)

Expected value = (probability of winning contract) × (its payoff)
+ (probability of not winning contract) × (its payoff)

Expected value = (0.30) × ($22 600) + (0.70) × (−$2400)
= $6780 − $1680
= $5100

The expected value of the contract proposal = $5100.

b) Since the expected value is positive, it is financially a good idea for the contractor to bid on the contract.

c) Some other factors the contractor might consider are the following: how much time she has available at the present, the type of contract, the completion date of the contract, and the reputation of the company offering the contract.

In the above example, an expected value of $5100 does not mean that if the contractor bids on the contract she will receive $5100. It means that if she bids on many such contracts, the expected gain per contract is $5100. For example, if she bids on 10 such contracts, on average her gain will be 10($5100) = $51,000. If she bids on only one contract, she will either gain $22,600 or lose $2400, depending on whether she wins or loses the contract.

Determining Expected Value in Multiple Choice Tests

Example 6

Consider the following multiple choice test. Each question on the test has five possible answers. You receive three points for each correct answer but lose one point for each incorrect answer.

a) What is your expected value on a question you answer by randomly guessing?

b) Is it to your advantage to answer a question by randomly guessing?

c) What is your expected value on a question in which the correct response is one of two potential answers?

d) Is it to your advantage to answer a question in which the correct response is one of two potential answers?

Solution

a) Since there are five possible answers, the probability of guessing an answer correctly is $\frac{1}{5}$ while the probability of guessing an answer incorrectly is $\frac{4}{5}$.

The expected value chart can be completed as follows:

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
answering a question correctly	$\frac{1}{5}$	3	0	$3 - 0 = 3$	$\left(\frac{1}{5}\right) \times (3)$
answering a question incorrectly	$\frac{4}{5}$	-1	0	$-1 - 0 = -1$	$\left(\frac{4}{5}\right) \times (-1)$

Expected value = (probability of answering correctly) × (its payoff)
+ (probability of answering incorrectly) × (its payoff)

$$\text{Expected value} = \left(\frac{1}{5}\right) \times (3) + \left(\frac{4}{5}\right) \times (-1)$$
$$= 0.6 - 0.8$$
$$= -0.2$$

The expected value on a question you answer by randomly guessing = -0.2.

b) Since the expected value is less than zero, it is not to your advantage to answer a question by guessing.

c) If you know the correct response is one of two potential answers, the probability of guessing correctly is $\frac{1}{2}$ while the probability of guessing incorrectly is $\frac{1}{2}$.

The expected value chart can be completed as follows:

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
answering a question correctly	$\frac{1}{2}$	3	0	$3 - 0 = 3$	$\left(\frac{1}{2}\right) \times (3)$
answering a question incorrectly	$\frac{1}{2}$	-1	0	$-1 - 0 = -1$	$\left(\frac{1}{2}\right) \times (-1)$

Expected value = (probability of answering correctly) × (its payoff)
+ (probability of answering incorrectly) × (its payoff)

$$\text{Expected value} = \left(\frac{1}{2}\right) \times (3) + \left(\frac{1}{2}\right) \times (-1)$$
$$= 1.5 - 0.5$$
$$= 1$$

Your expected value in this case = 1.

d) Since the expected value is greater than zero, it is to your advantage to answer a question if you know the correct response is one of two potential answers.

Now that you have gone through a few expected value calculations, it is time to complete the learning activity. Be sure you check your answers to ensure you are answering the questions correctly. Also, ask your tutor/marker or learning partner for help if you are having trouble understanding any of the material.

Learning Activity 4.3

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. The odds against winning a certain game are 1:2. Convert these odds to a probability.
2. Write this fraction in lowest terms: $\frac{360}{900}$.
3. There are 52 cards in a deck, with 13 cards in each suit. What is the probability of drawing a heart?
4. From your house, you walk 8 m north, 5 m west, 8 m south, and 4 m east. How far are you from your house (in terms of directions)?
5. Which of the following words would come next in this pattern?

   One, four, three, eleven, fifteen, thirteen, . . .

   a) Fourteen
   b) Five
   c) Seven
   d) Seventeen

continued

Learning Activity 4.3 (continued)

Part B: Determining Expected Value

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

Note: Even though expected value charts are optional in this lesson, one is included with most of the questions in this assignment. Use the expected value charts only if you find them helpful.

1. Consider the following game. It costs \$3 every time you roll a six-sided number cube. If you roll a 5 or 6, you receive \$6. If you roll any other number, you receive nothing.
   a) Find the expected value of the game.
   b) Is it financially a good idea to play this game?
   c) If you play this game 10 times, how much would you expect to win or lose?
   d) If you play this game 50 times, how much would you expect to win or lose?
   e) If the amount you receive back when you roll a 5 or 6 is increased to \$10, what is your expected value?
   f) Is it financially a good idea to play this revised game?

2. The following expected value chart describes a simple game. Complete the chart and find the expected value of the game.

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
Outcome A	$\frac{1}{4}$	\$5	\$2		
Outcome B	$\frac{3}{4}$	\$0	\$2		

continued

Learning Activity 4.3 (continued)

3. Consider the following game. It costs $2 each time you play. You have a 1 in 4 chance of winning the game and a 3 in 4 chance of losing. If you win the game, you receive $10. If you lose the game, you receive nothing. Complete the following chart and find the expected value of the game.

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff

4. Consider the following game. It costs $2 each time you play. You have a 2 in 5 chance of winning the game and a 3 in 5 chance of losing. If you win the game, you receive $4. If you lose the game, you receive nothing. Complete the following chart and find the expected value of the game.

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff

5. Based on past experience, a systems engineer sets the probability of winning a computer contract at 0.25. The contract is worth $10 000 and the engineer calculates it would cost her $1800 to prepare a contract proposal.
   a) Find the expected value of the contract proposal.
   b) How much will the engineer gain if she wins the contract?
   c) How much will the engineer lose if she does not win the contract?
   d) Is it financially a good idea for the engineer to bid on the contract?
   e) Name some other factors she might consider in deciding whether to bid on the contract.

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff

continued

Learning Activity 4.3 (continued)

6. Consider the following multiple choice test. Each question on the test has five possible answers. You receive two points for a correct answer and lose one point for an incorrect answer.
   a) What is your expected value on a question you answer by randomly guessing?
   b) Is it to your advantage to answer a question by guessing at random?
   c) What is your expected value on a question in which the correct response is one of three possible answers?
   d) Is it to your advantage to answer a question in which the correct response is one of three answers?

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff

7. A carnival operator runs a coin-toss game where the probability of winning is 1 in 150. If a participant wins, he or she gets a stuffed animal worth $15.
   a) If the operator charges $0.25 a toss, what is the participant's expected gain of the game?
   b) If the operator charges $0.15 a toss, what is the participant's expected gain of the game?
   c) If the operator charges $0.10 a toss, what is the participant's expected gain of the game?
   d) Which of the above is considered a fair game? Is it likely the operator would charge an amount that would make the game mathematically fair? Explain

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff

Lesson Summary

In this lesson, you used your knowledge of probability to calculate expected value. As you can see, expected value has many real-life applications. Knowing how to calculate the expected value will help you to determine whether or not a situation is fair. Knowing how to calculate expected value will also help you recognize the realities of gambling.

In the next lesson, you will continue to look at situations where you make decisions based on probability.

Lesson 4: Making Decisions Based on Probability

Lesson Focus

In this lesson, you will

- ❑ explore three types of probability
- ❑ observe how some decisions are based on a combination of these three types of probability
- ❑ solve problems that include the different types of probability

Lesson Introduction

In the previous lesson, you calculated the expected value in situations that involve chance. Knowing the expected value helps you make informed decisions when there is a chance of gain or loss. In this lesson, you will explore the following three types of probability: theoretical probability, experimental probability, and subjective judgments. You will learn how some decisions involving probability are based on a combination of these three kinds of probability.

Think about the weather forecast this morning. Was the weather supposed to be nice? Was it supposed to snow or rain? How accurate was the forecast? These weather forecasts are based on probability. Which type of probability is used in weather forecasting? In this lesson, you will also learn how probability comes into play in many areas such as medicine and insurance.

Decisions Based on Probability

In situations based on chance, experts base their decisions on one, two, or all three of the types of probability listed above. For example, when a flood expert predicts the likelihood of a dike being strong enough to withstand a flood, the prediction may be based on the following:

- **Theoretical probability:** The strength of the dike as measured by the material used to build it, the dimensions of the dike (height and width), the height of the water in past years, and so on.

- **Experimental probability:** How similar dikes have prevented flooding in previous years or in other areas of the province when dealing with similar amounts of water, the average rainfall over the last several years.
- **Subjective judgment:** If the forecaster has read the long-term weather forecast in an almanac, he may think that the weather will not be very windy, that there will not be any heavy rains during the flood, and therefore the dike will hold.

Theoretical Probability

Theoretical probability is the probability of an event occurring in an ideal situation. A theoretical probability can be calculated mathematically.

Most of the examples so far in this module have been examples of theoretical probability. Some situations where theoretical probability is used to predict outcomes are rolling a fair die, tossing a coin, or spinning a wheel.

Example 1

Which of these situations involves theoretical probability?

a) Jake thinks the probability of winning on Tim Horton's "Roll up the Rim" contest is 100% because he has always won.

b) Samantha knows there are 52 cards in a deck. She also knows half of them are red. She states the probability of drawing a red card as 1 : 2.

c) A radio station is giving away prizes to every 5th caller. However, they will only accept 50 calls. Rachel declares that if she gets through, she will have a 1 in 5 chance of winning a prize.

d) Sydney and Kenneth are studying the weather. Every day, they write down the weather conditions. They found that it seems to rain every Tuesday. Sydney and Kenneth then stated that there is a higher probability of rain on Tuesday.

Solution

a) This situation does not involve theoretical probability. Jake stated the probability as 100% based only on his own experiences. Jake did not consider the actual probability of the game or that he could have just been lucky. He is making a subjective judgment.

b) This situation does involve theoretical probability. Based on an ideal situation, the probability of drawing a red card from a deck of cards is 1 : 2.

c) This situation does involve theoretical probability. There is 1 winner for every 5 calls.

Therefore, if Rachel gets her call answered, she will have a 1 in 5 chance of winning a prize.

d) This situation is not an example of theoretical probability. Sydney and Kenneth based their prediction on an experiment. Experimental probability is a type of probability that you will study next.

Experimental Results

Experimental results are the results, or data, gathered from an experiment. Probability can be calculated from this data. At the beginning of this module, you completed a game. If you were to calculate probability based on this data, this would be called experimental probability. Other situations involving **experimental probability** include the chance of a sports game going into overtime or the chance that a student watches over 20 hours of television a week. These are examples of experimental probability because you can only calculate this probability from data obtained by experiment or observation.

Consider the probability formula.

$$\text{Probability of an event} = \frac{\text{number of ways the event can occur}}{\text{total number of possible outcomes}}$$

In theoretical probability, this calculation is based on ideal conditions. For example, if you have a fair die, you will roll a 6 one in six times.

In experimental probability, the calculation is based on the results from an experiment. Therefore, if Jake rolled a 6 two out of six times, the ratio would be $2:6$, or $\frac{2}{6}$.

Example 2

A bag has 11 blue marbles, 15 green marbles, and 4 yellow marbles. Antonio picks marbles out of the bag. After he picks a marble, he records its colour and places the marble back into the bag. After picking 30 marbles, this is Antonio's data.

Colour Marble	# of Times Antonio Picked It
Blue	9
Green	18
Yellow	3

a) What is the experimental probability of drawing a blue or green marble?

b) What is the theoretical probability of drawing a blue or green marble?

c) What is the experimental probability of drawing a yellow marble?

d) What is the theoretical probability of drawing a yellow marble?

e) What can you say about the difference between theoretical and experimental probability?

Solution

a) There are 30 marbles. In the experiment, the blue marble was picked 9 times and the green marble was picked 18 times.

The experimental probability of picking a blue or green marker is $\frac{(9+18)}{30} = \frac{27}{30}$.

b) There are 11 blue marbles and 15 green marbles in the bag. Theoretically, or in an ideal situation, Antonio would draw a blue marble 11 times out of 30, and a green marble 15 times out of 30. The theoretical probability of drawing a blue or green marble is $\frac{(15+11)}{30} = \frac{26}{30}$.

c) The experimental probability of drawing a yellow marble is $\frac{3}{30}$.

d) Since there are 4 yellow marbles, the theoretical probability of drawing a yellow marble is $\frac{4}{30}$.

e) In this case, the theoretical probability and the experimental probability are very close. The theoretical and experimental probabilities aren't always the same, but are usually quite similar.

Subjective Judgments

Subjective judgments are decisions based on personal experiences, biases, or opinions. Individuals can create their own form of probability based on these subjective judgments. No calculations are used to determine this type of probability.

This type of probability will usually be the least accurate. Different people may have different subjective judgments, and therefore different probabilities, about the same situation. This is because everybody has a different opinion. Sports is an example in which probabilities based on subjective judgments are often used. Throughout the rest of this course, this type of probability will be called **subjective probability**. Dave may think that the Winnipeg Goldeyes have a 100% chance of winning their next game because they are his favourite team. However, Lauren may think that the Goldeyes have only a 50% chance of winning because they are facing an equally strong team.

Example 3

Sierra, Blake, and Savannah are having an argument about the lottery. In this specific lottery, Lottery Canada guarantees that the $10,000,000 prize will be paid. Sierra argues that someone has to win the lottery, so why couldn't she be the winner? On the other hand, Blake argues that there are many people buying tickets for this lottery. Therefore, the chances of actually winning the lottery are very low. Savannah agrees with Blake that they shouldn't buy lottery tickets. However, Savannah is basing her reasoning on the fact that her parents have been buying lottery tickets for years and they haven't won anything.

a) What type of probability is Sierra using in her reasoning?

b) What type of probability is Blake using in his reasoning?

c) What type of probability is Savannah using in her reasoning?

Solution

a) Sierra is using subjective probability in her reasoning. Sierra is not basing her opinion on any calculations at all. Instead, Sierra is using her opinion that winning the lottery is an achievable goal because someone has to win.

b) Blake is using theoretical probability. He knows that many people are buying tickets, and has calculated that he has a very slim chance of actually winning the lottery.

c) Savannah is using experimental probability. Based on her parents' experiences with buying tickets for the lottery, Savannah concludes that she will never win.

If you haven't done so already, add the definitions of the different types of probability to your resource sheet. This will help you when answering questions about probability later in this module.

Example 4

Elijah needs to get from one side of the city of Winnipeg to the other. He knows that Portage Avenue is the most direct route. However, Elijah also knows that the Perimeter Highway has a higher speed limit. How might Elijah use the following types of probability to choose the fastest route?

a) Theoretical

b) Experimental

c) Subjective

Solution

Answers might vary. However, be sure your answers relate to the type of probability in the question.

a) **Theoretical Probability:** For each route, Elijah could calculate the time it would take, travelling at the given speed limit and taking into consideration the number of red lights and the time he would stop at them. Theoretically, the route with the faster time would get him to his destination quicker.

b) **Experimental Probability:** Elijah has driven both routes before and he may have kept track of which route took less time in the past. The route that took less time then would probably take less time now. Basing his decision on this data would be using experimental probability.

c) **Subjective Probability:** Red lights, construction, potholes, and traffic are all things to consider. If Elijah thinks about his route and all the obstacles, he may decide that one route is faster than another based on his intuition rather than on data.

Applications of Probability

You have seen the differences between theoretical, experimental, and subjective probability. You have also applied these differences to situations involving lotteries and simple games. Probability has other applications as well, such as in medicine and vehicle insurance.

Medicine

Experimental probability is often used in medicinal research. Normally, a research person cannot calculate the theoretical probability of the benefits or side effects of a new medication, and so experimental data is required to determine how beneficial a new medication might be.

For experimental probability to be useful, the **sample size** needs to be large enough. Sample size is the number of people, or animals, included in the experiment. If only three people participate in an experiment, the results aren't valid. The more people involved, the better the experimental results will be.

Example 5

A researcher has found a medicine that she thinks might be a cure for the latest flu. This researcher then gives the medicine to 50 mice that have been infected with this flu. Of these 50 mice, 30 are cured, 13 are showing improvements, and 7 show no improvement.

a) What is the probability that mice with flu will experience at least some improvement? Write this probability as a percent.

b) What is the probability that mice with flu will show no improvement? Write this probability as a percent.

c) What type of probability is being used here?

Solution

a) $P(\text{Improvement}) = \frac{(30 + 13)}{50} = \frac{43}{50} = 86\%$

b) $P(\text{No Improvement}) = \frac{7}{50} = 14\%$

c) This is experimental probability. This researcher is experimenting to see the effects of a new medicine on mice.

Vehicle Insurance

Probability is also used to determine the cost of vehicle insurance. Many insurance companies charge drivers under the age of 25 higher insurance premiums. This is because young drivers are more likely to have accidents. Also, insurance rates for cars are affected by factors such as how likely it is that a car will be stolen, or how likely it is that the car will be used for street racing because it has a powerful engine.

Example 6

Recent Manitoba Public Insurance statistics stated that of the 210 Pontiac Firebirds insured, 30 were stolen last year.

a) Based on the MPI data, if you own a Firebird, what is the probability that it will be stolen in the next year?

b) What is the probability that it will not be stolen in the next year?

c) How might this probability affect the insurance costs that you pay for your Firebird?

d) Which type of probability was used in the question?

Solution

a) $\text{P(Stolen)} = \frac{30}{210} = \frac{3}{21} = \frac{1}{7}$

b) $\text{P(Not Stolen)} = \frac{(210 - 30)}{210} = \frac{180}{210} = \frac{18}{21} = \frac{6}{7}$

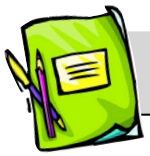
c) If your Firebird has a higher chance of being stolen than other models of cars, the insurance premium will likely increase.

d) Experimental probability, because it is based on MPI data.

Other Uses

Medical research labs use experimental data to determine the experimental probability of the safety of medications. Insurance companies use statistical data, which is the same as experimental data, to determine the rates they need to charge for insurance. Lottery Canada uses theoretical probability to determine how much money the corporation will earn from gambling revenues. Experts such as flood forecasters will use experimental probabilities based on data from previous years to determine the likelihood of a flood, but may also rely on subjective judgments based on past experiences or untested data when they predict the likelihood of a flood.

You should now be able to complete the following learning activity. Be sure you ask your learning partner or tutor/marker for help if you have any questions.



Learning Activity 4.4

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Evaluate: $\left(\frac{2}{9}\right) \times \left(\frac{9}{4}\right)$

2. One-third of students in a class of 108 students have never failed a test. How many students have never failed a test?

3. Convert this fraction to a decimal and a percent: $\frac{5}{40}$.

4. Evaluate and express as a mixed fraction: $\frac{5}{6} + \frac{7}{4}$.

5. A group of co-workers want to purchase pizza for lunch. There are seven co-workers, and the pizza costs $91. If each co-worker pays an equal amount of the cost, how much should each co-worker pay?

continued

Learning Activity 4.4 (continued)

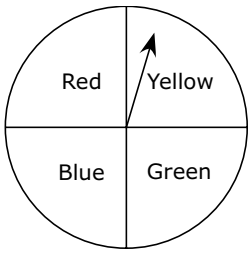
Part B: Applications of Probability

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Isabel has decided to buy a new car. She has taken her dad and her mom shopping with her. When they get to the car dealership, Isabel decides that she likes the look of a Chevrolet Cobalt. Isabel's dad talks to the salesman and discovers that in 50 test runs, the Chevrolet Cobalt had a higher safety rating than other Chevrolet cars. Isabel's mom tells Isabel that her friend Mary had a Cobalt, and she didn't like the Cobalt at all, so Isabel should look at other cars.
   a) What type of probability is Isabel's dad using? How do you know?
   b) What type of probability is Isabel's mom using? How do you know?

2. Kimberly spins this spinner 50 times. Her data is shown below.

Colour	Frequency
Red	17
Blue	13
Yellow	12
Green	8



   Write all of the following probabilities in percent form.
   a) What is the theoretical probability that the spinner will land on red?
   b) What is the experimental probability that the spinner will land on red?
   c) What is the theoretical probability that the spinner will land on yellow or green?
   d) What is the experimental probability that the spinner will land on yellow or green?
   e) Why aren't experimental and theoretical probabilities always the same?

continued

Learning Activity 4.4 (continued)

3. Explain which types of probability would apply to predicting that a 100-year flood will occur this year.

4. Name a situation in which you could use the three different types of probability to make a decision. Explain how the three different types of probability would relate to this situation.

Lesson Summary

In this lesson, you learned more about the applications of probability. You learned that there are three types of probabilities that can be used when making a decision: theoretical probability, experimental probability, and subjective judgments. Some decisions are based on only one type of probability, while other decisions can be based on two or more. Now that you have studied probability, it is time to complete the following assignment. After completing this assignment, Module 4 is done! Be sure to ask your learning partner or tutor/marker for help before completing this assignment if the material seems difficult. Probability can be a challenging topic to master.

Following this lesson Assignment 4.2. Remember to ask your learning partner or tutor/marker for help if you need to clarify some of the information taught in this lesson.

Notes

Assignment 4.2

Applications of Probability

Total: 35 marks

1. The following expected value chart describes a simple game. Complete the following chart and find the expected value of the game. *(3 marks)*

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
Outcome A	$\frac{3}{8}$	$3	$1		
Outcome B	$\frac{5}{8}$	$0	$1		

Expected value =

2. Consider the following game. It costs $3 each time you play. You have a 1 in 10 chance of winning $20, a 1 in 5 chance of winning $5, and a 7 in 10 chance of receiving nothing. Complete the following chart and find the expected value of the game. *(4 marks)*

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff

Expected value =

continued

Assignment 4.2: Applications of Probability (continued)

3. A community centre runs the following game at an annual fundraising event. In this game, marbles are randomly picked from a bag. The bag contains 6 red marbles, 3 white marbles, and 1 black marble. If you pick the black marble, you win $5. If the one you pick is white, you win $3. If you pick a red one, you do not win anything. The game costs $2 to play. *(4 marks)*

   a) Determine the expected value of the game.

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff

   Expected value =

   b) If you play this game 20 times, how much would you expect to win or lose?

   c) The community centre expects 1500 people to play this game. How much does it expect to win or lose from this game?

continued

Assignment 4.2: Applications of Probability (continued)

4. A carpet-cleaning company uses flyers to promote its business. The company knows that, on average, one out of every 100 households receiving its flyer will use its service. On average, the company makes a profit of $50 on each household whose carpets it cleans. It costs the company $0.25 for each flyer. *(4 marks)*

   a) Find the expected value of each flyer.

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff

   Expected value =

   b) Find the expected value of 10 000 flyers.

   c) Is it financially a good idea for the company to send out flyers?

continued

Assignment 4.2: Applications of Probability (continued)

5. Describe clearly a situation where the following types of probability can be used. *(3 marks)*

   a) Theoretical Probability

   b) Experimental Probability

   c) Subjective Probability

6. Name the type of probability that is being used in each situation. Explain how that type of probability relates to the situation. *(8 marks)*

   a) Caleb goes to work one day and discovers a motorcycle parked in his parking spot. He determines the probability of the owner being a male to be around 80%. *(2 marks)*

   b) Brooke declares the probability of rolling an even number with a fair die is 3:6 because there are three even numbers and six possible outcomes. *(2 marks)*

continued

c) Zoe and Alexa are gathering data about the different ways students travel to school. Out of 10 schools and 4000 students, they discovered that 3000 students walked. They concluded that 75% of students walk to school. *(2 marks)*

d) Chase hears about Zoe and Alexa's study and thinks the results are wrong. Chase asked his two best friends how they got to school, and they both said they biked. As Chase bikes too, he thinks that the percentage of people who walk to school should be lower. *(2 marks)*

7. Claire is trying to find a match for her pink sock. She knows there are 30 socks in her sock drawer. Thirteen socks are pink, 10 socks are black, and 7 socks are white. *(4 marks)*

a) What is the theoretical probability that Claire will select a pink sock (without looking) on her first try? *(1 mark)*

b) After six tries, Claire finally selects a pink sock. What is the experimental probability of selecting a pink sock in this case? Notice that in this experiment only six socks were drawn, with one of them being the correct colour. *(1 mark)*

c) Claire selects a pink sock after four tries. What is the experimental probability of selecting a pink sock in this case? *(1 mark)*

d) What is the theoretical probability of Claire selecting a white sock? *(1 mark)*

continued

Assignment 4.2: Applications of Probability (continued)

8. Sam is hired to be the operator of Toonie Toss, a game of chance at a local fundraising event for a charity. The game is as follows:

   A toonie ($2 coin) is tossed onto a table that has 50 holes. The toonie is equally likely to fall into any one of the 50 holes. Of these 50 holes, 1 is painted red, 10 are painted blue, and the other 39 holes are black. If the toonie falls into the red hole, the player wins $20, and if it falls into one of the 10 blue holes, the player wins $4. If the toonie falls into a black hole, it simply disappears. The person playing the game must use his or her own toonie.

   At the end of the evening, Sam reports to the manager of the fundraising event that 4500 toonies were tossed onto the table, and he paid back $4600 in prize money, which means that the charity earned $4400 ($9000 − $4600). Is Sam an honest operator? Explain your reasoning. *(5 marks)*

Module 4 Summary

You have now completed Module 4! Congratulations, you have completed half of the course! It is now time to write the midterm examination.

In this module, you studied probability and odds. You learned how to calculate the expected gain or loss in a situation that involves chance. You also studied three different types of probability, and how decisions may be based on more than one type of probability.

Once you have completed your midterm examination, you can begin the next module, where you will study the costs associated with owning and operating a vehicle.

Submitting Your Assignments

It is now time for you to submit the Module 4 Cover Assignment and Assignments 4.1 and 4.2 to the Distance Learning Unit so that you can receive some feedback on how you are doing in this course. Remember that you must submit all the assignments in this course before you can receive your credit.

Make sure you have completed all parts of your Module 4 assignments and organize your material in the following order:

- ❑ Module 4 Cover Sheet (found at the end of the course Introduction)
- ❑ Module 4 Cover Assignment: Applying Probability to Games
- ❑ Assignment 4.1: Expressing Probability and Odds
- ❑ Assignment 4.2: Applications of Probability

For instructions on submitting your assignments, refer to How to Submit Assignments in the course Introduction.

Midterm Examination

Congratulations, you have finished Module 4 in the course. The midterm examination is out of 100 marks and worth 12.5% of your final mark. In order to do well on this examination, you should review all of your learning activities and assignments from Modules 1 to 4.

You will complete this examination while being supervised by a proctor. You should already have made arrangements to have the examination sent to the proctor from the Distance Learning Unit. If you have not yet made arrangements to write it, then do so now. The instructions for doing so are provided in the Introduction to this module.

You will need to bring the following items to the examination: pens/pencils (2 or 3 of each), blank paper, a scientific or graphing calculator, and your Midterm Examination Resource Sheet. A maximum of 3.0 hours is available to complete your midterm examination. When you have completed it, the proctor will then forward it for assessment. Good luck!

At this point you will also have to combine your resource sheets from Modules 1 to 4 onto one 8½" × 11" paper (you may use both sides). Be sure you have all the formulas, definitions, and strategies that you think you will need. This paper can be brought into the examination with you. We suggest that you divide your paper into two quadrants on each side so that each quadrant contains information from one module.

This is a sample:

Front	**Back**
Module 1	Module 3
Module 2	Module 4

Examination Review

You are now ready to begin preparing for your midterm examination. Please review the content, learning activities, and assignments from Modules 1 to 4.

The midterm practice examination is also an excellent study aid for reviewing Modules 1 to 4.

You will learn what types of questions will appear on the examination and what material will be assessed. Remember, your mark on the midterm examination determines 12.5% of your final mark in this course and you will have 3.0 hours to complete the examination.

Midterm Practice Examination and Answer Key

To help you succeed in your examination, a practice examination can be found in the learning management system (LMS). The midterm practice examination is very similar to the actual examination that you will be writing. The answer key is also included so that, when you have finished writing the practice examination, you can check your answers. This will give you the confidence that you need to do well on your examination. If you do not have access to the Internet, contact the Distance Learning Unit at 1-800-465-9915 to get a copy of the practice examination and the answer key.

To get the most out of your midterm practice examination, follow these steps:

1. Study for the midterm practice examination as if it were an actual examination.
2. Review those learning activities and assignments from Modules 1 to 4 that you found the most challenging. Reread those lessons carefully and learn the concepts.
3. Contact your learning partner and your tutor/marker if you need help.
4. Review your lessons from Modules 1 to 4, including all of your notes, learning activities, and assignments.
5. Use your module resource sheets to make a draft of your Midterm Examination Resource Sheet. You can use both sides of an 8½" by 11" piece of paper.
6. Bring the following to the midterm practice examination: pens/pencils (2 or 3 of each), blank paper, a scientific calculator, and your Midterm Examination Resource Sheet.
7. Write your midterm practice examination as if it were an actual examination. In other words, write the entire examination in one sitting, and don't check your answers until you have completed the entire examination. Remember that the time allowed for writing the midterm examination is 3.0 hours.

8. Once you have completed the entire practice examination, check your answers against the answer key. Review the questions that you got wrong. For each of those questions, you will need to go back into the course and learn the things that you have missed.
9. Go over your resource sheet. Was anything missing or is there anything that you didn't need to have on it? Make adjustments to your Midterm Examination Resource Sheet. Once you are happy with it, make a photocopy that you can keep.

Grade 12 Essential Mathematics (40S)

Module 4
Probability

Learning Activity Answer Keys

Module 4: Probability

Learning Activity 4.1

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Convert this fraction to a decimal, a percent, and a ratio: $\frac{1}{8}$
2. Write this ratio as a fraction: $3:7$.
3. Add these two fractions: $\frac{3}{16} + \frac{2}{4}$
4. Name the numerator and the denominator in this fraction: $\frac{8}{37}$
5. For every 100 people in the world, 34 have A-positive blood type. Write this as a fraction in lowest terms.

Answers:

1. 0.125, 12.5%, $1:8$
2. $\frac{3}{7}$
3. $\frac{11}{16}\left(\frac{3}{16} + \frac{8}{16}\right)$
4. Numerator: 8
   Denominator: 37
5. $\frac{17}{50}\left(\frac{34}{100} = \frac{17}{50}\right)$

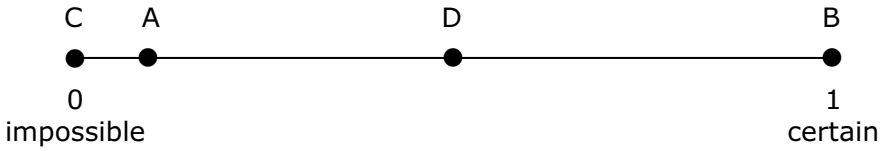
Part B: Expressing Probability

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Place the following events on a probability scale.

   a) You will live for 100 years. Represent this event by A.

   Answer:

   The likelihood that a person will live for 100 years is fairly small.

   b) In the first week of November, it will snow at least once in Thompson, Manitoba. Represent this event by B.

   Answer:

   It is very likely that it will snow at least once in Thompson during the first week of November, so the probability is close to 1.

   c) The sun will rise in the west tomorrow. Represent this event by C.

   Answer:

   The sun will never rise in the west, so the probability is 0.

   d) The next baby born in your local hospital will be a girl. Represent this event by D.

   Answer:

   The probability that the next baby to be born will be a girl is half or 0.5.

   e) You will finish this module in less than three weeks. Represent this event by E.

   Answer:

   Answers will vary. A possible answer is:

   If you think it is very unlikely, the E will be closer to zero. If you think it is very likely, the E will be closer to 1.

2. Rewrite each of the following statements without using the words "chance," "probability," or "likelihood."

   a) The probability of team A winning the baseball game on Saturday is 0.8.

      Answer:

      If Team A were to play 10 times on Saturday, it is expected to win eight times out of 10.

   b) There is a 50% chance of rain on Monday.

      Answer:

      It is as likely to rain on Monday as not to rain.

   c) The probability of a person living to age 90 is 0.02.

      Answer:

      Two people out of 100 live to the age of 90.

3. The probability of being born in a particular month is about 1 in 12. Express this ratio as a fraction, a decimal, a percent, and in words.

   Answer:

   fraction: $\frac{1}{12}$

   decimal: 0.083

   percent: 8.3%

   There is a 1 in 12 chance that a person was born in a particular month.

4. Determine the probability of not being born in a particular month. Express this ratio as a fraction, a decimal, a percent, and in words.

   Answer:

   P(not being born in a particular month)

   = 1 – P(being born in a particular month)

   $= 1 - \frac{1}{12}$

   $= \frac{11}{12}$

   decimal: 0.917

   percent: 91.7%

   There is an 11 in 12 chance that a person was not born in a particular month.

5. During a municipal election, 308 voters are registered at one polling station and 272 voters are registered at a second polling station. At the first polling station 148 voters cast their ballots. At the second polling station 131 voters cast their ballots.

   a) What is the probability voters at the first polling station cast their ballots? Express this probability as a percent.

      Answer:

      The probability that voters cast their ballots at the first polling station is $\frac{148}{308} = 48.05\%$.

   b) What is the probability voters at the second polling station cast their ballots? Express this probability as a percent.

      Answer:

      The probability that voters cast a ballot at the second polling station is $\frac{131}{272}$ or 48.16%.

   c) At which polling station were the voters more likely to cast their ballots?

      Answer:

      The voters were slightly more likely to cast their ballot at the second polling station.

      $\frac{131}{272} = 0.48162$

      is larger than

      $\frac{148}{308} = 0.48052$

   d) Based on the probability at the first polling station, if 400 voters register next year, how many voters will cast a ballot?

      Answer:

      $48.05\% \times 400$

      0.4805×400

      192 voters

6. A batting average is expressed as a 3-digit number out of 1000. A player's batting average is the probability of the total number of hits compared to the total number of official times the player is at bat. For example, if a batter has 15 hits in 60 official times at bat, her probability of a hit would be 15 ÷ 60 = 0.250. Her batting average is 250.

   a) What is the batting average of player A who has 18 hits in 70 official times at bat?

      Answer:

      $$\frac{18}{70} = 0.257$$

      The batting average is 257.

   b) What is the batting average of player B who has six hits in 25 official times at bat?

      Answer:

      $$\frac{6}{25} = 0.240$$

      The batting average is 240.

   c) Which of the two players has the higher batting average?

      Answer:

      The first player has the higher batting average.

   d) Explain what a batting average of 125 means.

      Answer:

      A batting average of 125 means that a player hits 125 times out of 1000 or 12.5% of the time when he or she is up to bat. That is equivalent to 1 out of 8.

   e) If a batter's average is 275, how many hits would you expect this batter to have in 100 official times at bat?

      Answer:

      If a batter's average is 275, he or she would be expected to have 27.5 hits out of 100 times at bat—that is, either 27 or 28 hits.

Learning Activity 4.2

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. What is 7% of 200?
2. Evaluate: $\left(\frac{5}{7}\right) - \left(\frac{2}{14}\right)$
3. Convert this fraction to a percent and a ratio in lowest terms: $\frac{3}{12}$.
4. Write two fractions that are equivalent to $\frac{4}{9}$.
5. One out of five people do not like the colour blue. Write this value in percent and decimal form.

Answers:

1. 14 (1% of 200 is 2; 7% of 200 is 14)
2. $\frac{4}{7}$ $\left(\left(\frac{5}{7}\right) - \left(\frac{1}{7}\right) = \frac{4}{7}\right)$
3. 25% or 1:4 $\left(\frac{3}{12} = \frac{1}{4} = 25\% = 1:4\right)$
4. There are many solutions including: $\frac{8}{18}, \frac{12}{27}$
5. 20% or 0.20 $\left(\frac{1}{5} = 0.20 = 20\%\right)$

Part B: Probability and Odds

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Each letter of the word MATHEMATICAL is on a different card. All the cards are the same size. The cards are placed face down and shuffled. Write your answers to these questions as ratios.
   a) Determine the probability of drawing an M.

      Answer:

      There are a total of 12 cards, two of which are Ms. Therefore, the probability of drawing an M is 2:12 or 1:6.

   b) Determine the odds in favour of drawing an M.

      Answer:

      Since there are 10 ways of not drawing an M, the odds in favour of drawing an M are 2:10 or 1:5.

   c) Determine the probability of not drawing an M.

      Answer:

      The probability of not drawing an M is 10:12 or 5:6.

   d) Determine the odds against drawing an M.

      Answer:

      The odds against drawing an M are 10:2 or 5:1.

2. A six-sided number cube (or die) is rolled. Find the following:
   a) the probability of rolling a number greater than 2

      Answer:

      There are four outcomes greater than 2. They are 3, 4, 5, 6. The probability of rolling one of these is 4:6 or 2:3.

   b) the odds in favour of rolling a number greater than 2

      Answer:

      Since there are two ways of not rolling a number greater than 2, the odds in favour of rolling a number greater than two are 4:2 or 2:1.

   c) the probability of not rolling an even number

      Answer:

      The probability of not rolling an even number is 3:6 or 1:2.

d) the odds against rolling an even number

Answer:

The odds against rolling an even number are 3 : 3 or 1 : 1.

3. A card is drawn from a standard deck of 52 playing cards. Find the following:

a) the probability of drawing a diamond

Answer:

There are 13 diamonds in a normal deck of 52 cards. Therefore, the probability of drawing a diamond out of a deck of 52 cards is 13 : 52 or 1 : 4.

b) the odds in favour of drawing a diamond

Answer:

The odds in favour of drawing a diamond are 13 : 39 or 1 : 3.

c) the probability of drawing an ace

Answer:

There are four aces in a deck of 52 cards, so the probability of drawing an ace is 4 : 52 or 1 : 13.

d) the odds against drawing an ace

Answer:

The odds against drawing an ace are 48 : 4 or 12 : 1.

4. Determine the probabilities (as a percent) of the following events occurring:

a) the odds in favour of an event are 1 : 2

Answer:

If the odds in favour of an event occurring are 1 : 2, then there are 3 (add 1 + 2) possible outcomes, so the probability would be 1 : 3 or 1 ÷ 3 = 0.333 or 33.3%.

b) the odds against an event are 4 : 1

Answer:

Total is 4 + 1, number in favour is 1, so P(event) = 1 : 5 or 1 ÷ 5 = 0.20 = 20%

c) the odds in favour of an event are 99 : 1

Answer:

Total is 99 + 1, number in favour is 99, so P(event) = 99 : 100 or 99 ÷ 100 = 0.99 = 99%.

d) the odds against an event are 1 : 1

Answer:

Total is 1 + 1, number in favour is 1, so P(event) = 1 : 2 or 1 ÷ 2 = 0.5 = 50%.

5. The probability of a soccer game in a particular league going into overtime is 0.125. Find the following:

a) the odds in favour of a game going into overtime

Answer:

0.125 is $\frac{125}{1000}$

125 in favour and 875 (1000 – 125) against

Odds in Favour = 125 : 875 or 1 : 7

b) the odds in favour of a game not going into overtime

Answer:

Odds Against = 875 : 125 or 7 : 1

c) If the teams in the league play 100 games in a season, about how many games would you expect to go into overtime?

Answer:

0.125 × 100 = 12.5 games

You would expect between 12 and 13 games to go into overtime.

6. Explain the difference between probability and odds.

Answer:

Answers will vary. Answers should contain the formulas for probability and odds. The different values for probability and odds should also be mentioned, such as the probability of an event occurring is always a fraction between 0 and 1, and the odds of an event occurring can be greater than 1 or less than 1.

Learning Activity 4.3

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. The odds against winning a certain game are 1 : 2. Convert these odds to a probability.
2. Write this fraction in lowest terms: $\frac{360}{900}$.
3. There are 52 cards in a deck, with 13 cards in each suit. What is the probability of drawing a heart?
4. From your house, you walk 8 m north, 5 m west, 8 m south, and 4 m east. How far are you from your house (in terms of directions)?
5. Which of the following words would come next in this pattern?

   One, four, three, eleven, fifteen, thirteen, . . .

   a) Fourteen
   b) Five
   c) Seven
   d) Seventeen

Answers:

1. P(winning) = $\frac{1}{3}$
2. $\frac{2}{5}\left(\frac{360}{900} = \frac{180}{450} = \frac{90}{225} = \frac{30}{75} = \frac{10}{25} = \frac{2}{5}\right)$
3. P(heart) = $\frac{13}{52}$
4. You are 1 m west from your house.
   (8 m north − 8 m south = 0 m north; 5 m west − 4 m east = 1 m west)
5. seventeen (Each word has one more letter than the previous word.)

Part B: Determining Expected Value

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

Note: Even though expected value charts are optional in this lesson, one is included with most of the questions in this assignment. Use the expected value charts only if you find them helpful.

1. Consider the following game. It costs \$3 every time you roll a six-sided number cube. If you roll a 5 or 6, you receive \$6. If you roll any other number, you receive nothing.

   a) Find the expected value of the game.

   Answer:

   Since there are six possible outcomes, 1, 2, 3, 4, 5, and 6, and since 5 and 6 are two of these outcomes, the probability of rolling a 5 or 6 = $\frac{2}{6}$ or $\frac{1}{3}$.

   Since there are six possible outcomes, 1, 2, 3, 4, 5, and 6, and since 1, 2, 3, and 4 are four of these outcomes, the probability of rolling a 1, 2, 3, and 4 = $\frac{4}{6}$ or $\frac{2}{3}$.

   The expected value chart can be completed as follows.

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
rolling a 5 or 6	$\frac{1}{3}$	\$6	\$3	\$6 − \$3 = \$3	$\frac{1}{3} \times (\$3)$
not rolling a 5 or 6	$\frac{2}{3}$	\$0	\$3	\$0 − \$3 = −\$3	$\frac{2}{3} \times (-\$3)$

   Expected value = (probability of winning) × (its payoff)
   + (probability of losing) × (its payoff)

   $$\text{Expected value} = \frac{1}{3}(\$3) + \frac{2}{3}(-\$3)$$
   $$= -\$1$$

   The expected value of the game = −\$1.

b) Is it financially a good idea to play this game?

Answer:

Because the expected value is less than zero, it is not financially a good idea to play this game.

c) If you play this game 10 times, how much would you expect to win or lose?

Answer:

If you play this game 10 times, you would expect to lose $10 \times \$1 = \$10$.

d) If you play this game 50 times, how much would you expect to win or lose?

Answer:

If you play this game 50 times, you would expect to lose $50 \times \$1 = \$50$.

e) If the amount you receive back when you roll a 5 or 6 is increased to \$10, what is your expected value?

Answer:

Expected value = (probability of winning) × (its payoff)
+ (probability of losing) × (its payoff)

$$\text{Expected value} = \frac{1}{3}(\$10 - \$3) + \frac{2}{3}(\$0 - \$3)$$

$$= \frac{1}{3}(\$7) + \frac{2}{3}(-\$3)$$

$$= \$2.33 - \$2 \left(\text{rounded to the nearest cent}\right)$$

$$= \$0.33$$

The expected value of the game = +\$0.33.

f) Is it financially a good idea to play this revised game?

Answer:

Because the expected value is greater than zero, it is financially a good idea to play this revised game.

2. The following expected value chart describes a simple game. Complete the chart and find the expected value of the game.

Answer:

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
Outcome A	$\frac{1}{4}$	\$5	\$2	\$5 − \$2 = \$3	$\frac{1}{4} \times (\$3)$
Outcome B	$\frac{3}{4}$	\$0	\$2	\$0 − \$2 = −\$2	$\frac{3}{4} \times (-\$2)$

$$\begin{aligned}\text{Expected value} &= \frac{1}{4}(\$3) + \frac{3}{4}(-\$2) \\ &= \$0.75 + (-\$1.50) \\ &= \$0.75 - \$1.50 \\ &= -\$0.75\end{aligned}$$

3. Consider the following game. It costs \$2 each time you play. You have a 1 in 4 chance of winning the game and a 3 in 4 chance of losing. If you win the game, you receive \$10. If you lose the game, you receive nothing. Complete the following chart and find the expected value of the game.

Answer:

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
winning	$\frac{1}{4}$	\$10	\$2	\$10 − \$2 = \$8	$\frac{1}{4} \times (\$8)$
losing	$\frac{3}{4}$	\$0	\$2	\$0 − \$2 = −\$2	$\frac{3}{4} \times (-\$2)$

$$\begin{aligned}\text{Expected value} &= \frac{1}{4}(\$8) + \frac{3}{4}(-\$2) \\ &= \$2 + (-\$1.50) \\ &= \$2 - \$1.50 \\ &= \$0.50\end{aligned}$$

4. Consider the following game. It costs \$2 each time you play. You have a 2 in 5 chance of winning the game and a 3 in 5 chance of losing. If you win the game, you receive \$4. If you lose the game, you receive nothing. Complete the following chart and find the expected value of the game.

   Answer:

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
winning	$\frac{2}{5}$	\$4	\$2	\$4 − \$2 = \$2	$\frac{2}{5} \times (\$2)$
losing	$\frac{3}{5}$	\$0	\$2	\$0 − \$2 = −\$2	$\frac{3}{5} \times (-\$2)$

$$\begin{aligned}\text{Expected value} &= \frac{2}{5}(\$2) + \frac{3}{5}(-\$2) \\ &= \$0.80 + (-\$1.20) \\ &= \$0.80 - \$1.20 \\ &= -\$0.40\end{aligned}$$

5. Based on past experience, a systems engineer sets the probability of winning a computer contract at 0.25. The contract is worth \$10 000 and the engineer calculates it would cost her \$1800 to prepare a contract proposal.

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
winning a contract	0.25	\$10,000	\$1800	\$10,000 − \$1800 = \$8200	0.25 × \$8200
not winning a contract	0.75	\$0	\$1800	\$0 − \$1800 = −\$1800	0.75 × −\$1800

   a) Find the expected value of the contract proposal.

      Answer:

$$\begin{aligned}\text{Expected Value} &= 0.25(\$10\,000 - \$1800) + 0.75(\$0.00 - \$1800) \\ &= 0.25(\$8200) + 0.75(-\$1800) \\ &= \$2050 - \$1350 \\ &= \$700\end{aligned}$$

b) How much will the engineer gain if she wins the contract?

Answer:

If the engineer wins the contract, she will gain $8200.

c) How much will the engineer lose if she does not win the contract?

Answer:

If the engineer loses the contract, she will lose $1800.

d) Is it financially a good idea for the engineer to bid on the contract?

Answer:

Since there is an expected gain, it is financially a good idea for her to bid on the contract

e) Name some other factors she might consider in deciding whether to bid on the contract.

Answer:

Some other factors include:

- how much time she has to prepare the proposal
- what other opportunities she may miss by allotting time to this contract
- whether she has the $1800 she needs to prepare the proposal

6. Consider the following multiple choice test. Each question on the test has five possible answers. You receive two points for a correct answer and lose one point for an incorrect answer.

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
correct answer	$\frac{1}{5} = 0.2$	2	0	$2 - 0 = 2$	$(0.2) \times (2) = 0.4$
incorrect answer	$\frac{4}{5} = 0.8$	-1	0	$-1 - 0 = -1$	$(0.8) \times (-1) = -0.8$

a) What is your expected value on a question you answer by randomly guessing?

Answer:

$$\text{Expected value} = \frac{1}{5}(2-0) + \frac{4}{5}(0-1)$$
$$= \frac{1}{5}(2) + \frac{4}{5}(-1)$$
$$= 0.4 - 0.8$$
$$= -0.4$$

b) Is it to your advantage to answer a question by guessing at random?

Answer:

No, it is not to your advantage to answer a question at random since the expected value is negative.

c) What is your expected value on a question in which the correct response is one of three possible answers?

Answer:

If you know the answer is one of three, the probability of guessing correctly is $\frac{1}{3}$ and the probability of guessing wrong is $\frac{2}{3}$. So the expected value calculations would look like the following:

$$\text{Expected value} = \frac{1}{3}(2-0) + \frac{2}{3}(0-1)$$
$$= \frac{1}{3}(2) + \frac{2}{3}(-1)$$
$$= 0.67 - 0.67$$
$$= 0$$

d) Is it to your advantage to answer a question in which the correct response is one of three answers?

Answer:

If you know the answer is one of three, it is neither to your advantage nor to your disadvantage to guess.

7. A carnival operator runs a coin-toss game where the probability of winning is 1 in 150. If a participant wins, he or she gets a stuffed animal worth $15.

   a) If the operator charges $0.25 a toss, what is the participant's expected gain of the game?

   Answer:

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
winning a stuffed animal	$\frac{1}{150}$	$15	$0.25	$15 − $0.25 = $14.75	$\left(\frac{1}{150}\right) \times (\$14.75)$
losing	$\frac{149}{150}$	$0	$0.25	$0 − $0.25 = −$0.25	$\left(\frac{149}{150}\right) \times (-\$0.25)$

$$\begin{aligned}\text{Expected value} &= \frac{1}{150}(\$15 - \$0.25) + \frac{149}{150}(\$0 - \$0.25)\\ &= \frac{1}{150}(\$14.75) + \frac{149}{150}(-\$0.25)\\ &= \$0.10 - \$0.25\\ &= -\$0.15\end{aligned}$$

Therefore, the player loses $0.15/play and the operator wins $0.15/play.

   b) If the operator charges $0.15 a toss, what is the participant's expected gain of the game?

   Answer:

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
winning a stuffed animal	$\frac{1}{150}$	$15	$0.15	$15 − $0.15 = $14.85	$\left(\frac{1}{150}\right) \times (\$14.85)$
losing	$\frac{149}{150}$	$0	$0.15	$0 − $0.15 = −$0.15	$\left(\frac{149}{150}\right) \times (-\$0.15)$

$$\begin{aligned}\text{Expected value} &= \frac{1}{150}(\$15 - \$0.15) + \frac{149}{150}(\$0 - \$0.15)\\ &= \frac{1}{150}(\$14.85) + \frac{149}{150}(-\$0.15)\\ &= \$0.10 - \$0.15\\ &= -\$0.05\end{aligned}$$

Therefore, the player loses $0.05/play and the operator wins $0.05/play.

c) If the operator charges \$0.10 a toss, what is the participant's expected gain of the game?

Answer:

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability × Payoff
winning a stuffed animal	$\frac{1}{150}$	\$15	\$0.10	\$15 − \$0.10 = \$14.90	$\left(\frac{1}{150}\right) \times (\$14.90)$
losing	$\frac{149}{150}$	\$0	\$0.10	\$0 − \$0.10 = −\$0.10	$\left(\frac{149}{150}\right) \times (-\$0.10)$

$$\begin{aligned}\text{Expected value} &= \frac{1}{150}(\$15 - \$0.10) + \frac{149}{150}(\$0 - \$0.10) \\ &= \frac{1}{150}(\$14.90) + \frac{149}{150}(-\$0.10) \\ &= \$0.10 - \$0.10 \\ &= \$0\end{aligned}$$

Therefore, the player does not lose any money/play and the operator does not win any money/play.

d) Which of the above is considered a fair game? Is it likely the operator would charge an amount that would make the game mathematically fair? Explain

Answer:

Option (c) would be considered a fair game. The operator would not set the charges so that the game is mathematically fair because she/he would not likely make a profit in the carnival business.

Learning Activity 4.4

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Evaluate: $\left(\frac{2}{9}\right) \times \left(\frac{9}{4}\right)$

2. One-third of students in a class of 108 students have never failed a test. How many students have never failed a test?

3. Convert this fraction to a decimal and a percent: $\frac{5}{40}$.

4. Evaluate and express as a mixed fraction: $\frac{5}{6} + \frac{7}{4}$.

5. A group of co-workers want to purchase pizza for lunch. There are seven co-workers, and the pizza costs $91. If each co-worker pays an equal amount of the cost, how much should each co-worker pay?

Answers:

1. $\frac{1}{2}$ $\left(\left(\frac{2}{9}\right) \times \left(\frac{9}{4}\right) = \frac{2}{4} = \frac{1}{2}\right)$

2. 36 (one-third of 99 = 33; one-third of 9 = 3; one-third of 108 = 33 + 3 = 36)

3. 12.5% $\left(\frac{5}{40} = \frac{1}{8} = 0.125 = 12.5\%\right)$

4. $2\frac{7}{12}$ $\left(\frac{5}{6} + \frac{7}{4} = \frac{10}{12} + \frac{21}{12} = \frac{31}{12} = 2\frac{7}{12}\right)$

5. $13 (You want to find $\frac{91}{7}$. You know that $\frac{70}{7} = 10,$ which leaves 91 − 70 = $21 unaccounted for. $\frac{21}{7} = 3,$ which implies that $\frac{91}{7} = 10 + 3 = 13.$ Each co-worker should pay $13.)

Part B: Applications of Probability

Remember, these questions are similar to the ones that will be on your assignments and midterm examination. If you are able to answer them correctly, you are likely to do well on your assignments and midterm examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Isabel has decided to buy a new car. She has taken her dad and her mom shopping with her. When they get to the car dealership, Isabel decides that she likes the look of a Chevrolet Cobalt. Isabel's dad talks to the salesman and discovers that in 50 test runs, the Chevrolet Cobalt had a higher safety rating than other Chevrolet cars. Isabel's mom tells Isabel that her friend Mary had a Cobalt, and she didn't like the Cobalt at all, so Isabel should look at other cars.

   a) What type of probability is Isabel's dad using? How do you know?

      Answer:

      Isabel's dad is using experimental probability. He found the results of an experiment from the salesman, and used this data to make a decision. He has determined that Isabel has a higher probability of surviving a car crash in this car than other Chevrolet cars. Therefore, according to her dad, Isabel should get the Chevrolet Cobalt.

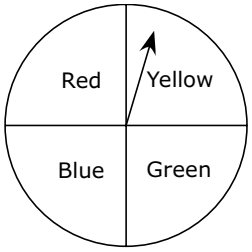
   b) What type of probability is Isabel's mom using? How do you know?

      Answer:

      Isabel's mom is using subjective probability. Isabel's mom is not using any facts to make her decision. Instead, she is basing her decision on her own opinion, based on her friend's experiences. Isabel's mom has determined that Isabel has a lower probability of liking this car because of Mary's opinion.

2. Kimberly spins this spinner 50 times. Her data is shown below.

Colour	Frequency
Red	17
Blue	13
Yellow	12
Green	8



Write all of the following probabilities in percent form.

a) What is the theoretical probability that the spinner will land on red?

Answer:

$$P(\text{red}) = \frac{1}{4} = 25\%$$

b) What is the experimental probability that the spinner will land on red?

Answer:

$$P(\text{red}) = \frac{17}{50} = 34\%$$

c) What is the theoretical probability that the spinner will land on yellow or green?

Answer:

$$P(\text{yellow or green}) = \frac{(1+1)}{4} = \frac{2}{4} = 50\%$$

d) What is the experimental probability that the spinner will land on yellow or green?

Answer:

$$P(\text{yellow or green}) = \frac{(12+8)}{50} = \frac{20}{50} = 40\%$$

e) Why aren't experimental and theoretical probabilities always the same?

Answer:

Theoretical probabilities occur in ideal situations and are calculated mathematically. Maybe the spinner wasn't accurate, or kept getting stuck at a certain place. This could affect the experimental probability. Also, there were only 50 trials, and with more trials (e.g., 500 or 5000 trials), the experimental probability tends to get closer to the theoretical probability.

3. Explain which types of probability would apply to predicting that a 100-year flood will occur this year.

   Answer:

   Theoretical, experimental, and subjective probability would apply. Experts can make a decision theoretically based on formulas using amount of snowfall, ground saturation, and amount of available drainage for the water to flow through. Experts can also make a decision based on previous years' data, or experimental data. If a 100-year flood only happens once every 100 years, then there is a $\frac{1}{100}$ chance of the flood occurring any given year. A decision could also be based on an expert's subjective opinion, or subjective probability. An expert could have personal experiences or opinions that lead her to the conclusion that a flood may or may not occur.

4. Name a situation in which you could use the three different types of probability to make a decision. Explain how the three different types of probability would relate to this situation.

   Answer:

   Answers may vary.

   Answers should include a situation, such as insurance/warranties, in which the three different types of probability can be used to make a decision. The explanation should include theoretical, experimental, and subjective probability.

   Theoretical probability should relate to the event in an ideal situation using mathematics. Experimental probability should relate to the event using data from an experiment. Subjective probability should relate to the event by having someone's opinion included in the decision.

Grade 12 Essential Mathematics (40S)

Module 5
Vehicle Finance

Module 5:
Vehicle Finance

Introduction

Welcome to the second half of the course! In the first half of this course, you covered four modules. Two of these modules dealt with financial topics: home finance and business finance. This module on vehicle finance deals with another topic in finance that may be important to anyone planning to own and operate a car.

If you decide to buy a car, you can use your own money to pay for the vehicle (pay cash) or make a loan to pay for the vehicle. Another option is leasing a new vehicle for a period of time. Usually, at the end of the lease, you can purchase this vehicle for a previously determined buy-out price. As in renting or buying a house, most financial advisors would probably say that buying a vehicle is the most economical approach. This will be discussed further in Lesson 2. However, the intent of this module is not to determine whether it is best for you to buy or to lease a vehicle. Instead, its intent is to draw your attention to the factors involved and then let you decide which option is best for you.

In addition to exploring the differences between leasing and buying a new or used car, you will also calculate costs involved when purchasing, leasing, and maintaining a car. By the end of this module, you should be able to make well informed decisions about which options are best for you.

Assignments in Module 5

When you have completed the assignments for Module 5, submit your completed assignments to the Distance Learning Unit either by mail or electronically through the learning management system (LMS). The staff will forward your work to your tutor/marker.

Lesson	Assignment Number	Assignment Title
	Cover Assignment	Vehicle Analysis
2	Assignment 5.1	Financing a New Vehicle
4	Assignment 5.2	Used Vehicles and Using Vehicles
5	Assignment 5.3	Insurance Costs

Resource Sheet

When you write your final examination, you are encouraged to take a Final Examination Resource Sheet with you into the examination. This sheet will be one letter-sized page, 8½ " by 11", with both sides in your handwriting or typewritten. You will submit it with your examination, but you do not receive any marks for it.

Many students have found that preparing a resource sheet is an excellent way to review. It provides you with a summary of the important facts of each module. You should complete a resource sheet for each module to help with your studying and reviewing. Lesson summaries and module summaries are included for you to use as a guide.

You may use the following list of instructions to help you with preparing your resource sheet for the material in Module 5. On this sheet, you should record mathematics terms and definitions, formulas, sample questions, or a list of places where you often make mistakes. You should also identify special areas that require extra attention or review by writing the page numbers.

After you have completed each module's resource sheet, you may summarize the sheets from Modules 5, 6, 7, and 8 to prepare your Final Examination Resource Sheet. The final examination for this course is based on Modules 5 to 8.

Resource Sheet for Module 5

As you go through the lessons of this module, you may want to consider the following suggestions regarding the creation of a resource sheet.

1. List all the important mathematics terms, and define them if necessary.
2. List all the formulas and perhaps a sample problem that shows how each formula is used.
3. If necessary, write the solutions to some problems, showing in detail how you did the calculations.
4. Copy any questions that represent the key points of the lesson, and perhaps include the solutions as well.
5. Identify the problems you found most difficult, and copy the page numbers onto the resource sheet so that you can review them before writing the examination. You may also copy the problems and the solutions onto your resource sheet, and later write them onto your Final Examination Resource Sheet.
6. Write any comments, ideas, shortcuts, or other reminders that may be helpful during an examination.

Module 5 Cover Assignment: Vehicle Analysis

The purchase of a vehicle is a multi-layered proposition that places the buyer in the position of having to make a variety of decisions. The first decision involves analyzing your needs or reason for buying a vehicle, which will help to determine the type of vehicle you buy. Once you decide the type of vehicle you are buying, then you need to decide if you want a used or a new vehicle. If you want a new vehicle, you need to decide if you will purchase it or lease it.

Your responsibilities do not end with the purchase, however, as maintenance of that vehicle is not only economically important, but ensures that your vehicle is safe and reliable for you, for your passengers, and for the other drivers with whom you share the streets and highways.

Maintenance includes everything from correct tire inflation to tire rotation and knowing what tires your car needs and when they need to be replaced. It involves knowing your driving habits and how that affects your tune-up schedule, from oil changes, to brake checks, to changing a dirty air filter.

The following cover assignment is meant to start you thinking about your responsibilities as a car owner. It is an introduction to a module that is geared to making your purchase of a vehicle as economical as possible, and to help you to be a safe and reliable owner.

Notes

Vehicle Analysis

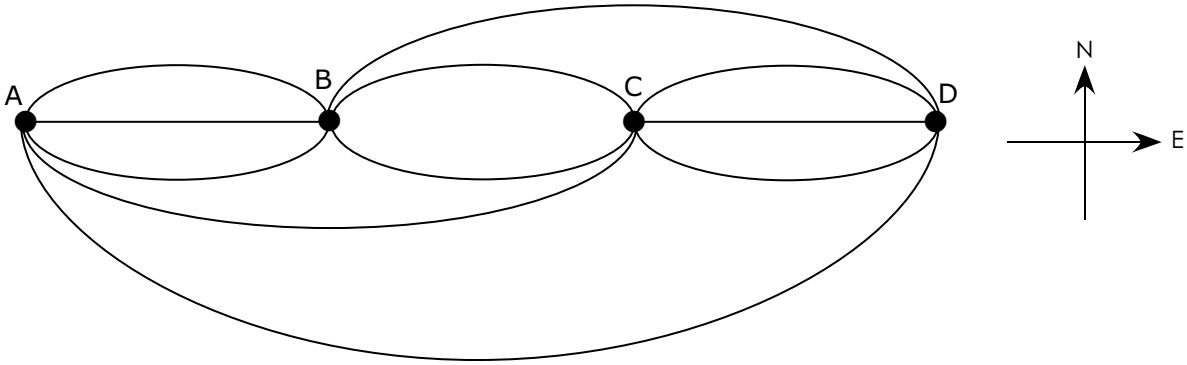
Total: 10 marks

Part A: Problem Analysis

Note: You are required to send in **ONLY** Part A **OR** Part B of this Cover Assignment for marking.

For each of the following problems, you must not only give the answer, but also an explanation of how you obtained that answer.

1. Examine the road map shown below. In how many ways can you select a route from A to D if you must always travel in an easterly direction? *(2 marks)*



2. A motorist purchases car tires that are guaranteed for 60 000 km. If the motorist uses each tire for only 60 000 km, what is the fewest number of tires she needs to purchase in order to drive 90 000 km? *(2 marks)*

continued

Module 5 Cover Assignment: Vehicle Analysis (continued)

3. A car dealer is taking stock of her new and used cars. She finds the following: Every green car is a new car. Half of the blue cars are new cars. Half of all the new cars are green. If there are 32 blue cars and 24 green cars, how many new cars are neither green nor blue? *(2 marks)*

4. An automobile tank is $\frac{1}{6}$ full of gasoline. When eight litres are added to the tank, it is $\frac{1}{4}$ full of gasoline. How many litres of gasoline does the tank hold? *(2 marks)*

5. A motorist makes a 120-km trip at an average speed of 40 kilometres per hour. On the return trip, he drives at an average speed of 60 kilometres per hour. What is the motorist's average speed for the entire trip? *(2 marks)*

continued

Module 5 Cover Assignment: Vehicle Analysis (continued)

Part B: Understanding Your Vehicle

Tires

What do the numbers and letters on the tires of your vehicle really mean? While the tire-sizing system may change and some companies' systems may vary, the following information should give you a better understanding. Here is a typical tire size: P185/60R14

- "P" means the tire is intended for a passenger vehicle.
- "LT" means the tire is designed for a light truck.
- "185" refers to the width of the properly inflated tire from sidewall to sidewall in millimetres. If this number contains a decimal, it means the tire width is given in inches.
- "60" is the aspect ratio of the tire. This ratio is a percentage between the tire section height and the section width. In our example, the height is 60 percent of the width. A low aspect ratio should give the car better control, since the tire rides low and wide. A tire with a high aspect ratio, on the other hand, has more give on a bumpy road.
- "R" refers to a radial tire. A "B" would mean a belted bias tire and a "D" signifies a diagonal bias tire. All refer to the way or direction that layers of rubber are added to the tire.
- "14" refers to the diameter of the rim of the wheel in inches. Common rim sizes that have been standardized throughout the automobile industry are 13, 14, 15, or 16. While it is possible to select a different width, aspect ratio, or type of tire, the rim diameter cannot be changed.

What about 31 × 10.5R15LT? The "31" refers to the diameter of the tire in inches. The width of the tire, "10.5", is also in inches. The rest is the same as P tires.

In light truck tires, a number and letter may follow the tire size information. The number refers to the ply rating (layers of rubber added to the tire) and the letter refers to the load range. The lower the letter, the smaller the load-carrying capacity of the tire.

In passenger car tires, if the number is followed by a two-digit number and letter (i.e., P155/80R13 79S), the "79S" represents a speed rating. There are a number of speed rating systems, but it is not necessary for you to learn them for this course.

continued

Module 5 Cover Assignment: Vehicle Analysis (continued)

1. Explain what is meant by each of the following tire codes: *(8 marks)*
   a) P195/60R15

   b) P205/75R14

   c) LT235/85R16 10E

   d) 33 × 12.50R15LT 6C

continued

Module 5 Cover Assignment: Vehicle Analysis (continued)

Oil

While the owner's manual of your vehicle should recommend a specific grade of oil, do you understand what SAE 10W/30 represents?

"SAE" means that numbers rating the oil have been assigned by the Society of Automotive Engineers.

The "W" stands for winter. Oils with two viscosity ratings (two numbers) are oils that have been tested at both cold and hot temperatures. Viscosity refers to the thickness of the oil, or its ability to flow. The colder it becomes, the thicker the oil gets. An oil needs to be thin enough to flow in winter so that an engine can start but thick enough to perform its lubricating function at high temperatures.

The "10" has no units. It arbitrarily stands for oil of a certain thinness tested at 0°F. This first number may be rated 5, 10, 15, or 20.

- 10W oil flows half as fast as 5W oil
- 15W oil flows half as fast as 10W oil
- 20W oil flows half as fast as 15W oil

Generally, the colder the winter temperature, the lower the "W" rating needs to be.

The second number, a regular rating, tests the oil at 210°F. The second number may be rated at 20, 30, 40, or 50. Again, if the number is higher, the oil is thicker and runs slower. The higher the number, the better the protection against hot temperatures.

2. Compare oil that is rated 10W30 with oil rated 20W30. *(2 marks)*

Notes

Lesson 1: Purchasing a New Vehicle

Lesson Focus

In this lesson, you will

- ❑ explore numerous factors you should consider before buying a vehicle
- ❑ use the Total Debt Service (TDS) ratio to determine whether you can afford to buy a vehicle
- ❑ identify a number of extra costs you must pay when buying a new vehicle
- ❑ calculate the cost of purchasing a new vehicle without a loan
- ❑ calculate the cost of purchasing a new vehicle if you make a loan

Lesson Introduction

Purchasing a new vehicle involves many decisions. There are many types of vehicles, models, colours, and options from which to choose. Vehicles differ in terms of size, fuel economy, reliability, price, warranty, and reputation. The first step in purchasing a new vehicle is establishing why you need the vehicle and which features are most important to you.

After determining which type of vehicle is best suited for you, there are still more decisions to make. Should you buy a new vehicle, or is a used vehicle a better option? If you decide to buy new, should you lease this vehicle or purchase it? This lesson will focus on the costs of buying a new vehicle. The costs of leasing a new vehicle and buying a used vehicle will be discussed in the next two lessons.

Before You Buy

Before you buy a vehicle, there are some options you need to think about. Once you know exactly why you need a vehicle and how you will use it, it will be easier to look for a vehicle that suits your specific needs.

Why Should You Buy a Vehicle?

There are many reasons for buying a vehicle. The following may be some of the reasons:

- convenience—you can go anywhere you want whenever you want
- commuting to work or school
- feeling of independence—you do not need to ask other people for a ride
- trying to avoid expensive repair costs on your present vehicle
- replacing your present vehicle because it is getting old

Establishing Your Needs

Once you decide to purchase a vehicle, you should decide how you are going to use the vehicle. This way, you will be able to choose a vehicle suited to your personal needs.

- When will you use this vehicle? Will you be using it for commuting to work daily or for weekend pleasure driving?
- Will you be doing more city driving or highway driving?
- Do you really need a vehicle?
- Will you be the only one driving this vehicle?
- Will you be using this vehicle for a carpool?
- Will you be towing anything (e.g., a camper) with this vehicle?
- What types of vehicles appeal to you?
- What features of a vehicle are most important to you?

Your answers to these questions will help you decide which type of vehicle to purchase.

Note: As you go through this lesson, be sure to add all definitions to your resource sheet. Also, you may wish to include examples of some of the more challenging questions.

Types of Vehicles

Sedans are the most common type of vehicle. They have two or four doors, with a trunk in the rear of the vehicle. The size class for sedans is based on the combined volume of the interior passenger space and the cargo space. The **cargo space** is the amount of space for transporting goods. The cargo space in most sedans is usually the amount of space in the trunk.

The classification of larger vehicles is based on their **Gross Vehicle Weight Rating**. The Gross Vehicle Weight Rating refers to the total weight of the vehicle plus its carrying capacity. The **carrying capacity** of a vehicle is the amount of weight the vehicle can carry, including passengers.

What Can You Afford?

Once you have decided to buy a vehicle, you need to determine how much you can afford to pay for it. To do this, you use the **Total Debt Service ratio**. In Module 1, you did calculations using the Gross Debt Service ratio. The Total Debt Service ratio is similar to the Gross Debt Service ratio. However, the Total Debt Service ratio also includes other debt repayments (such as a vehicle loan) in the calculation. The following formula will help you calculate the Total Debt Service ratio and should be included on your resource sheet.

$$\text{Total Debt Service Ratio (TDS)} = \frac{\text{Monthly Housing Costs + All Other Monthly Debts}}{\text{Gross Monthly Income}} \times 100$$

The TDS ratio should never exceed 40%.

Example 1

Chaska and Jacy are a newly married couple who have just moved into their own house. They are trying to decide if they can afford a new car. The car they wish to purchase will cost them $149 biweekly. They are currently living in a bungalow with a monthly mortgage of $1200. Heating costs are $89 a month, and property taxes are $1300 a year. Chaska also has a credit card debt that she is paying off with monthly payments of $120. Chaska and Jacy's combined gross monthly income is $4600.

a) Calculate the TDS ratio.

b) Should Chaska and Jacy purchase this car?

Solution

a) $$\text{Total Debt Service Ratio (TDS)} = \frac{\text{Monthly Housing Costs + All Other Monthly Debts}}{\text{Gross Monthly Income}} \times 100$$

$$\text{TDS ratio} = \frac{1200 + 89 + 108.33 + 120 + 298}{4600} \times 100 = 39.5\%$$

Note: A biweekly payment is a payment that occurs every two weeks. As there are approximately four weeks in a month, you need to multiply the biweekly payment by 2 to get the monthly payment.

b) This TDS ratio is very close to 40%. Therefore, Chaska and Jacy may not be leaving enough money for unexpected expenses if they purchase this car. Chaska and Jacy might want to consider purchasing a car that has a lower biweekly payment. If, however, the credit card debt is nearly paid off, they may decide that they can afford the car. Not including the credit card payment, the TDS ratio would be 36.9%.

Example 2

Cade wants to determine how much money he can spend on a vehicle. He is currently living in an apartment with rental fees of $850 a month. Cade's rent does not include heating, which is an additional $60 a month. Cade has no credit card debt and his monthly income is $2500.

a) Based on the Total Debt Service ratio, what is the maximum amount of money Cade can spend on a vehicle?

b) Cade sees an advertisement in the paper for a new Dodge Neon for $130 a month. Can Cade afford this vehicle?

Solution

a) 40% of Cade's income is $\$2500 \times 0.4 = \$1000$

Cade spends $\$850 + \$60 = \$910$ a month on rent and heating.

Available for vehicle debt = $\$1000 - \$850 - \$60 = \$90$

Therefore, based on the Total Debt Service ratio, Cade is left with $90 a month to spend on a vehicle.

b) No, Cade cannot afford this car because it would cost more than the $90 a month Cade has available to spend on a vehicle.

Shopping for a New Vehicle

After determining the type of vehicle you need and the amount you can afford, you are now ready to go shopping.

Choosing a Dealership

The following are some of the points you should keep in mind when shopping for a car:

- Visit dealers that have a good reputation.
- Friends or family members may provide some good advice, especially if this is your first car purchase.
- Do some comparison shopping. Many dealerships will advertise different prices for the same vehicle. This is especially true if you are trading in your present car.

- The location of a dealership may also be a factor in which dealership you choose. A dealership closer to your home is more convenient when your car needs service or repairs.

Before You Buy

After you choose a dealership and a vehicle, be sure to do the following before you purchase the vehicle.

- Check the sticker price of the vehicle.
- Obtain written quotes of the vehicle.
- Test drive the vehicle.
- Read the owner's manual of the vehicle.
- Read the warranty agreement of the vehicle. Warranty agreements of most vehicles are available online.
- Read the contract before you sign it.
- Check that your financing is in order.

Most car companies offer a three- to five-year "bumper-to-bumper" warranty on new vehicles, and extended warranties can be purchased that take effect after the original warranty expires. Extended warranties usually only cover manufacturing flaws or defective parts; they do not cover wear and tear on the vehicle due to age or use.

Saving Money

Below are listed some options that can reduce your costs when you purchase a vehicle:

- Choose a smaller vehicle. Dealerships usually have lower prices for small vehicles for various reasons.
- Negotiate for options. Some dealerships may be more willing to provide free options for your car, such as air conditioning, rather than a lower sale price.
- Avoid buying brand new vehicles as soon as they arrive at the dealer. New vehicles are in high demand and thus have a higher price. If you wait a few months, the price will usually go down.
- Look for reduced prices at the end of the year. Dealerships need to make room for the next year's models. Therefore, last year's models will be priced to sell quickly.
- Look for rebates and incentives. These can come from manufacturers or even the government.

Before Driving Your New Vehicle Home

After you have purchased your vehicle, you still need to do two more things before you leave the dealership.

- Check your vehicle for dents or scratches. Make sure your vehicle is spotless! If you have purchased a new vehicle, there should be no wear and tear on it.
- Match the **serial number** on your contract with the serial number on your vehicle. You don't want to be driving away with the wrong vehicle!

A **serial number** of a vehicle is a unique 17-digit combination of letters and numbers assigned to a vehicle to distinguish it from every other vehicle. Serial numbers of vehicles are usually located on the dashboard, and are visible through the windshield.

Complete the following learning activity before continuing on with the rest of Lesson 1. This learning activity deals with things you need to do before you purchase a vehicle.

Learning Activity 5.1

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Calculate 40% of 5600.
2. A computer costs $900. Estimate the cost, including taxes.
3. Evaluate for $n = 4$: $4n^2 + n - 9$
4. Solve for c: $\frac{8}{c} = 4$
5. The price of a $24,000 vehicle is reduced by 20%. What is the reduced price of the vehicle (not including taxes)?

continued

Learning Activity 5.1 (continued)

Part B: Vehicle Decisions

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Use the Vehicle Features Chart to complete the questions that follow.

Vehicles Features Chart		
Vehicle Options	**Important To You**	**Rating**
Standard Transmission		
Automatic Transmission		
Fuel Consumption		
Air Bags—Driver/Passenger/Side		
Warranty		
Anti-lock Braking System		
Power Brakes		
Power Steering		
Power Seat Adjustments		
Power Mirror Adjustments		
Power Windows		
Central Door Locking		
Childproof Locks		
Integrated Child Restraint System		
Air Conditioning		
Rear Window Defroster		
Heated Seats		
Cruise Control		
Tinted Glass		
Sunroof		
Winter Tires		
Summer Tires		
All Season Tires		
Sound System		
Telephone		
Anti-theft Device		
Spoiler		

continued

a) Check off at least 10 features that you consider important in a vehicle that you would like to purchase.

b) Rate these features in order of importance to you. Use a scale of one (the most important) to 10 (the least important).

2. State the highest allowable percentages for the Gross Debt Service ratio and the Total Debt Service ratio. Why is one percentage greater than the other?

3. Tiago is a single dad with two young children. His gross monthly income is $4300. He lives in a bungalow in St. Vital, and his monthly mortgage payment is $1100. Annual property taxes are $1440. Tiago has monthly costs of $65 for heating, and $80 for his credit card debt. Tiago wants to purchase a new vehicle that has a biweekly payment of $130.

   a) Calculate the Total Debt Service ratio.

   b) Can Tiago afford this car?

   c) Refer to the Vehicle Features Chart above. Which features might Tiago consider adding to his new vehicle? In your decision, take into account the fact that Tiago has young children.

4. Aneko is a university student, and she commutes from a rural location to Winnipeg every day for school and work. She lives with her parents, so she does not have to pay for housing costs. However, she does have a student loan that she is repaying at $250 a month. Aneko also has a credit card debt that she is trying to pay off with $45 monthly payments. Her gross monthly income from her part-time job is $1150. Aneko wants to buy a new vehicle, and the biweekly loan payments will be $79.

   a) Calculate the Total Debt Service ratio.

   b) Can Aneko afford this car?

   c) Refer to the Vehicle Features Chart above. Which features might Aneko consider adding to her new vehicle?

   d) Winnipeg winters always include lots of snow. Did you include winter tires as a feature that Aneko should purchase? Remember that these vehicle options are meant to be practical, and to help drivers get the most out of their vehicle.

continued

Learning Activity 5.1 (continued)

5. Cooper is trying to determine how much money he is able to spend on monthly vehicle payments. He is currently living in a bungalow with a monthly mortgage of $890. Heating costs an additional $93 a month. Cooper is also trying to pay off his credit card debt with $70 monthly payments. Cooper's monthly income is $3500.

   Based on the Total Debt Service ratio, what is the maximum amount of money Cooper can spend on a vehicle each month?

Purchasing a New Vehicle

Before you buy a new vehicle, you must decide how you will pay for the vehicle. Most people make a loan—either at the automobile dealership or at a bank—to pay for their vehicle. If you have saved up enough money, it is also possible to "pay cash" for the vehicle, which means that you use your own money to pay the total cost of the vehicle at the time of purchase.

When you buy a vehicle, you pay for its entire cost. You can drive the vehicle as often and as much as you want. Also, once you have paid for the vehicle, you own it and are free to sell or trade it whenever you wish.

Trade-in Allowance

If you already own a vehicle, you may want to use your old vehicle as part of the payment for the new one. The dealer may give you a **trade-in allowance** if you decide to trade your older vehicle for a newer one. For example, the dealer may decide that your current vehicle has a trade-in value of $5000, and so when you buy the new vehicle, the amount you pay for it is reduced by $5000. This amount is called the trade-in allowance.

Manufacturer's Suggested Retail Price

The Manufacturer's Suggested Retail Price (MSRP) of a car is the selling price that the manufacturer recommends to the retailer, which is the dealership. Each new vehicle comes with an MSRP. The MSRP is also known as the sticker price because it is placed on a window of the vehicle when it leaves the factory. The MSRP of a vehicle includes the base price, any optional equipment, an air-conditioning excise tax, and a destination or freight charge.

- The **base price** is the suggested price of the vehicle without any additional features.

- **Optional equipment** may include any of the options listed on the Vehicle Features Chart.
- The **air-conditioning excise tax** is a $100 payment required for vehicles with air conditioning that are purchased in Canada or imported from the United States.
- The destination charge covers the cost that a dealership must pay to transport the vehicle from the manufacturing facility to the car dealership.

Example 1

Find the Manufacturer's Suggested Retail Price for the following two-door convertible. The base price is $25,880 and it has the following optional equipment: a preferred equipment package group costing $1260, a four-speed automatic transmission costing $995, and an AM/FM stereo with CD player costing $200. In addition, there is an air-conditioning excise tax of $100 and a destination charge of $620.

Base Price		
Optional Equipment		
Total Options		
Excise Tax (air-conditioning)		
Destination Charge		
Total Price		

Solution

Base Price		$25,880
Optional Equipment: Preferred Equipment Group Four-speed automatic transmission Radio-AM/FM stereo with CD player	 $1260 $995 $200	
Total Options		$2455
Excise Tax (air-conditioning)		$100
Destination Charge		$620
Total Price		$29,055

The MSRP of a particular vehicle model will be the same at all dealerships. However, the actual sale price may vary by dealership. This is because of arbitrary markups or markdowns imposed by car dealerships. A dealer may increase the price of a car to earn more money, or reduce the price to encourage a sale. Therefore, it is important that you shop around before you decide to purchase a vehicle.

Purchasing a New Vehicle Outright

In addition to the MSRP, the total purchase price of a new vehicle will include a number of fees and taxes. These include a documentation fee, a tire tax, the Provincial Sales Tax (PST), and the Goods and Services Tax (GST). As of 2012, the GST is 5% and the PST in Manitoba is 7%.

Note: The values for PST and GST may change, but the process of computing these answers remains the same.

If you have saved up enough money, you can purchase a new vehicle outright. This means that you will not have monthly payments. Instead, you will pay for the total purchase price of the vehicle, including any additional features you wish to purchase, before you start driving your vehicle.

To calculate the cost of purchasing a vehicle, use the following steps:

1. Add together the MSRP, the documentation fee, and the tire tax.
2. Subtract the trade-in allowance (if applicable) from the amount you found in Step 1.
3. Multiply the amount in Step 2 by 1.12. This calculates the total purchase price of the vehicle including taxes.

Note: In Manitoba, PST and GST together are 12%. Therefore, if you multiply the value in Step 2 by 1.12, you will find the sum of the purchase price and the taxes on this amount.

Include these steps on your resource sheet.

Example 2

Moira Wheeler purchases a new mid-size automobile from Deal-a-Car Dealership. The automobile has an MSRP of $22,998. Moira receives a trade-in allowance of $5000 for her old vehicle. Calculate the total purchase price of her new vehicle, if, in addition to PST and GST, she pays a documentation fee of $149 and a tire tax of $14.

Solution

1. MSRP + documentation fee + tire tax = $22,998 + $149 + $14 = $23,161
2. $23,161 − trade-in allowance = $23,161 − $5000 = $18,161
3. $18,161 × 1.12 = $20,340.32

Total Purchase Price = $20,340.32.

Purchasing a New Vehicle through Financing

Because vehicles are expensive, many consumers cannot afford to pay for a vehicle outright. Instead, many consumers finance the purchase with a loan from the automobile dealership or a financial institution.

When you take out a loan from an automobile dealership or financial institution, the total amount you pay is greater than if you were to pay for it outright at the time of purchase. The total you pay when you finance the purchase of a vehicle is known as the **deferred payment**. The difference between the deferred payment and the total purchase price is known as the **finance charge**.

A car loan is a type of personal loan. In order to calculate monthly payments based on this loan, you need to consult an amortization table. The amortization table indicates the monthly payment required to pay a $1000 loan for a given time period and at a given interest rate. Refer to Table 5.1 to answer the following questions. Table 5.1: Amortization Table will be provided for you on your final examination.

Note: Amortization tables are also available online. If you have access to the Internet, you can use a search engine, such as Google, to look for amortization tables. Many of these tables are interactive and will allow you to see the differences in monthly payments when you change the interest rate or the interest period.

Table 5.1: Amortization Table					
Amortization Period Monthly Payment Per $1000 Loan Proceeds					
Annual Rate	1 Year Monthly	2 Years Monthly	3 Years Monthly	4 Years Monthly	5 Years Monthly
6.00%	$86.07	$44.33	$30.43	$23.49	$19.34
6.25%	$86.18	$44.44	$30.54	$23.61	$19.46
6.50%	$86.30	$44.56	$30.66	$23.72	$19.57
6.75%	$86.41	$44.67	$30.77	$23.84	$19.69
7.00%	$86.53	$44.78	$30.88	$23.95	$19.81
7.25%	$86.64	$44.89	$31.00	$24.07	$19.93
7.50%	$86.76	$45.01	$31.11	$24.19	$20.05
7.75%	$86.87	$45.12	$31.23	$24.30	$20.16
8.00%	$86.99	$45.24	$31.34	$24.42	$20.28
8.25%	$87.10	$45.34	$31.45	$24.53	$20.40
8.50%	$87.22	$45.46	$31.57	$24.65	$20.52
8.75%	$87.34	$45.57	$31.68	$24.71	$20.64
9.00%	$87.45	$45.68	$31.80	$24.89	$20.76
9.25%	$87.57	$45.80	$31.92	$25.00	$20.88
9.50%	$87.68	$45.91	$32.03	$25.12	$21.00
9.75%	$87.80	$46.03	$32.15	$25.24	$21.12
10.00%	$87.92	$46.14	$32.27	$25.36	$21.25
10.25%	$88.03	$46.26	$32.38	$25.48	$21.37
10.50%	$88.15	$46.38	$32.50	$25.60	$21.49
10.75%	$88.27	$46.49	$32.62	$25.72	$21.62
11.00%	$88.38	$46.61	$32.74	$25.85	$21.74
11.25%	$88.50	$46.72	$32.86	$25.97	$21.87
11.50%	$88.62	$46.84	$32.98	$26.09	$21.99
11.75%	$88.73	$46.96	$33.10	$26.21	$22.12
12.00%	$88.85	$47.07	$33.21	$26.33	$22.24
12.25%	$88.97	$47.19	$33.33	$26.46	$22.37
12.50%	$89.08	$47.31	$33.45	$26.58	$22.50
12.75%	$89.20	$47.42	$33.57	$26.70	$22.63
13.00%	$89.32	$47.54	$33.69	$26.83	$22.75
13.25%	$89.43	$47.66	$33.81	$26.95	$22.88
13.50%	$89.55	$47.78	$33.94	$27.08	$23.01
13.75%	$89.67	$47.89	$34.06	$27.20	$23.14
14.00%	$89.79	$48.01	$34.18	$27.33	$23.27

Example 3

Moira Wheeler is able to make a down payment of $5000 on the new mid-size automobile she purchases in Example 2 for $20,340.32. In order to finance the remaining amount, she takes out a three-year car loan at a fixed interest rate of $8\frac{1}{4}\%$.

a) Calculate her monthly payment for the automobile.

b) Calculate her deferred payment for the automobile.

c) Calculate her finance charge for the automobile.

Solution

a) Amount of the loan = $20,340.32 − $5000.00 = $15,340.32

Refer to Table 5.1. This table gives the monthly payments required to repay a loan of $1000 at a variety of interest rates paid off in from one to five years. Note that $8\frac{1}{4}\% = 8.25\%$. Move down the first column at the left, titled "Annual Interest Rate," until you find the entry 8.25%. Then move across that row until you are in the column titled "3 Years." The monthly payment for a $1000 loan is $31.45.

Since the loan Moira requires is for $15,340.32, you need to divide this number by 1000 in order to use the value on Table 5.1. This is similar to the calculations you did regarding amortization periods and mortgages in Module 1.

$$\text{Moira's monthly payment} = \frac{31.45 \times \$15,340.32}{1000} = \$482.45$$

b) Since Moira is repaying the loan in three years, and there are 12 months in a year, she makes a total of $12 \times 3 = 36$ payments.

The total amount Moira pays at the end of three years = $\$482.45 \times 36 = \$17,368.20$.

The deferred payment = loan payment + down payment
= $17,368.20 + $5000.00 = $22,368.20.

c) The finance charge = deferred payment − total purchase price
= $22,368.20 − $20,340.32 = $2027.88.

Moira pays an additional $2027.88 in interest over the three-year period of the loan.

Include the steps for solving this type of problem on your resource sheet. Similar problems may appear on the final examination.

Note: The cost of purchasing a vehicle outright is considerably less than purchasing it through financing. In Example 3, interest of $2027.88 is paid on a three-year loan of $15,340.32. However, the comparison is not quite so simple. When comparing the cost of purchasing a vehicle outright to the cost of purchasing it through financing, you also have to consider the loss of the use of your money if you purchase the vehicle outright. The money you used to purchase the vehicle outright could be invested and could potentially earn you more money. However, the cost of financing is usually much greater than money you can earn by investing.

Now that you have seen some calculation problems, it is time for you to try completing the calculations by yourself. Complete the following learning activity to practice solving these problems. This is also good practice as similar problems will appear on your next assignment.

Learning Activity 5.2

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Savanna was born in 1995. How old will she be in 2031?

2. Jackie wants to purchase a DVD for $20, a sweater for $60, a jacket for $120, a pair of jeans for $45, and hair products for $25. If the bank machine only gives out money in multiples of $20, how much money does Jackie need to withdraw from the bank machine to cover the costs of her purchases?

3. Burgandy needs to fundraise $2000 for her school trip. If she earns a profit of $4 from each box of chocolates she sells, how many boxes of chocolates does she need to sell to earn $2000?

4. Evaluate: $\frac{4}{7} + \frac{7}{2}$

5. Your credit card has a balance of $250. The minimum payment will be $10 or 10% of your balance—whichever is greater. How much is your minimum payment?

continued

Learning Activity 5.2 (continued)

Part B: Purchasing a New Vehicle

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Find the Manufacturer's Suggested Retail Price for the following coupe. The base price is $14 765. Its optional equipment package consists of a preferred equipment group costing $1730, plus a three-speed automatic transmission costing $765, an AM/FM stereo with CD player costing $350, 15-inch steering wheel costing $170, a spoiler costing $150, and a gauge costing $40. In addition, there is an air-conditioning excise tax of $100 and a destination charge of $760.

2. Find the Manufacturer's Suggested Retail Price for the following pickup truck. The base price is $28,300. Its optional equipment package consists of a preferred equipment group costing $1375, an electronic auto overdrive costing $1260, a tilt steering wheel and electronic speed control costing $500, heavy-duty trailering equipment costing $215, and an AM/FM stereo with CD player costing $190. In addition, there is an air-conditioning excise tax of $100 and a destination charge of $790.

3. Claire Cruise purchases the sports coupe in Question 1 from Deal-a-Car Dealership. She receives a trade-in allowance of $3500 for her old car. Calculate the total purchase price of her new vehicle, if, in addition to PST and GST, she pays a documentation fee of $129 and a tire tax of $14.

4. Claire Cruise is able to make a down payment of $2000 on the sports coupe she purchases in Question 3. In order to finance the remaining portion, she takes out a five-year car loan at a fixed interest rate of $8\frac{3}{4}\%$.

   a) Calculate her monthly payment for the sports coupe.

   b) Calculate her deferred payment for the sports coupe.

   c) Calculate her finance charge for the sports coupe.

5. Otto Mobile purchases the truck in Question 2 from Deal-a-Car Dealership. Calculate the total purchase price of his new vehicle, if, in addition to PST and GST, he pays a documentation fee of $100 and a tire tax of $14.

continued

Learning Activity 5.2 (continued)

6. Otto Mobile is able to make a down payment of $3500 on the truck in Question 5. In order to finance the remaining portion, he takes out a two-year car loan at a fixed interest rate of $8\frac{1}{2}\%$.

   a) Calculate his monthly payment for the truck.

   b) Calculate his deferred payment for the truck.

   c) Calculate his finance charge for the truck.

Lesson Summary

In this lesson, you explored numerous factors you should consider before you buy a vehicle. You also calculated how much a vehicle would cost if you paid cash for it or financed it with a loan. In the next lesson, you will look at leasing a vehicle. Leasing a vehicle is becoming a more popular option as you get to drive a new vehicle every few years. However, there are also drawbacks to leasing a new vehicle.

Notes

Lesson 2: Leasing a New Vehicle

Lesson Focus

In this lesson, you will

- ❑ explore the options available when leasing a new vehicle
- ❑ list the pros and cons of buying versus leasing a new vehicle
- ❑ calculate the cost of leasing a vehicle

Lesson Introduction

In Lesson 1, you calculated the cost of purchasing a new vehicle. Rather than *purchasing* a new vehicle *outright* or purchasing it through *financing*, you can *lease* the vehicle. When you lease a vehicle, you pay a given monthly leasing fee for a specified number of months. At the end of the specified time period, you can either purchase the vehicle or lease another one. Leasing a vehicle is a popular option as it has the advantages of little or no down payment and reduced monthly payments. However, leasing also has a downside, as you do not own the vehicle at the end of the lease.

It is a complex decision whether to purchase a new vehicle outright, purchase it through financing, or lease it. You have to consider many factors before reaching a decision. If you intend to trade in your vehicle every two or three years, leasing is an attractive option. If you intend to keep your vehicle for longer periods of time, or if you drive more than 25 000 kilometres per year, you will probably find leasing to be the more expensive option.

Leasing a Vehicle

You may have already noticed that leasing a vehicle is not the same as purchasing a vehicle. When you purchase a vehicle, you own the vehicle once you are done paying back your vehicle loan. When you lease a vehicle, you *do not* own the vehicle at the end of the lease. Instead, you have just paid for the *use* of the vehicle. This is why you have a lower monthly payment when you lease a vehicle.

With leasing, you may have the option of putting the money you save each month from your lower monthly payments into more productive investments. However, most people will typically find other uses for the money they save by leasing—such as paying the mortgage or buying groceries.

Conditions of a Lease

Different car dealerships offer different leases that have different conditions. These conditions may include the number of kilometres you may drive each year and the term (number of years) of the lease. If you decide to lease a vehicle, it is important that you understand the conditions of your lease. If you violate the terms of your lease, you may be responsible for paying extra fees for things like

- extra kilometres driven
- excessive wear and tear on the vehicle
- ending your lease early

At the end of the lease, you can return the vehicle or you can purchase the vehicle for its **guaranteed residual value**. The guaranteed residual value is an estimate of how much the vehicle will be worth after being used for the length of your lease. This value is given to you when you lease the vehicle.

Be sure to include this definition on your resource sheet.

Making the Decision to Lease a Vehicle

The following are some factors you should consider when trying to decide whether or not it is best to lease a vehicle:

1, **Repair costs to the vehicle.**

   a) In the lease option, repairs are usually covered by a warranty offered by the manufacturer. If, at the end of the lease, the vehicle appears to require a number of major repairs, you should probably not purchase the vehicle. Instead, you return the vehicle to the dealer and then buy or lease the next vehicle.

   b) If you have purchased the vehicle, repairs will be covered by warranty for a similar period of time. However, when the warranty has expired, you are responsible for any repair bills, and you may decide to trade the vehicle or sell it.

2. **How much do you drive the vehicle?**

   a) If you drive the vehicle more than the amount specified in your lease agreement, you will likely have to pay for the extra kilometres at the end of the lease. These costs can be high. Therefore, if you lease, you must be relatively sure of your driving habits and negotiate a price for the lease that will reflect these habits.

   b) If you own the vehicle, the number of kilometres you drive does not affect the amount you pay for the vehicle. It may, however, reduce the trade-in value of the vehicle.

3. **What are the monthly payments for the vehicle?**
    a) Generally, leasing is more attractive because the down payment and regular monthly payments are less than if you buy the vehicle and have to finance it. However, at the end of the lease, you must return the car to the dealer, which usually means that you now have to buy the car you leased, buy another car, or lease another car.
    b) If you purchase a vehicle, you must pay for the entire vehicle, but after it is paid, you own the vehicle, and can continue to use it as long as you want without making any monthly payments.
4. **How often do you change vehicles?**
    a) If you plan to drive a new vehicle every two or three years, leasing is an attractive option.
    b) If you buy a new car, take proper care of it, and keep it for a number of years or until it is worn out, you will spend a lot less money than if you leased new cars for the same period of time.

Overall, there are many pros and cons to consider before you decide to lease a vehicle.

Leasing a New Vehicle versus Purchasing a New Vehicle

Leasing and purchasing loans are two different methods of automobile financing. When you lease a vehicle, you pay a portion of the vehicle's cost. When you purchase a vehicle, you pay the whole price of the vehicle, regardless of how much you use it. Both leasing and purchasing have their own benefits and drawbacks. In order to decide which option is best for you, you need to look at your own personal priorities and financial situation.

Generally, buying a vehicle and driving it until it is worn out is the best option from a personal finance point of view. If you can purchase the vehicle without financing, you will save a lot of money on interest. If you are financing the vehicle, then the best option is to be as well informed as you can be about your financing options. For example, it may be to your advantage to make a bank loan rather than to finance the vehicle at the dealership.

Overall, a new vehicle is a major purchase. If you wish to purchase a new vehicle, you must research all of your options carefully. The following examples compare the costs of leasing to the costs of purchasing one particular minivan over a five-year period. The first two examples involve leasing the minivan before purchasing it and the last two involve only purchasing it. In order to make the examples less confusing, fees such as the destination charge, documentation fee, the tire tax, and the security deposit are not included.

As you complete the following questions, write the problem-solving procedures onto your resource sheet. Questions very similar to these will be included on your final examination.

Example 1

A minivan sells for $28,500 plus tax and can be leased for 24 months at $479 per month plus taxes. A down payment of $3275 is required. The guaranteed residual value of the vehicle is 65% of the sales price.

a) Calculate the total monthly leasing payment.

b) Calculate the total amount paid by the end of the lease.

c) Calculate the total residual value of the minivan, including tax.

d) Calculate the total cost of the vehicle if it is purchased outright at the end of the lease.

Solution

a) Monthly leasing payment = $479 × 1.12 = $536.48 (including PST and GST).

b) The total amount paid by the end of the lease

= down payment + monthly leasing payments.

= $3275.00 + ($536.48 × 24) = $16,150.52

c) The guaranteed residual value = 65% × $28,500

= 0.65 × $28,500 = $18,525

The total guaranteed residual value = $18,525 × 1.12 = $20,748

d) The total cost of the vehicle if it is purchased outright at the end of the lease

= down payment + total of all the monthly leasing payments + total guaranteed residual value

= ($3275.00 + $12,875.52) + $20,748.00

= $16,150.52 + $20,748.00 = $36,898.52

Example 2

The total guaranteed residual value of the minivan in Example 1 is financed at the end of the lease by a three-year car loan at a fixed interest rate of 6%.

a) Calculate the monthly payment on the guaranteed residual value.

b) Calculate the total of the monthly payments on the guaranteed residual value.

c) Calculate the total amount paid for the minivan if the guaranteed residual value is paid through financing.

Solution

a) The loan required is equal to the guaranteed residual value which from Example 1 is equal to $20,748.

Refer to Table 5.1. Look at the first column at the left, titled "Annual Interest Rate," and find the entry 6%. Then move across that row until you are in the column titled "3 Years." The monthly payment for a $1000 loan is $30.43.

Since the loan required is for $20,748, the value of 30.43 must be multiplied by $20,748 and divided by 1000.

The monthly payment = $\dfrac{30.43 \times \$20,748}{1000} = \$631.36.$

b) Since the loan is for three years and there are 12 months in a year, there are a total of $12 \times 3 = 36$ payments.

The total of the monthly payments at the end of three years
= $631.36 × 36 = $22,728.96.

c) The total cost of the minivan if it is financed at the end of the lease
= down payment + total of all the monthly leasing payments + total cost of financing the guaranteed residual value
= $3275.00 + $12,875.52 + $22,728.96
= $38,879.48

Example 3

Calculate the total purchase price of a new minivan that sells for $28,500 plus PST and GST.

Solution

The total purchase price = $28,500 × 1.12 = $31,920.

Example 4

The minivan of Example 1 is purchased with financing by a five-year loan at 6%. A down payment of $4000 is required.

a) Calculate the monthly finance payment of the minivan.

b) Calculate the deferred finance payment of the minivan.

Solution

a) From Example 3 the total purchase price of the minivan is $31,920.

The loan required = $31,920 − $4000 = $27,920.

Refer to Table 1.1. The monthly payment for a $1000 loan with an amortization period of five years at 6% is $19.34.

The monthly payment = $\frac{19.34 \times \$27,920}{1000} = \$539.97$.

b) Since the loan is for five years and there are 12 months in a year, there are a total of 12 × 5 = 60 payments.

The total amount of payments at the end of five years
= $539.97 × 60 = $32,398.20.

The deferred payment = total down payment + loan payment
= $4000.00 + $32,398.20 = $36,398.20.

The costs of the minivan found in Examples 1 through 4 are the following.

- Leasing and purchasing outright at the end of the lease: $36,898.52
- Leasing and purchasing through financing at the end of the lease: $38,879.48
- Purchasing outright: $31,920.00
- Purchasing it through financing: $36,398.20

Comparing the cost of the minivan in Examples 1 through 4, the least expensive option is purchasing the minivan outright, followed by purchasing through financing. The most expensive option is leasing and purchasing it through financing at the end of the lease.

There are numerous variables to consider when you compare the cost of purchasing to leasing a vehicle. Some of these variables are the down payment, the monthly leasing payment, the guaranteed residual value, and the interest rate. If you have access to the Internet, you can explore the costs of leasing or buying a new vehicle on a variety of websites. To find such a website, search with words like *car buy lease calculator*.

The questions in this lesson include only some of the factors you have to consider when deciding whether to purchase or lease a new vehicle. In order to do a more complete comparison, you have to include additional fees and taxes, as well as the loss of use of the money you pay to purchase the vehicle. You also have to consider special promotions, such as reduced financing on certain vehicles, rebates, and security deposits. As you can see, you need to consider many factors when deciding whether to lease or purchase a car.

The following learning activity includes problems similar to the examples above. Be sure to check your answers.

Learning Activity 5.3

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. If Dave drives at a steady speed of 50 km/h, how long will it take him to drive 10 km?
2. Janice is four times as old as Enrique. If the sum of their ages is 30, how old is Enrique?
3. Evaluate: 65×13
4. There are seven green and six blue balls in a box. If one ball is randomly selected, what is the probability that it is blue?
5. If $x = -1$ and $y = 2$, evaluate the expression: $3x^3 - xy$

Part B: Leasing a New Vehicle

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Make a list of the pros and cons of leasing a vehicle. Are any items on both the pro and the con side?
2. List at least three pros and three cons of purchasing a new vehicle rather than leasing a new vehicle. Refer to the pros and cons of leasing a new vehicle if you need help.

continued

Learning Activity 5.3 (continued)

3. Ida and Viktor Stover have four children. They must decide whether they should purchase a new vehicle or lease a new vehicle. In making this decision, the safety of their children is a very important factor. Also, they want to be environmentally friendly by choosing a green vehicle with lower emissions and better gas mileage. Discuss some of the pros and cons that relate to the Stovers' situation. Should the Stovers purchase or lease a new vehicle?

4. An extended cab truck leases for $229 a month plus taxes for a lease term of 30 months. A down payment of $3500 is required.
   a) Calculate the total lease monthly payment.
   b) Calculate the total lease payment at the end of the lease term.

5. The extended cab truck in Question 4 has a sale price of $20,050. The guaranteed residual value is 75% of the sale price, including taxes.
   a) Calculate the guaranteed residual value, including taxes.
   b) Calculate the total cost if the truck is purchased outright at the end of the lease.
   c) Calculate the difference between the total cost if the cab is purchased outright at the end of the lease and the cost of the cab if it is purchased outright at time of purchase.

6. A sport utility vehicle (SUV) sells for $34,200 plus tax and leases for $348 per month plus tax for a 48-month lease. A down payment of $3500 is required. The guaranteed residual value of the SUV at the end of the lease is $16,526. Determine the total lease payment and the total cost of the SUV if it is purchased at the end of the lease.

7. The minivan in Example 1 of this lesson sells for $28 500 plus tax and leases for $479 per month plus taxes for a lease term of 24 months. A down payment of $3275 is required. The guaranteed residual value of the vehicle has been changed from 65% to 70% of the sales price.
   a) Calculate the total monthly leasing payment.
   b) Calculate the total amount paid by the end of the lease.
   c) Calculate the total residual value of the minivan at 70%, including tax.
   d) Calculate the total cost of the vehicle if it is purchased outright at the end of the lease.
   e) Determine how much increasing the guaranteed residual value from 65% to 70% affects the total cost of a vehicle.

Lesson Summary

In this lesson, you looked at various options available when leasing a new vehicle, and the costs associated with these options. You compared the costs and benefits of leasing versus buying a new vehicle. In the next lesson, you will explore the option of purchasing a used vehicle, which is usually less expensive than buying or leasing a new vehicle.

Be sure to check your answers in the above learning activity before moving on to the following assignment.

It is now time to complete Assignment 5.1. If any material seems challenging to you, be sure to ask your tutor/marker or learning partner for help. Also, make sure your resource sheet is up to date with all definitions and sample solutions for some of the more difficult questions.

Notes

Assignment 5.1

Financing a New Vehicle

Total: 34 marks

1. Anders is trying to decide whether he can afford a new car. The car he wishes to purchase will cost him $109 biweekly. He is currently living in an apartment that costs him $800 a month. Heating costs an additional $50 a month. Anders also has a credit card debt that he is paying off with monthly payments of $90. Anders' gross monthly income is $3700.

   a) Calculate his TDS ratio if he decides to buy the car. *(1 mark)*

   b) Can Anders afford to purchase this car? Explain. *(2 marks)*

   c) Refer to the Vehicle Features Chart from Module 5, Lesson 1. If Anders is concerned about winter driving, what additional features should he purchase with this vehicle? *(1 mark)*

continued

Assignment 5.1: Financing a New Vehicle (continued)

2. Find the Manufacturer's Suggested Retail Price for the following four-door, four-wheel-drive vehicle. The base price is $38,445. Its optional equipment package consists of front heated seats costing $295, heavy-duty trailering equipment costing $275, tires costing $185, and underwoody shield package costing $165. In addition, there is an air-conditioning excise tax of $100 and a destination charge of $820. *(2 marks)*

Base Price		
Optional Equipment:		
Total Options		
Excise Tax (air-conditioning)		
Destination Charge		
Total Price		

3. Max Trucker purchases the four-wheel-drive vehicle in Question 2 from Deal-a-Car Dealership. He receives a trade-in allowance of $8500 for his old car. Calculate the total purchase price of his new vehicle, if, in addition to the PST and GST, he must pay a documentation fee of $149 and a tire tax of $14. *(3 marks)*

continued

Assignment 5.1: Financing a New Vehicle (continued)

4. Max Trucker is able to make a down payment of $3500 on the four-wheel-drive vehicle in Question 3. In order to finance the remaining portion, he takes out a four-year car loan at a fixed interest rate of 9%.

   a) Calculate his monthly payment for the four-wheel-drive vehicle. *(2 marks)*

   b) Calculate his deferred payment for the four-wheel-drive vehicle. *(2 marks)*

   c) Calculate his finance charge for the four-wheel-drive vehicle. *(1 mark)*

5. Explain the difference between purchasing a vehicle outright and purchasing a vehicle through financing. *(2 marks)*

continued

Assignment 5.1: Financing a New Vehicle (continued)

6. The selling price of a two-door sedan is $14 500 plus tax. The monthly lease payment is $203.79 a month plus taxes for a term of 60 months. A down payment of $2175 is required. Financing a loan for the sedan is at $8\frac{1}{2}\%$. The guaranteed residual value is 58% of the selling price before taxes.

   a) Calculate the total cost of leasing the sedan. *(2 marks)*

   b) Calculate the total cost of the sedan if it is purchased outright at the end of the lease. *(2 marks)*

   c) Calculate the total cost of the sedan if it is purchased with financing at the end of the lease. The residual value is financed with a five-year loan. *(2 marks)*

   d) Calculate the finance charge of the loan to pay for the residual value of the sedan. *(1 mark)*

continued

Assignment 5.1: Financing a New Vehicle (continued)

7. Jake wants to purchase a 4 × 4 truck priced at $37,000. A financial institution has offered Jake financing for three years at 8.25%, with a down payment of $4000. This truck can also be leased, with no down payment, for $856 a month including taxes for three years.

   a) Calculate the cost of purchasing the truck outright. *(1 mark)*

   b) Calculate the deferred payment if Jake purchases the truck through financing. *(4 marks)*

   c) At the end of three years, the truck can be sold for 40% of its selling price. How much could Jake get from the sale of his truck at the end of three years? *(1 mark)*

   d) Calculate the cost of leasing the truck for three years. *(1 mark)*

continued

Assignment 5.1: Financing a New Vehicle (continued)

e) If Jake only needed this truck for three years, which financing option would be less expensive—buying the truck outright and then selling it, or leasing? How much cheaper? *(2 marks)*

f) If Jake only needed this truck for three years, which financing option would be less expensive—buying the truck with financing and then selling it, or leasing? How much cheaper? *(2 marks)*

Lesson 3: Purchasing a Used Vehicle

Lesson Focus

In this lesson, you will

- ❑ discover the costs of buying a used vehicle
- ❑ calculate the total cost of purchasing a used vehicle at a licensed automobile dealership
- ❑ calculate the total cost of purchasing a used vehicle privately

Lesson Introduction

In the previous lesson, you looked at the cost of leasing a new vehicle, as well as the cost of purchasing a new vehicle. Another option when purchasing a vehicle is to purchase a used vehicle. Purchasing a used vehicle is a good choice for many consumers because it is usually less expensive.

Depending on your income, the amount you are willing to pay for a vehicle, and your knowledge of vehicles, buying a used vehicle can be an excellent choice. A used vehicle may also be a better choice for younger drivers who may not have a lot of driving experience.

Used Vehicles

A new vehicle depreciates by about 30% of its original value during the first year of ownership. Therefore, you will need to pay only approximately 70% of the new cost when buying a vehicle that is just one year old. While this may make the purchase of a used vehicle seem very attractive, you must also keep in mind the saying "buyer beware" when shopping for a used vehicle. Just as there are many factors to consider when planning to purchase a new vehicle, there are also many factors to consider when you plan to buy a used vehicle.

Costs of Purchasing a Used Vehicle

Listed below are a number of things that need to be done before you buy a used vehicle.

Include all of the following definitions on your resource sheet.

- **Lien search**—a lien search is a search for claims on the car by a creditor (maybe the car owner used the car as security for a debt)
- **Certificate of Inspection**—a procedure in which a vehicle is inspected to ensure that it conforms to regulations governing safety, emissions, or both. In Manitoba, a certificate of inspection, also called a safety inspection, is required before the transfer of a title of a vehicle. This safety inspection cannot be more than one year old. A certificate of inspection covers the following:
  - Brakes
  - Windows
  - Tires
  - Lights
  - Exhaust system
  - Seatbelts
  - Turn signals
  - Horn
  - Other components and systems related to safety and emissions

  If you want to know more about certificates of inspection for vehicles in Manitoba, you can visit the following website:

  www.mpi.mb.ca/english/Registration/reg_Transfers.html#COI
- **Diagnostic test**—An inspection of a vehicle, either at a dealership or at the garage of a certified technician, to determine the quality of the vehicle, and whether the vehicle will require repair work. Some parts of the vehicle that should be inspected include the following:
  - Engine
  - Transmission
  - Suspension
  - Body—to check for evidence of accidents
  - Exhaust system

Before you purchase a used vehicle, you should also be aware of its **book value**. The **book value** of a vehicle is the average monetary value a specific year, make, and model of a vehicle is worth. This is roughly what you can expect to pay for the vehicle, depending on its condition.

Purchasing a Used Vehicle through a Dealership

When you purchase a used vehicle through a dealership, there are no extra costs involved. The dealer has the responsibility to do a lien search and a safety inspection. Dealers are not required to do a diagnostic test. As diagnostic tests cover areas that safety inspections do not, it may be to your advantage to get a diagnostic test done. This is, however, not required before you register a vehicle with Autopac. A certificate of inspection, or a safety inspection, is required before you register a vehicle.

Therefore, the total cost of a used vehicle, purchased at a licensed dealership, is the total of the dealer's price plus PST and GST. If you decide to get a diagnostic test done, you would have to add this to the cost of the vehicle.

Example 1

Jade wants to buy a used vehicle. At the Deal-A-Car dealership, Jade finds two used vehicles that she likes. The first vehicle is a $4500 sedan plus taxes, and the second vehicle is a $5000 SUV plus taxes.

a) Calculate the total purchase price of the sedan.

b) Calculate the total purchase price of the SUV.

c) Jade decides to run a diagnostic test on both vehicles to see which one she should purchase. The diagnostic tests are $50 each. Calculate how much Jane spends on the diagnostic tests.

Solution

a) To calculate the total purchase price of the sedan, you need to find the price of the sedan including tax.

   Total purchase price = $4500 × 1.12 = $5040 for the sedan

b) Total purchase price = $5000 × 1.12 = $5600 for the SUV

c) PST and GST are both charged on diagnostic tests. As Jade gets two diagnostic tests done, the cost will be:

   Total cost = 2 × 50 × 1.12 = $112

Purchasing a Used Vehicle Privately

Calculating the total cost of a vehicle you purchase privately is more complicated. There are additional costs involved and the taxes on these costs are calculated differently.

When you purchase a vehicle privately, you do not pay GST. When you license it, you pay PST on either the book value or the selling price of the vehicle, whichever is greater. It is important that you have a lien search done for the vehicle to check if the owner owns it outright or if there is money owing against it. You are not charged PST or GST for your lien search. It is also important you have a diagnostic test done on the vehicle. Both PST and GST are charged for diagnostic tests.

It is mandatory in Manitoba to have a safety check done on a used vehicle that you have purchased. However, it is recommended that you purchase a vehicle that has already had the safety check done. Only GST is charged for the safety inspection. As well, it is important to have a qualified technician check the vehicle before you make your purchase. Any repairs that have to be done on the vehicle are subject to PST and GST. The following chart will help you to calculate the taxes on a used vehicle purchased privately.

Taxes on Used Vehicle Purchased Privately		
Item	**PST**	**GST**
Price of Vehicle	PST on the greater of the book value or selling price	no GST
Lien Search	no PST	no GST
Diagnostic Test	PST	GST
Safety Inspection	no PST	GST
Repairs on Vehicle	PST	GST

Add this chart to your resource sheet, as it will be a useful tool for you when completing the upcoming learning activities, assignments, and final examination.

Example 2

Oliver is considering purchasing a used automobile from a private owner. The owner is asking $3900 for the vehicle. The lien search Oliver does on the automobile costs $4. He has a diagnostic test done, and it costs $45. The automotive technician tells him that some transmission work is needed, which will cost $1200. The seller has just recently obtained a certificate of inspection.

a) Calculate the total price Oliver will pay for this vehicle if the book value of the automobile is $3400.

b) Calculate the total price Oliver will pay for this vehicle if the book value of the automobile is $4200.

Solution

a) Asking price of the car = $3900

The asking price is higher than the book value of the car; therefore, PST is paid on top of $3900 (the asking price). In Manitoba, PST is 7%.

PST = $3900 × 7%

= $3900 × 0.07

= $273

Total cost of the diagnostic test = diagnostic test + PST + GST

= $45 × 1.12

= $50.40

Total cost of the repairs = repairs + PST + GST

= $1200 × 1.12

= $1344

Lien Search = $4

Safety Inspection = free

Total cost of the car = cost of the car + PST on the asking price of the car + total cost of the diagnostic test + total cost of the repairs + lien search + safety inspection.

= $3900.00 + $273.00 + $50.40 + $1344.00 + $4.00 + $0

= $5571.40

b) Asking price of the car = $3900

In this case, the book value is higher than the asking price. Therefore, PST is paid on top of $4200 (the book value).

= $4200 × 0.07

= $294

The total cost of the diagnostic test, repairs, lien search, and safety inspection are all the same as before.

Total cost of the car = cost of the car + PST on the book value of the car + total cost of the diagnostic test + total cost of the repairs + lien search + safety inspection.

= $3900.00 + $294.00 + $50.40 + $1344.00 + $4.00 + $0

= $5592.40

Example 3

Rhoda Carr is looking for a vehicle. She is considering two vehicles. One of the vehicles she is considering is a used automobile from Deal-a-Car Dealership. The dealership is asking $3500 for the used automobile. The second vehicle Rhoda Carr considers purchasing is a used automobile from a private owner. The owner is asking $2995 for the automobile. The lien search Rhoda has done on the automobile costs her $4. She has a diagnostic test done that costs her $30. The automotive technician tells her that some engine work is required, which will cost $875. The safety inspection will cost her $40. The book value of the automobile is $3500.

a) Calculate the total purchase price of the used automobile from Deal-a-Car Dealership.

b) Calculate the total price Rhoda will pay for the automobile from the private owner.

Solution

a) Total purchase price = $3500 × 1.12 = $3920 from Deal-a-Car Dealership.

b) Asking price of the car = $2995

PST on the book value of the car = 7% × $3500

= $245

Total cost of the diagnostic test = diagnostic test + GST + PST

= $30 × 1.12

= $33.60

Total cost of the repairs = repairs + PST + GST

= $875 × 1.12

= $980

Lien search = $4

Safety inspection = $40 + GST (GST in Manitoba is 5%)

= $40 × 5% + $40

= $40 × 0.05 + $40

= $40 × 1.05

= $42.00

Total cost of the car = cost of the car + PST on the book value of the car + total cost of the diagnostic test + total cost of the repairs + lien search + safety inspection.

= $2995.00 + $245.00 + $33.60 + $980.00 + $4.00 + $42.00

= $4299.60

Note that this amount includes repairs to the car. If this car were purchased at the dealer (#a), it might require the same repairs. The dealer is not required to do a diagnostic test or to inform the buyer about needed repairs.

If you have any trouble understanding these questions, be sure to ask your learning partner or tutor/marker for help.

As you can see, additional costs on used vehicles purchased from private sellers can add up. To ensure that the vehicle you purchase is in good condition, both a safety inspection and a diagnostic test are recommended. Before completing those tests, you can inspect the vehicle yourself.

How to Inspect a Used Vehicle

You don't need to be an expert on vehicles to inspect a car. There are some aspects of a vehicle that anyone can check.

Exterior

- **Paint:** Does the colour match on all parts of the vehicle? Is the paint dull or faded? No used vehicle is going to be perfect, and there may be little chips or dents on the vehicle.
- **Rust**
- **Windshield/Windows:** Look for cracks or scratches. Large cracks or scratches may mean that you will need to replace the glass.

- **Tires:** Check the amount of wear on the tires. If the tire tread is badly worn or is less than two millimetres in depth, you may need to replace the tires.
- **Shock Absorbers:** There is one shock absorber by each tire. To test them, stand by each corner of the car and push the bumper of the car up and down until the car starts bouncing. Stop. If the car bounces more than once or twice, the shock absorbers may need to be replaced.
- **Lights:** Be sure to check all lights, including headlights and taillights, turn signal lights, back-up light, brake lights, and license plate light.

Interior

- **Overall Appearance and Smell**
- **Seats/Belts:** The seats should be easy to adjust. All seatbelts should also work properly.
- **Pedals:** The accelerator, brake, and the clutch (on standard vehicles) may show some signs of wear. However, if the brake or the clutch shows extreme signs of wear, this could signify engine problems. The previous driver may have been a "stop-and-go" driver, which is hard on the engine.
- **Instruments:** Make sure all buttons, knobs, gauges, and instruments in the vehicle work properly.
- **Features:** air conditioner, radio
- **Lights**

Engine

- **Leaks**
- **Under the Hood:** A dirty engine is normal. Wet spots, such as oil, are not.
- **Exhaust:** Exhaust smoke should be slightly white or not visible at all.

Road Test

- **Brakes**, including parking brake
- **Acceleration**
- **Handling**
- **Transmission** (standard vehicles only)

List other aspects of a vehicle that you could check. Ask your learning partner for help if you cannot think of anything on your own.

If too many parts of the vehicle need maintenance or repair, you may want to consider looking for another vehicle. You normally do not want to purchase a used vehicle that will cost you thousands of dollars to repair.

Complete the following learning activity. If you cannot answer the questions, you may need to read through this lesson again. Contact your tutor/marker for help if any material seems difficult.

Learning Activity 5.4

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Janique is paid $5 each time she cuts a log. How much will she be paid if she cuts a log into quarters?

2. When Michelle first woke up, the temperature was −5° C. By the time Michelle got home from school, the temperature was 18° C. How much did the temperature rise during that day?

3. Evaluate: $\left[\left(\frac{3}{4}\right)-\left(\frac{1}{2}\right)\right]+\left[\left(\frac{1}{6}\right)+\left(\frac{5}{3}\right)\right]$

4. You and four friends want to attend a concert. Tickets are $18 each. However, if you all buy your tickets together, tickets only cost $85. How much will each of you save if you buy all of your tickets together?

5. Solve for x: $\frac{9}{6}=\frac{x}{8}$

continued

Learning Activity 5.4 (continued)

Part B: Used Vehicles

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Make an inspection checklist with four subheadings: Exterior, Interior, Engine, and Road Test. Include all the aspects of a vehicle mentioned in this lesson, as well as the ones you came up with. Add extra columns where you can indicate whether each aspect of the vehicle needs work, or if it seems okay.

2. Complete either Part A **or** Part B of this question.

   Part A: Using the inspection checklist you just created, you will inspect a vehicle. This vehicle can either belong to you, your parents, or your friends. If you do not have a driver's licence, the road test section of the checklist can be completed by the owner of the vehicle. They can determine if each item seems okay or if it needs to be checked. After you are done this inspection, pretend that you are interested in purchasing this vehicle. Based on your inspection, does this vehicle seem like a good vehicle to purchase, or does this vehicle require too many repairs?

   Part B: Look carefully at a vehicle or the picture of a vehicle. The picture could be in a newspaper or on the Internet. Using the inspection checklist you have just created, determine which items can be inspected just by looking at the vehicle. What does this tell you about judging a vehicle just by its appearance?

3. Clayton is a young man who lives at home with his parents. He has saved $4000 to buy his first vehicle. He has a part-time job working at a fast food restaurant. Discuss whether Clayton should buy a used vehicle or a new vehicle.

4. Dominique wants to purchase a used truck listed at $7450 plus taxes at a licensed automobile dealership.
   a) Find the total purchase price of this vehicle.
   b) Dominique decides to get a diagnostic test done on this vehicle. This test costs $66. Find the new total purchase price of the vehicle.

continued

Learning Activity 5.4 (continued)

5. Jammille wants to purchase a used two-door sedan that is being sold privately. The price the vendor is asking is $2600. A lien search costs $4. The safety check costs $40. Calculate the total purchase price of the sedan if the book value is $3500.

6. Holly wants to purchase a used car that is being sold privately. The price the vendor is asking is $3600. A lien search costs $4, and a diagnostic test costs $35. The technician reports that the car needs the following repairs: engine work, $50; electrical, $275; suspension, $250; exhaust, $170; and tires, $680. A safety check costs $45.
   a) Calculate the total cost of buying this car if the book value is $3775.
   b) Calculate the total cost of buying this car if the book value is $3500.

7. Ivana Carr has a choice of two cars. The first is a used car sold privately. The price the vendor is asking is $7500 but the book value of the car is $8000. A lien search costs $4. Ivana pays a technician $40 to do a diagnostic test on the car. The technician reports the car needs engine work for $190 and electrical work for $75. A safety check costs $40. The second car Ivana is considering is at a dealership. The dealership is listing the car at $7750.
   a) Calculate the total purchase price of the car sold privately.
   b) Calculate the total purchase price of the car sold at the dealership.
   c) Which car is less expensive and by how much?

Lesson Summary

You have now explored a number of options for obtaining a vehicle. You can

- purchase a new vehicle outright
- finance the purchase a vehicle
- buy a used vehicle
- lease a vehicle
- have the option to purchase your vehicle at the end of a lease

However, there is still more to consider. In the next lesson, you will look at the various costs of owning and operating a vehicle.

Notes

Lesson 4: Costs Associated with Owning a Vehicle

Lesson Focus

In this lesson, you will

- ❑ observe that there are numerous costs associated with vehicle ownership
- ❑ calculate the fuel consumption rate for a vehicle
- ❑ calculate the cost of gasoline used to drive a vehicle
- ❑ calculate the cost of maintaining a vehicle
- ❑ calculate the depreciation in the value of a vehicle
- ❑ explore various repair costs

Lesson Introduction

After purchasing or leasing a vehicle, you must pay the costs of operating it. Not only do you need to fill the gasoline tank, you also need to service it on a regular basis and have repairs done when problems arise. If you look after your vehicle properly, it will last longer, operate more efficiently, require fewer repairs, and retain its value much longer than if you neglect it.

Owning a Vehicle

In this lesson, you will look at the following costs of owning and operating a vehicle:

- the cost of gasoline and the fuel economy of the vehicle
- regular maintenance
- repairs
- depreciation

Fuel Economy of a Vehicle

A major operating cost of a vehicle is the cost of gasoline. Different vehicles require different amounts of gasoline to drive the same distance. **The number of litres of gasoline a vehicle requires to travel 100 kilometres is known as its fuel consumption rate.**

The fuel consumption rate of your vehicle affects your gasoline costs. A **higher fuel consumption rate** corresponds to a higher cost of driving your vehicle a certain distance. A **lower fuel consumption rate** corresponds to a lower cost of driving your vehicle a certain distance.

Be sure to include these definitions on your resource sheet.

For example, a fuel consumption rate of 7.4 L/100 km means that 7.4 litres of gasoline are required to travel 100 kilometres. A fuel consumption rate of 8.5 L/100 km means that 8.5 litres of gasoline are required to travel 100 kilometres.

The fuel consumption rate of your vehicle will vary depending on

- when you drive
- how you drive
- the types of optional equipment installed
- the condition of your vehicle

Most manufacturers voluntarily place a fuel consumption rate label on new vehicles. The labels state the city and highway fuel consumption rates for that particular model. The fuel consumption rate is higher for city driving than highway driving because of stop-and-go city driving. Extra fuel is used while a vehicle is idling during a red light, and while accelerating.

The following is the formula for determining the fuel economy of a vehicle:

$$\text{Fuel consumption rate} = \frac{\text{litres of gasoline required}}{\text{kilometres driven}} \times 100$$

Fuel consumption rate is expressed in L/100 km.

Include this formula on your resource sheet.

Note: The following information is for interest only, and is not part of this course. In the United States, **fuel economy** is measured in miles per gallon, and many Canadians still use the term "gas mileage" to describe fuel economy as miles per (imperial) gallon instead of litres per 100 kilometres. In Canada, to convert from one system to another, divide 282.5 by one system to get the other.

For example:

282.5 ÷ (25 mi/gal) = 11.3 L/100 km, and

282.5 ÷ (8.5 L/100 km) = 33.2 mi/gal

To convert using the US gallon, the conversion factor is 235.

Note again that you do not need to know this material for this course.

Example 1

At 60 kilometres per hour, a sedan uses 18.4 L of gasoline to drive 225 kilometres. At 100 kilometres per hour, the sedan uses 22.1 L of gasoline to drive the same distance.

a) Find the fuel consumption rate for the sedan at 60 kilometres per hour.

b) Find the fuel consumption rate for the sedan at 100 kilometres per hour.

c) Find the percent increase in fuel economy.

Solution

a) $$\text{Fuel consumption rate} = \frac{\text{litres of gasoline required}}{\text{kilometres driven}} \times 100$$

$$= \frac{18.4}{225} \times 100$$

$$= 8.2 \left(\text{rounded to the nearest tenth}\right)$$

The fuel consumption rate at 60 km/h = 8.2 L/100 km.

b) $$\text{Fuel consumption rate} = \frac{\text{litres of gasoline required}}{\text{kilometres driven}} \times 100$$

$$= \frac{22.1}{225} \times 100$$

$$= 9.8 \left(\text{rounded to the nearest tenth}\right)$$

The fuel consumption rate at 100 km/h = 9.8 L/100 km.

c) The increase in fuel consumption rate = 9.8 − 8.2 = 1.6 L/100 km.

You need to find the percent increase in fuel economy. To do this, you need to divide the increase in fuel economy by the lower fuel economy. Multiply this number by 100. This will give you the percentage of how much the fuel consumption has increased compared to the original, lower value.

$$\text{Rate of percent increase} = \frac{1.6}{8.2} \times 100 = 19.5\%$$

Example 2

The odometer of a mid-size car reads 34 719 at the beginning of a trip and 34 853 at the end. The car consumes 12.4 L of gasoline during the trip. Recall that the odometer of a car tells you the total distance (in kilometres) the vehicle has been driven during its entire life.

a) Determine the fuel economy of the sedan.

b) If the cost of gasoline is 112.9¢ per litre, find the cost of driving 100 kilometres.

Solution

a) The number of kilometres driven during the trip = 34 853 − 34 719 = 134.

$$\text{Fuel consumption rate} = \frac{12.4}{134} \times 100 = 9.3$$

The fuel consumption rate for the trip = 9.3 L/100 km.

b) The cost of gasoline = 9.3 × 112.9¢ = 9.3 × \$1.129 = \$10.50

The fuel consumption rate of a vehicle can be used to calculate the number of litres of gasoline required to drive a specified distance.

The number of litres of gasoline required by a vehicle to drive a given distance

$$= \frac{\text{fuel consumption rate of the vehicle}}{100} \times \text{distance}$$

Include this formula on your resource sheet.

Example 3

The Fender family is planning a vacation where they will drive a distance of about 5000 kilometres. The family has two vehicles: a sedan and a van. The fuel consumption rate is 8.8 L/100 km for the sedan and 12.7 L/100 km for the van. The family estimates the cost of gasoline on the vacation to be \$1.15 per litre.

a) Calculate the cost of gasoline required by the sedan.

b) Calculate the cost of gasoline required by the van.

c) Which vehicle is less expensive to drive on the vacation, and by how much?

d) What other factors might the Fender family consider as they decide which vehicle to take on their vacation?

Solution

a) The number of litres of gasoline required by the sedan

$$= \frac{\text{fuel consumption rate of the vehicle}}{100} \times \text{distance}$$

$$= \frac{8.8}{100} \times 5000 = 440 \text{ L}$$

The cost of gasoline required by the sedan = 440 L × \$1.15 = \$506.

b) The number of litres of gasoline required by the van

$$= \frac{12.7}{100} \times 5000 = 635 \text{ L}.$$

The cost of gasoline required by the minivan = 635 L × \$1.15 = \$730.25.

c) The sedan is less expensive to drive on the vacation. The difference in the cost of gasoline = \$730.25 − \$506.00 = \$224.25.

d) Other factors the Fender family might consider are the age, condition, and comfort of the vehicles.

Maintenance

One other operating cost is the regular maintenance of a vehicle. One crucial step in maintaining a vehicle is to make sure it gets a regular oil change. When you purchased your vehicle, you should have received an owner's manual. This will tell you how often your vehicle needs to get an oil change. Also, a light may appear on the dashboard indicating that it is time to change the oil. For most vehicles, oil changes should be done every 3000 to 5000 kilometres or every three months, whichever comes first. When you get the oil changed, the technician should tell you when your vehicle is due for its next oil change.

The following are other tasks that you can do to maintain your vehicle:

- Check the fluid levels
- Change all fluids at intervals suggested by the manufacturer
- Check that your tires are inflated to the proper pressure
- Check for leaks under and around the vehicle

List any other tasks that you can do to maintain your vehicle. Ask your learning partner for help if you cannot think of anything by yourself.

Repairs

When your vehicle breaks down, you need to repair it. The older a vehicle, the more likely it is to need repairs, and the less likely it is to be under warranty. When the cost of the repairs is not covered by warranty, you are the one responsible for the cost of the repairs. However, when the cost of the repairs is covered by warranty, you are not responsible for the cost of the repairs.

Example 4

Find the total cost of servicing a vehicle that requires new brakes for $149.95 and a new starter for $250. The time required for servicing the vehicle is 2.6 hours. The rate the service station charges for labour is $85 an hour.

Solution

The cost of parts = $149.95 + $250.00 = $399.95

The cost of labour = 2.6 × $85 = $221

The cost of parts and labour = $399.95 + $221.00 = $620.95

The cost of parts and labour plus tax = $620.95 × 1.12 = $695.46

The total cost of servicing the vehicle = $695.46

The cost of repairing your vehicle will not always be the same. The cost will depend on the following:

- What is wrong with the vehicle
- The repair facility you take your vehicle to for repairs (or whether you try to fix the vehicle yourself)
- The labour rates in your area
- The year, make, and model of your vehicle (luxury vehicles are usually more expensive to fix!)
- The availability of parts for your vehicle
- How much you are willing to pay for repairs (it is sometimes possible to negotiate for less expensive repair costs)

Vehicle repairs are unavoidable. Sooner or later, something will break or wear out on your vehicle. Therefore, it is useful to know a technician you can count on in the event of a vehicle emergency. You do not want to pay high repair costs to a technician you do not know or trust.

Depreciation

All vehicles lose value as they get older. This is called **depreciation**. There are different ways of calculating depreciation. In this course, depreciation will be calculated at 20% per year. In other words, the resale value of a vehicle is 20% less than the previous year. Write this down on your resource sheet.

Example 5

The sale price of a car is $38,500.

a) Calculate how much the car depreciates in the third year.

b) Calculate the value of the car after the third year.

c) Calculate how much the car depreciates in the first three years.

d) Calculate the percent the car depreciates in the first three years.

Solution

a) Depreciation in the first year = 20% × $38,500 = $7700.

The value of the car after the first year = $38,500 − $7700 = $30,800.

Depreciation in the second year = 20% × $30,800 = $6160.

The value of the car after the second year = $30,800 − $6160 = $24,640.

Depreciation in the third year = 20% × $24,640 = $4928.

Note that in order to find the depreciation in the third year, it is necessary to calculate the depreciation and value of the vehicle for the previous years.

b) Value of the car after the third year = $24,640 − $4928 = $19,712.

c) The amount of depreciation in the first three years = $7700 + $6160 + $4928 = $18,788.

Note that the depreciation in the first three years can also be found by subtracting the value of the car after the third year from the sale price. The depreciation in the first three years = $38,500 − $19,712 = $18,788.

d) Percent the car depreciates in the first three years:

$$= \frac{\text{depreciated value}}{\text{original price}} \times 100$$

$$= \frac{\$18,788}{\$38,500} \times 100 = 48.8\%$$

This car depreciates by almost half of its value in three years. You may have also noticed that a vehicle depreciates more slowly, or by a smaller amount, each year. Why do you think this is?

Each year a vehicle has less value due to depreciation. A vehicle depreciates by 20% a year. Even though the value of a vehicle keeps decreasing, the percentage of depreciation stays the same. Therefore, when you are taking 20% of a smaller number, the result is a smaller amount of depreciation. In other words, a vehicle depreciates by a smaller amount each year.

In Lesson 2, you studied leasing a vehicle. Have you ever wondered how car dealerships determine the guaranteed residual value of a vehicle at the end of a lease? This value is based on the depreciation of the vehicle.

Example 6

A minivan sells for $28,500 and leases for $479 plus taxes per month for a lease term of 24 months. A down payment of $4275 is required. The guaranteed residual value of the vehicle is 65% of the sale price.

a) Calculate the guaranteed residual value of the vehicle.

b) Calculate the value of the depreciated vehicle after two years.

c) How does the value of the depreciated vehicle after two years compare to the guaranteed residual value?

Solution

a) The guaranteed residual value = 65% × $28,500 = $18,525.

b) Depreciation in the first year = 20% × $28,500 = $5700.

The value of the minivan after the first year = $28,500 − $5700 = $22,800.

Depreciation in the second year = 20% × $22,800 = $4560.

The value of the minivan after the second year = $22,800 − $4560 = $18,240.

c) The guaranteed residual value you pay to purchase the minivan when your lease expires is slightly more than the depreciated value of the minivan.

Example 7

Gazz O'Lean purchases a new convertible for $16,980, including all fees and taxes. He makes a down payment of $3500 and finances the remainder with a 36-month loan at $8\frac{1}{4}\%$. During the first year, Gazz drives his convertible 15 045 kilometres. He estimates the fuel economy of his convertible to be 9.6 L/100 km and his average cost of gasoline to be $1.19 per litre.

a) Calculate the total loan payments Gazz makes during the first year he owns his convertible.

b) Calculate the total gasoline costs Gazz has during the first year of driving his convertible.

Solution

a) Monthly payment per \$1000 = \$31.45 (from Table 5.1 in Lesson 1)

Amount of loan = \$16,980 − \$3500 = \$13,480

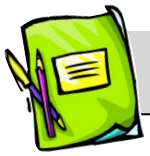
Monthly Payment = \$31.45 × 13.480.00 = \$423.95

Total finance payments for year one = \$423.95 × 12 = \$5087.40

b) Total cost of gasoline for year one = $15\ 045 \times \frac{9.6}{100} \times \$1.19 = \$1718.74$

Now that you have explored the costs of owning a vehicle, including depreciation, you will have more to consider if you wish to purchase a vehicle. As you can see, buying and owning a vehicle is a complex process.

Be sure to complete the following learning activity. Check your answers before completing Assignment 5.2.



Learning Activity 5.5

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Tanner is trying to calculate his Total Debt Service ratio. To do this, he needs to calculate 40% of his income. If Tanner makes \$56,000 a year, what is 40% of his income?
2. Calculate the price including tax of a vehicle on sale for \$24,000.
3. How many months are in seven years?
4. Evaluate: $\left(\frac{4}{5}\right) - \left(\frac{7}{3}\right)$
5. Complete the pattern: 8, 4, 2, 1, $\frac{1}{2}$, $\frac{1}{4}$, ___, ___

continued

Learning Activity 5.5 (continued)

Part B: Vehicle Costs

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. A pickup truck travels 92 km on 10 L of gasoline when driven on a smooth, paved road. The truck is only able to travel 78 km on the same amount of gasoline on a gravel road.
   a) Determine the fuel consumption rate of the truck on the paved road.
   b) Determine the fuel consumption rate of the truck on the gravel road.
   c) What is the percent difference in fuel economy?

2. The fuel consumption rate of a two-door convertible is 8.5 L/100 km.
   a) How many litres of gasoline are required to drive 20 000 kilometres?
   b) If the cost of gasoline averages 119.2¢ per litre, find the cost of driving the convertible 20 000 kilometres.

3. A van requires 46.1 L to drive 380 kilometres.
   a) Determine the fuel consumption rate of the van.
   b) If the cost of gasoline is 118.3¢ per litre, find the cost of driving the van 380 kilometres.

4. Complete Option A **or** Option B.

   Option A: Find the fuel consumption rate of your own vehicle or the vehicle you inspected in Lesson 3. If you cannot drive, let the person who took your vehicle for a road test in Lesson 3 do the driving. To check the fuel economy of the vehicle, follow these steps:

   Step 1. Make sure the gas tank is full before you start driving.

   Step 2. Check the odometer at the beginning of the trip.

   Step 3. Drive 15 km.

   Step 4. At the end of your trip, fill up the gas tank again.

   Step 5. Check the odometer at the end of the trip.

continued

Learning Activity 5.5 (continued)

a) How many litres of gasoline did your vehicle consume? This will be the same number as the number of litres of gas used to fill up your tank.

b) What is the fuel consumption rate of your car?

c) Were you driving in the city or on the highway? If you were driving in the city, what can you say about the highway fuel economy of the vehicle? If you were driving on the highway, what can you say about the city fuel economy of the vehicle?

Option B: Jannie takes her sedan for a drive through the city. At the beginning of her trip, the odometer reads 114 570; at the end of her trip, the odometer reads 114 637.

a) How far did Jannie drive?

b) If Jannie used 16.3 litres of gasoline, what is the fuel consumption rate of her vehicle?

c) Would the highway fuel consumption rate be higher or lower than the rate you found in (b)?

6. Find two estimates for the cost of an oil change near the area where you live. Most dealerships, mechanic shops, and quick service stations do oil changes. It is also possible to get prices online, by phone, or by advertising signs near the above-mentioned places. Are both prices the same? Why do you think one price might be different than the other price?

7. Find the total cost of servicing a vehicle that requires two headlights at $28.50 each, an exhaust pipe at $130, and a muffler and a tail pipe at $55.50. The time required for servicing the vehicle is 1.6 hours. The rate the service station charges for labour is $55 an hour.

8. Find two estimates for the cost of replacing four tires (include the price of the tires and the labour required to replace the tires).

   a) Were these estimates the same?

   b) Did you choose the same type of tire in each instance?

   c) What can you say about repair costs in general?

9. The purchase price of a truck is $24,750.

   a) Calculate how much the truck depreciates in the first two years.

   b) Calculate the percent the truck depreciates in the first two years.

continued

Learning Activity 5.5 (continued)

10. A minivan sells for $22,400 and leases for $316 plus tax per month for a lease term of 24 months. A down payment of $2000 is required. The guaranteed residual value of the vehicle is $14,832.
    a) Calculate the value of the depreciated vehicle after two years.
    b) How does the depreciated value of the vehicle after two years compare to the guaranteed residual value?

Lesson Summary

In this lesson, you looked at the costs of owning and operating a vehicle. These costs included the fuel, maintenance and regular service, repairs, and depreciation. As you can see, vehicles can be expensive to purchase and maintain. However, you may decide that the freedom and convenience you gain by owning a vehicle are well worth the expense.

There is still another cost involved in owning a vehicle! In the next lesson, you will study vehicle insurance.

It is now time to complete Assignment 5.2. If any material seems challenging to you, be sure to ask your tutor/marker or learning partner for help. Also, make sure your resource sheet is up to date with all definitions and sample solutions for some of the more difficult questions.

Assignment 5.2

Used Vehicles and Using Vehicles

Total: 41 marks

1. Calculate the total purchase price of a used mid-size automobile sold privately. The price the vendor is asking is $5500. A diagnostic test costs $35. The mechanic reports the automobile does not need any repairs. A safety check costs $40. The lien search costs $4. The book value of the automobile is $5850. *(5 marks)*

2. Lisa Carr is comparing the cost of leasing a new vehicle with the cost of purchasing a used vehicle. The new vehicle she is considering leasing sells for $18,500 and leases for $298.98 per month plus taxes for a lease term of 36 months. There is no down payment required. The guaranteed residual value of the vehicle is $10,175.

   Lisa is also considering buying a used vehicle listed at $10,950 plus taxes from a dealership. In order to purchase the vehicle, Lisa would have to take out a three-year loan at 8%. *(10 marks)*

   a) Calculate the total monthly leasing payment of the new vehicle.

   b) Calculate the total amount paid by the end of the lease on the new vehicle.

   c) Calculate the total residual value of the new vehicle, including taxes.

continued

Assignment 5.2: Used Vehicles and Using Vehicles (continued)

d) Calculate the total cost of the vehicle if it is purchased outright at the end of the lease.

e) Calculate the total purchase price of the used vehicle sold at the dealership.

f) Calculate the monthly loan payment on the used vehicle.

g) Calculate the total cost of the used vehicle if it is purchased through financing.

h) How do the monthly leasing payments compare to the monthly finance payments?

i) What are the advantages of leasing? What are the advantages of purchasing a used vehicle?

continued

Assignment 5.2: Used Vehicles and Using Vehicles (continued)

3. In the city, a sport utility vehicle (SUV) requires 29.8 L to travel a distance of 250 km. On the highway, the SUV requires 31.8 L to travel a distance of 340 km. *(4 marks)*
   a) Determine the fuel consumption rate of the SUV in the city.

   b) Determine the fuel consumption rate of the SUV on the highway.

   c) What is the percent difference in fuel consumption rates?

4. Phil Pheul leases a car for $529 per month plus taxes for a lease term of 24 months. At the end of the first year, Phil has driven 18 431 kilometres. He estimates the fuel consumption rate for the car to be 12.8 L/100 km and his average cost of gasoline to be $1.19 per litre. *(4 marks)*
   a) Calculate the total lease payments Phil makes during the first year of leasing the car.

   b) Calculate Phil's total gasoline costs during his first year of driving the car.

continued

Assignment 5.2: Used Vehicles and Using Vehicles (continued)

5. Find the total cost including taxes of servicing a vehicle that requires two litres of oil at $2.10 per litre, two wiper blades at $3.50 a pair, and two fan belts at $29.50 each. The time required for servicing the vehicle is 0.8 hour. The rate the service station charges for labour is $70 an hour. *(3 marks)*

6. The purchase price of a mid-size automobile is $18,980. *(6 marks)*
   a) Calculate how much the automobile depreciates in the fourth year.

   b) Calculate the value of the automobile after the fourth year.

continued

Assignment 5.2: Used Vehicles and Using Vehicles (continued)

7. A sport utility vehicle (SUV) sells for $34,200 and leases for $348 plus tax per month for a lease term of 24 months. A down payment of $3500 is required. The guaranteed residual value of the vehicle is $22 126. *(4 marks)*

   a) Calculate the value of the depreciated vehicle after two years.

   b) How does the depreciated value of the vehicle after two years compare to the guaranteed residual value?

8. Otto Ryde purchases a used sports car on December 31, 2011, for $9500. During the year 2012 he drives 15,000 kilometres. If the fuel consumption of the sports car is 8.9 L/100 km, and his average cost of gasoline during the year is $1.24 per litre, calculate the following:

   a) the cost of gasoline during the year 2012 *(1 mark)*

   b) the depreciation of the sports car during 2013 *(2 marks)*

continued

Assignment 5.2: Used Vehicles and Using Vehicles (continued)

9. A young automotive technician wants to purchase a vehicle. He is debating whether to buy a used vehicle or a new vehicle. Discuss some factors that may influence this young technician's decision to buy a new or used vehicle. *(2 marks)*

Lesson 5: Insuring a Vehicle

Lesson Focus

In this lesson, you will

- ❑ learn how Autopac works
- ❑ calculate the basic costs of insuring an all-purpose passenger vehicle
- ❑ calculate the basic costs of insuring a pleasure passenger vehicle

Lesson Introduction

In the past four lessons, you have learned how to lease or purchase a vehicle and how to maintain that vehicle. What happens if you get into an accident? It is almost impossible to predict when or if you are going to have an accident. Therefore, having vehicle insurance is a necessity. Vehicle insurance protects you from having to pay large amounts of money to get your vehicle repaired. Vehicle insurance also protects you from having to pay the health care costs of anyone injured in an accident.

Vehicle Insurance

If you live in Manitoba and own a vehicle, you need vehicle insurance. Manitoba Public Insurance (MPI) provides basic automobile insurance for all Manitobans. This program is called Autopac. MPI is a not-for-profit Crown corporation, accountable to the people of Manitoba through the provincial government.

Autopac is vehicle insurance that

- compensates you for your vehicle's damage and for your injuries
- compensates others for damage and injuries when the accident is your fault

In other provinces, such as Alberta, vehicle insurance is distributed through private companies, which results in a greater variety of insurance rates.

Include all of the following definitions on your resource sheet.

Autopac Coverage

When you buy Autopac insurance, you must at least buy the **basic coverage**, which consists of Basic All Perils Coverage, a Personal Injury Protection Plan, and Basic Third Party Liability.

- **Basic All Perils Coverage** compensates Manitobans against accidental loss or damage to their vehicles that occurs in Canada or the United States.
- **The Personal Injury Protection Plan** compensates Manitobans for specific costs they may have sustained from injuries or death caused by a vehicle. It does not matter who is at fault or whether the accident occurred in Canada or the United States.
- **Basic Third Party Liability** provides Manitobans with up to $200,000 of coverage for claims made against them. These claims can be for damage their vehicle caused to someone else's vehicle and/or injuries to another individual in an accident outside of Manitoba.

In addition to Basic Autopac coverage, Manitobans can also buy **optional insurance**, which is extra insurance protection for

- Third Party Liability coverage
- insuring a vehicle for more than basic maximum insured value
- reducing the deductible

Your **deductible** is the amount you are responsible for paying if you are at fault, or if your vehicle is stolen. Your Autopac insurance covers the amount over your deductible.

An **Autopac claim** is made when you have an accident, there is damage done to your vehicle, or your vehicle is stolen. To make an Autopac claim, you need to report all of the relevant information about the incident to Autopac. After assessing the damage, Autopac will tell you the amount of your coverage and how much you need to pay out of your pocket. The amount you need to pay is usually the amount of your deductible.

Paying for Your Autopac

In Manitoba, Autopac is not free; however, it is a necessity if you plan to own and drive a vehicle in Manitoba. In order to have Autopac coverage, you need to pay a yearly fee. This yearly fee is called your **Autopac rate**. Your Autopac rate depends on the following four factors:

1. **Where you live**
2. **Vehicle use**
3. **Vehicle type**
4. **Your driving record**

1. Where you live

To set Autopac rates, Manitoba is divided into the following four territories:

- *Territory 1*

  Winnipeg (includes St. Norbert, Headingley, East and West St. Paul)

- *Territory 2*

  All areas south of the 53rd parallel except for Territory 1 (includes Portage la Prairie, Brandon, and Dauphin)

- *Territory 3*

  All areas north of the 55th parallel (includes Thompson, Lynn Lake, and Churchill)

- *Territory 4*

  The area north of the 53rd parallel and south of the 55th parallel (includes Flin Flon, The Pas, and Grand Rapids)

Include the definitions of these territories on your resource sheet.

2. Vehicle use

How you use your vehicle affects how likely you are to have an accident, and therefore how likely you are to make an Autopac claim.

Autopac has many categories for vehicle use. In this course, you are only responsible for learning the following two categories:

- The **all-purpose passenger vehicle** can be used for pleasure driving, for driving to and from work or school, and for business purposes.
- The **pleasure passenger vehicle** has limited business use. It can only be driven to or from—or partway to or from—work or school up to four days in one month and not more than 1609 kilometres a year. However, it can be used to drive dependent children to and from school without limits.

3. Vehicle type

The third factor that affects your Autopac rate is the make, model, and year of your vehicle. This is because some vehicles are more expensive to repair or replace than others, and some vehicles are more frequently stolen than others. Also, vehicle characteristics such as engine size, passenger protection features such as air bags, and repair costs all affect the cost of your insurance.

MPI uses the Canadian Loss Experience Automobile Rating (CLEAR) system, developed by the Insurance Bureau of Canada (IBC), to group cars and vans. The IBC collects information about vehicles involved in accidents and the cost of claims from these accidents. Cars and vans with similar claim costs and claim risks are placed into the same rating group.

The rating of vehicles is given in the *Rate Application 2011*, published by MPI. Included in this lesson are some pages taken from the *Rate Application 2011*. You will use these pages to find the Autopac rates of vehicles given in this lesson.

4. Your driving record

The best Autopac rates in a group are for drivers who have maintained a safe driving record for a number of years. You are entitled to a discount rate if you meet the following three conditions:

1. You have at least one year of claim-free driving.
2. You have at least one **merit point** on your valid Manitoba driver's licence. You can obtain merit points for safe driving, and you can also lose merits for unsafe driving. If you get into many accidents or have many traffic convictions, you may have a negative number of merits. Negative merit points are called **demerits**.
3. You have not been convicted for a major offence within a certain time period.

As of 2009, Manitoba uses the **Driver Safety Rating scale** to determine the amount of your Autopac rate discount. Your **Driver Safety Rating** is your position on a scale with 36 levels. Your level on this scale depends on how many merits you have.

- Each at-fault accident in the past year lowers your Driver Safety Rating by five levels. In other words, you lose five merits for every at-fault accident. An **"at fault" accident** is one for which you are found 50% or more responsible.
- Each year of safe driving moves you one level up the Driver Safety Rating scale. In other words, you gain one merit for each year of safe driving.

The higher you are on the scale, the less you pay for your Autopac. The lower you are on the scale, the more you pay for your Autopac. However, regardless of how low you are on the scale, your Autopac rates will not be above the values given in the *Rate Application 2011*.

The following Driver Safety Rating Chart displays how each merit level affects your Autopac discount. You can find tables similar to this one online at www.mpi.mb.ca/en/DL/DL/DSR/pages/dsroverview.aspx.

Driver Safety Rating Chart	
Merits for Safe Driving	**Autopac Discount**
+15	33%
+14	30%
+13	29%
+12	28%
+11	27%
+10	26%
+9	25%
+8	25%
+7	25%
+6	20%
+5	15%
+4	15%
+3	10%
+2	10%
+1	5%
0 (base)	0%
−1	0%
−2	0%
−3	0%
−4	0%
−5	0%
−6	0%
−7	0%
−8	0%
−9	0%
−10	0%
−11	0%
−12	0%
−13	0%
−14	0%
−15	0%
−16	0%
−17	0%
−18	0%
−19	0%
−20	0%

If you want more information about Autopac, you can obtain the booklet *Your Guide to Autopac*, available from MPI. At the time this course was printed, this booklet could be found online at www.mpi.mb.ca/en/PDFs/PolicyGuide2014.pdf. If the link no longer works, try searching for a newer version from the MPI home page.

There are thousands of vehicles on the road, and every year the Autopac rates, or vehicle insurance rates, change for each vehicle. However, the process of calculating insurance remains the same. In this lesson, you will become familiar with this process by computing the 2011 Autopac rates for a number of vehicles.

To find the Autopac rate of a vehicle, use the following steps:

1. Find the rating of the vehicle under consideration. To do this, refer to the pages from the 2011 Passenger Vehicle Rate Groups Table included at the end of this module. There are 35 rating groups given.
2. Refer to the 2011 Basic Rate Table included in this lesson. Find the Autopac rate of a vehicle with a particular rating in a particular territory, corresponding to a specific discount and for a specific use. Tables for pleasure passenger vehicles and all-purpose vehicles are given for each rating group in each of the four territories with each level of merit discount.

The following example will illustrate how to use both the 2011 Passenger Vehicle Rate Groups table and the 2011 Basic Rate Table to compute Autopac rates. It would be a good idea for you to copy one of these examples and solutions onto your resource sheet so that you can refer back to it later.

Example 1

Suzanne is a motorist living in Territory 3 who owns a 2009 Chrysler PT Cruiser LX. She uses the vehicle both for driving to work and for personal use. She has two merit points. Calculate her 2011 Autopac rate.

Solution

Refer to the 2011 Passenger Vehicle Rate Groups Table. Locate the Chrysler PT Cruiser LX. The rating group for a 2009 vehicle is 29.

Refer to the 2011 Basic Rate Table listing the 2011 Autopac rates. Suzanne uses this vehicle for work and personal use. This is classified as an all-purpose passenger vehicle. Also note that Suzanne lives in Territory 3.

The first column in the 2011 Basic Rate Table is divided into categories based on the territory you live in. Locate the Territory 3 category.

The second column is divided into categories based on the discount you receive. Suzanne has two merits. Based on the Driver Safety Rating Chart, she receives a discount of 10%.

The third column is divided into categories based on the use of a vehicle. Suzanne uses this vehicle as an all-purpose passenger vehicle.

Once you have found the row corresponding to Territory 3, a 10% discount and an all-purpose passenger vehicle, move across the row to find rating group 29. The 2011 Autopac rate for a 10% discount on an all-purpose passenger vehicle with a rating group of 29 is **$1654**.

This 2011 Autopac rate is based on basic Autopac coverage. Basic coverage includes a deductible of $500 and Third Party Liability coverage of $200,000. If Suzanne wanted optional Autopac coverage, such as a lower deductible, or increased Third Party Liability coverage, she would have to pay more.

Example 2

Jacob is a motorist living in Flin Flon. He owns a 2011 Ford Fiesta SE four-door hatchback. He uses the vehicle for personal use. He has 6 demerits. Calculate his 2011 Autopac rate.

Solution

Refer to the 2011 Passenger Vehicle Rate Groups table. Locate the Ford Fiesta SE four-door hatchback. The rating group for a 2011 vehicle is 31.

Refer to the 2011 Basic Rate Table listing the 2011 Autopac premiums. Jacob just uses this vehicle for personal use. This is classified as a pleasure passenger vehicle. Also, Jacob lives in Flin Flon, which is in Territory 4.

Now, Jacob has 6 demerits. This is the same as having negative six merits. Based on the Driver Safety Rating Chart, he receives a discount of 0%.

Locate the row for Territory 4, with a discount of 0% for a Pleasure Passenger Vehicle. Move across the row to find rating group 31. The 2011 Autopac rate for a 0% discount in a rating group of 31 is **$1579**.

Example 3

A motorist in Territory 2 owns a 2010 four-door Toyota Camry LE V6. She uses the vehicle for business and personal use. She has 14 merit points. The sale price of the vehicle in 2010 was $23,800 including all fees and taxes, which the motorist financed. She made a down payment of $5000 on the vehicle and financed the remaining amount with a four-year car loan at a fixed interest rate of 8½%. The gasoline costs of the vehicle for the year 2011 are $1769, while the maintenance and repair costs are $190.

a) Calculate her 2011 Autopac rate.

b) Calculate her total loan payments for the year 2011.

c) Calculate the depreciation of the vehicle during the year 2011.

d) Calculate the total cost of the vehicle during the year 2011.

Solution

a) The Rating Group for a 2010 four-door Toyota Camry LE V6 is 27. The motorist has 14 merit points, which corresponds to a discount of 30%. The 2011 Autopac rate for an all-purpose passenger vehicle in rating group 27 and in Territory 2 with a discount of 30% is $981.

b) Amount of loan = $23,800 − $5000 = $18,800

Monthly payment per $1000 = $24.65 (from Table 5.1)

Monthly payment = $24.65 × 18.800 = $463.42

Total monthly payments for 2011 = $463.42 × 12 = $5561.04

c) Depreciation (2010) = 0.2 × $23,800 = $4760

New value = $23,800 − $4760 = $19,040

Depreciation (2011) = 0.2 × $19,040 = $3808

d) Total cost = $981.00 + $5561.04 + $3808.00 + $1769.00 + $190.00 = $12,309.04

Learning Activity 5.6

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Charlise sees a vehicle priced at $27,500. If Charlise has a down payment of $5250, what is the size of her loan?
2. Shantelle is buying meat for a family reunion. She bought $8\frac{3}{4}$ pounds of hamburger, 20.25 pounds of chicken, and 9.5 pounds of steak. How many pounds of meat did Shantelle buy?
3. On a math test, 22 students earned an A. This number is 20% of the total number of students in the class. How many students are in the class?
4. Evaluate: $3 \times 5 + 6 - \frac{8}{2}$
5. Calculate 11% of 3410.

continued

Learning Activity 5.6 (continued)

Part B: Vehicle Insurance

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Compare the cost of insuring a vehicle for pleasure use and insuring a vehicle for all purpose use in Territory 1.
   a) In which instance is the Autopac rate more expensive? Why do you think this is so?
   b) Is this true for all territories?
2. Compare the cost of insuring an all-purpose passenger vehicle in different territories, if the driver has a 0% discount.
   a) Which territory has the most expensive 2011 Autopac rates?
   b) Which territory has the least expensive 2011 Autopac rates?
   c) Why do you think Autopac rates are different in different territories?
3. Demarco is a motorist living in Territory 1. He owns a 2007 Dodge Nitro RT. He uses the vehicle for personal use only. He has 9 merit points. Calculate his 2011 Autopac rate.
4. Laqueta is a motorist living in Territory 3. She owns a 2009 Honda Civic Hybrid. She uses the vehicle for work and personal reasons. She currently has 0 merit points.
   a) Calculate her 2011 Autopac rate.
   b) If she obtains one more merit from safe driving this year, what will be her Autopac rate next year? Assume the rates stay the same and still use the 2011 Basic Rate Table.
   c) By how much does her Autopac rate decrease?
5. Desmond is a motorist living in Grand Rapids. He drives a 2008 diesel Jeep Grand Cherokee Limited six-cylinder, two-wheel-drive (2 WDR) vehicle. He has 6 demerits and uses this vehicle for driving to work, school, and for pleasure. Calculate his 2011 Autopac rate.

continued

Learning Activity 5.6 (continued)

6. Rosalie is a motorist living in Territory 3. She owns a 2010 Mazda3 GS. She uses the vehicle only for personal use. She has three merit points. The sale price of the vehicle, which Rosalie purchased outright in 2010, was $15,600. The gasoline costs of the vehicle for the year 2011 are $1375, while the maintenance and repair costs are $280.
   a) Calculate her 2011 Autopac rate.
   b) Calculate the depreciation of the vehicle during the year 2011.
   c) Calculate the total cost of the vehicle during the year 2011.

Lesson Summary

You have now studied the costs involved in buying, maintaining, and insuring a vehicle!

Insuring your vehicle is a necessary cost when you own a vehicle. It is not legal to operate a motor vehicle in Manitoba without insurance. Even though vehicle insurance may be expensive, having an accident and not having insurance would likely be much more expensive. Not only would you have to pay for the repair of your own vehicle, but, if you were at fault, you would have to pay compensation for injuries and property damage for anyone else involved in the accident. Most people would go bankrupt if they were required to pay this.

It is now time to complete Assignment 5.3. If any material seems challenging to you, be sure to ask your tutor/marker or learning partner for help. Also, make sure your resource sheet is up to date with all definitions and sample solutions for some of the more difficult questions.

Assignment 5.3

Insurance Costs

Total: 21 marks

1. Use the 2011 Basic Rate Table and the 2011 Passenger Vehicle Rate Groups table to answer the following questions:
   a) Do vehicles with lower ratings or higher ratings generally have a more expensive Autopac rate? *(1 mark)*

   b) Consider the table. If you wanted to purchase a vehicle with a less expensive Autopac rate, should you buy a newer vehicle or an older vehicle? Explain. *(2 marks)*

2. Vincenzo is a motorist living in Territory 1. He owns a 2011 Toyota Camry Hybrid. He uses the vehicle for personal use only. He has 7 merit points. Calculate his 2011 rate. *(2 marks)*

continued

Assignment 5.3: Insurance Costs (continued)

3. Brandi is a motorist living in Territory 3. She owns a 2010 Chrysler Sebring Limited retractable hardtop. She uses the vehicle for work and personal reasons. She currently has 2 merit points.

   a) Calculate her 2011 Autopac rate. *(2 marks)*

   b) If she obtains one more merit from safe driving this year, what will be her Autopac rate next year? Assume the rates stay the same and still use the 2011 Basic Rate Table. *(1 mark)*

4. Nicoli is a motorist living in Dauphin. He drives a 2010 Mazda3 Sport GX. He has 10 demerits and uses this vehicle for driving to work, school, and for pleasure. Calculate his 2011 Autopac rate. *(3 marks)*

continued

Assignment 5.3: Insurance Costs (continued)

5. Sancha is a motorist living in Territory 2. She owns a 2010 Jeep Compass Limited four-wheel-drive vehicle. She uses the vehicle only for personal use. She has four merit points. The sale price of the vehicle, which Sancha purchased through financing in 2010, was $25,900 including all fees and taxes. She made a down payment of $2500 on the vehicle and financed the remaining amount with a three-year car loan at a fixed interest rate of 8.75%. The gasoline costs of the vehicle for the year 2011 are $1995, while the maintenance and repair costs are $140.

   a) Calculate her 2011 Autopac rate. *(3 marks)*

   b) Calculate her loan payments for the year 2011. *(3 marks)*

   c) Calculate the depreciation of the vehicle during the year 2011. *(3 marks)*

   d) Calculate the total cost of the vehicle during the year 2011. *(1 mark)*

Notes

Module 5 Summary

In this module, you studied the responsibilities and costs of owning and operating a vehicle in Manitoba. The topics studied included

- purchasing a new vehicle
- leasing a new vehicle
- purchasing a vehicle at the end of the term of a lease
- purchasing a used vehicle
  - from a licensed dealer
  - privately
- the cost of financing the purchase of a vehicle
- maintaining and servicing a vehicle
- depreciation
- Autopac insurance for "All Purpose" and "Pleasure" use in different parts of Manitoba

In the next module, you are asked to complete a Career Life project. Now that you have studied Home Finance, Business Finance, and Vehicle Finance, you should be well prepared to complete the next module. If you haven't done so already, start thinking about the types of careers that interest you. In the next module, you will be looking further into *two* possible career choices.

Submitting Your Assignments

It is now time for you to submit the Module 5 Cover Assignment and Assignments 5.1 to 5.3 to the Distance Learning Unit so that you can receive some feedback on how you are doing in this course. Remember that you must submit all the assignments in this course before you can receive your credit.

Make sure you have completed all parts of your Module 5 assignments and organize your material in the following order:

- ❑ Module 5 Cover Sheet (found at the end of the course Introduction)
- ❑ Module 5 Cover Assignment: Vehicle Analysis
- ❑ Assignment 5.1: Financing a New Vehicle
- ❑ Assignment 5.2: Used Vehicles and Using Vehicles
- ❑ Assignment 5.3: Insurance Costs

For instructions on submitting your assignments, refer to How to Submit Assignments in the course Introduction.

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
CHRYSLER	PT CRUISER LX	4 Door Hatchback	4	Gas	2	2757	Regular	1730025374			29	28												
CHRYSLER	PT CRUISER TOURING	Convertible	4	Gas	2	2765	Regular	1730006011					22	21	19									
CHRYSLER	PT CRUISER TOURING EDITION	4 Door	4	Gas	2	2757	Regular	1730004108							25	23	21	19						
CHRYSLER	PT CRUISER TOURING EDITION	4 Door Hatchback	4	Gas	2	2757	Regular	1730009863			29	28	27	26	25	23	21	19						
CHRYSLER	PT CRUISER TURBO	4 Door	4	Gas	2	2767	Regular	1730006582							30									
CHRYSLER	PT CRUISER TURBO	4 Door Hatchback	4	Gas	2	2767	Regular	1730009864						31	30									
CHRYSLER	SEBRING	2 Door	4	Gas	2	1456	Regular	1730015185							31	30								
CHRYSLER	SEBRING	4 Door	4	Gas	2	1189	Regular	1730005334					26	25	25	23								
CHRYSLER	SEBRING	4 Door	6	Gas	2	1189	Regular	1730005335					26	25	25	23								
CHRYSLER	SEBRING	Convertible	4	Gas	2	1114	Regular	1730012862						31	30									
CHRYSLER	SEBRING	Convertible	6	Gas	2	1114	Regular	1730005750						31	30	28								
CHRYSLER	SEBRING GTC	Convertible	6	Gas	2	1171	Regular	1730004109				27		30	29	27	26	24						
CHRYSLER	SEBRING JX	Convertible	4	Gas	2	1171	Regular	1730000332													17	14	12	11
CHRYSLER	SEBRING JX	Convertible	6	Gas	2	1171	Regular	224982												20	17	14	12	11
CHRYSLER	SEBRING JXI	Convertible	6	Gas	2	1172	Regular	224995												19	19	16	14	10
CHRYSLER	SEBRING JXI LIMITED	Convertible	6	Gas	2	1172	Regular	1730022191												19				
CHRYSLER	SEBRING LIMITED	2 Door	6	Gas	2	1169	Regular	1730021930							31	31								
CHRYSLER	SEBRING LIMITED	4 Door	4	Gas	2	1190	Regular	1730022761				28												
CHRYSLER	SEBRING LIMITED	4 Door	6	Gas	2	1190	Regular	1730005336	28	28	28	27	27	26	24									
CHRYSLER	SEBRING LIMITED	4 Door	6	Gas	4	1471	Regular	1730022762			29													
CHRYSLER	SEBRING LIMITED	Convertible	6	Gas	2	1172	Regular	1730001543	30	30	30		27	27	26	25	22	21						
CHRYSLER	SEBRING LIMITED	Retractable Hard Top	6	Gas	2	1172	Regular	1730024813	30	30	30													
CHRYSLER	SEBRING LX	2 Door	4	Gas	2	1168	Regular	27051											29				15	13
CHRYSLER	SEBRING LX	2 Door	6	Gas	2	1168	Regular	27052									32	31	29	28	22	19	15	13
CHRYSLER	SEBRING LX	4 Door	4	Gas	2	1175	Regular	1730002102	28	28	27					23	22	20	21					
CHRYSLER	SEBRING LX	4 Door	6	Gas	2	1175	Regular	1730002103								23	22	20	21					
CHRYSLER	SEBRING LX	Convertible	4	Gas	2	1171	Regular	1730015186	27	28	27					27								
CHRYSLER	SEBRING LX	Convertible	6	Gas	2	1171	Regular	1730001541	27	28	27				29	27	26	24	22					
CHRYSLER	SEBRING LXI	2 Door	6	Gas	2	1169	Regular	27053									32	32	31	27	24	21	17	15
CHRYSLER	SEBRING LXI	4 Door	6	Gas	2	1176	Regular	1730002104								24	23	22	23					
CHRYSLER	SEBRING LXI	Convertible	6	Gas	2	1172	Regular	1730001542						27	27	26	25	22	21					
CHRYSLER	SEBRING TOURING	4 Door	4	Gas	2	1190	Regular	1730022763				28												
CHRYSLER	SEBRING TOURING	4 Door	6	Gas	2	1190	Regular	1730005337	28	28	28	27	27	26	24									
CHRYSLER	SEBRING TOURING	Convertible	6	Gas	2	1172	Regular	1730006583	30	30	30			27	27	26								

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
DODGE	NEON EX	2 Door	4	Gas	2	2262	Regular	226736													18	16	14	10
DODGE	NEON EX	4 Door	4	Gas	2	2261	Regular	1730000404													18			
DODGE	NEON HIGHLINE	2 Door	4	Gas	2	2262	Regular	2210													18	16	14	10
DODGE	NEON HIGHLINE	4 Door	4	Gas	2	2261	Regular	2211													18	16	14	12
DODGE	NEON R/T	4 Door	4	Gas	2	2261	Regular	1730002671							30	29	28	25	24					
DODGE	NEON SE	4 Door	4	Gas	2	2261	Regular	1730004113							30	29	28							
DODGE	NEON SPORT	2 Door	4	Gas	2	2262	Regular	2215													18	16	14	10
DODGE	NEON SPORT	4 Door	4	Gas	2	2261	Regular	2216													18	16	14	12
DODGE	NEON SXT	4 Door	4	Gas	2	2261	Regular	1730004114							30	29	28							
DODGE	NITRO RT	Sport Utility 4 Door	6	Gas	4	2812	Regular	1730014870			30	29	27											
DODGE	NITRO SE	Sport Utility 4 Door	6	Gas	2	2810	Regular	1730014871			26	24	22											
DODGE	NITRO SE	Sport Utility 4 Door	6	Gas	4	2811	Regular	1730014872		30	29	29	28											
DODGE	NITRO SLT	Sport Utility 4 Door	6	Gas	2	2810	Regular	1730015191					22											
DODGE	NITRO SLT	Sport Utility 4 Door	6	Gas	4	2811	Regular	1730014873			29	29	28											
DODGE	NITRO SXT	Sport Utility 4 Door	6	Gas	2	2810	Regular	1730014874			26	24	22											
DODGE	NITRO SXT	Sport Utility 4 Door	6	Gas	4	2811	Regular	1730014875		30	29	29	28											
DODGE	OMNI	2 Door	4	Gas	2	2339	Regular	1341																
DODGE	OMNI	2 Door Hatchback	4	Gas	2	2339	Regular	1730005755																
DODGE	OMNI	4 Door	4	Gas	2	2341	Regular	1342																
DODGE	OMNI	4 Door Hatchback	4	Gas	2	2341	Regular	1730005431																
DODGE	OMNI 024	2 Door Hatchback	4	Gas	2	2328	Regular	1730005432																
DODGE	OMNI CUSTOM	4 Door	4	Gas	2	2341	Regular	1551																
DODGE	OMNI CUSTOM	4 Door Hatchback	4	Gas	2	2341	Regular	1730005433																
DODGE	OMNI GLH	4 Door	4	Gas	2	2341	Regular	2783																
DODGE	OMNI SE	4 Door	4	Gas	2	2341	Regular	1658																
DODGE	OMNI SE	4 Door Hatchback	4	Gas	2	2341	Regular	1730006773																
DODGE	POLARA	2 Door	6	Gas	2	2228	Regular	1730022192																
DODGE	POLARA	2 Door	8	Gas	2	2228	Regular	1730001345																
DODGE	POLARA	4 Door	8	Gas	2	2230	Regular	1730001346																
DODGE	POLARA	Convertible	8	Gas	2	2228	Regular	1730001347																
DODGE	POLARA	Station Wagon	8	Gas	2	2229	Regular	1730001348																
DODGE	RAIDER	Sport Utility 2 Door	4	Gas	4	2651	Regular	2921																
DODGE	RAIDER	Sport Utility 2 Door	6	Gas	4	2651	Regular	2922																
DODGE	RAM VAN 1500	Passenger Van	6	Gas	2	2746	Regular	224959											10	9	7	6	5	3

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
FORD	FIESTA	2 Door Hatchback	4	Gas	2	3709	Regular	1730006791																
FORD	FIESTA	4 Door	4	Gas	2	3709	Regular	723																
FORD	FIESTA S	4 Door	4	Gas	2	3792	Regular	1762106921	26															
FORD	FIESTA SE	4 Door	4	Gas	2	3793	Regular	1762106922	30															
FORD	FIESTA SE	4 Door Hatchback	4	Gas	2	3794	Regular	1762106923	31															
FORD	FIESTA SEL	4 Door	4	Gas	2	3793	Regular	1762106924	30															
FORD	FIESTA SES	4 Door Hatchback	4	Gas	2	3794	Regular	1762106925	31															
FORD	FIVE HUNDRED LIMITED	4 Door	6	Gas	2	9011	Regular	1730007192					24	23	22									
FORD	FIVE HUNDRED LIMITED	4 Door	6	Gas	4	9013	Regular	1730007193					27	27	26									
FORD	FIVE HUNDRED SE	4 Door	6	Gas	2	9010	Regular	1730007194					22	21	20									
FORD	FIVE HUNDRED SE	4 Door	6	Gas	4	9012	Regular	1730007195					27	26	24									
FORD	FIVE HUNDRED SEL	4 Door	6	Gas	2	9010	Regular	1730007196					22	21	20									
FORD	FIVE HUNDRED SEL	4 Door	6	Gas	4	9012	Regular	1730007197					27	26	24									
FORD	FLEX LIMITED	Sport Utility 4 Door	6	Gas	2	3583	Regular	1730025037		24	23													
FORD	FLEX LIMITED	Sport Utility 4 Door	6	Gas	4	3581	Regular	1730025038		27	27													
FORD	FLEX SE	Sport Utility 4 Door	6	Gas	2	3584	Regular	1730025039		24	23													
FORD	FLEX SEL	Sport Utility 4 Door	6	Gas	2	3584	Regular	1730025040		24	23													
FORD	FLEX SEL	Sport Utility 4 Door	6	Gas	4	3582	Regular	1730025041		27	27													
FORD	FOCUS LX	4 Door	4	Gas	2	9020	Regular	1730000960								24	22	20	19	15				
FORD	FOCUS S	4 Door	4	Gas	2	9020	Regular	1730025489		30	29	28												
FORD	FOCUS SE	2 Door	4	Gas	2	3448	Regular	1730022972		32	32	31												
FORD	FOCUS SE	2 Door Hatchback	4	Gas	2	9021	Regular	1730026561					31											
FORD	FOCUS SE	4 Door	4	Gas	2	9020	Regular	1730000961		30	29	28				24	22	20	19	15				
FORD	FOCUS SE	Station Wagon	4	Gas	2	9022	Regular	1730000962								20	19	17	14	13				
FORD	FOCUS SEL	4 Door	4	Gas	2	9020	Regular	1730025490		30	29													
FORD	FOCUS SES	2 Door	4	Gas	2	3448	Regular	1730022973		32	32	31												
FORD	FOCUS SES	4 Door	4	Gas	2	9020	Regular	1730022974		30	29	28												
FORD	FOCUS SVT	2 Door	4	Gas	2	9026	Regular	1730003890								31	29	28						
FORD	FOCUS SVT	2 Door Hatchback	4	Gas	2	9026	Regular	1730006792									29	28						
FORD	FOCUS SVT	4 Door	4	Gas	2	9027	Regular	1730004928								28	26							
FORD	FOCUS ZTS	4 Door	4	Gas	2	9023	Regular	1730000963								26	23	23	21	18				
FORD	FOCUS ZTW	Station Wagon	4	Gas	2	9024	Regular	1730002673								24	22	20						
FORD	FOCUS ZX3	2 Door	4	Gas	2	9021	Regular	1730000964							29	28	27	24	22	19				
FORD	FOCUS ZX3	2 Door Hatchback	4	Gas	2	9021	Regular	1730006793					31	30	29	28	27	24	22	19				

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
HONDA	CIVIC CX	2 Door	4	Gas	2	0245	Regular	3146												21	18	16	14	11
HONDA	CIVIC CX	2 Door Hatchback	4	Gas	2	0245	Regular	1730006823												21	18	16	14	11
HONDA	CIVIC CX-G	2 Door	4	Gas	2	0245	Regular	225492												21	18	16	14	
HONDA	CIVIC DEL SOL S	2 Door	4	Gas	2	0256	Regular	1659															18	16
HONDA	CIVIC DEL SOL SI	2 Door	4	Gas	2	0257	Regular	1674															21	19
HONDA	CIVIC DEL SOL SIR	2 Door	4	Gas	2	0250	Regular	1730026836																
HONDA	CIVIC DEL SOL VTEC	2 Door	4	Gas	2	0262	Regular	2325															24	21
HONDA	CIVIC DX	2 Door	4	Gas	2	0258	Regular	1999		32	32	31	32	32	29	27	25	24	22	23	20	17	14	13
HONDA	CIVIC DX	2 Door Hatchback	4	Gas	2	0246	Regular	1730006824												21	18	15	13	
HONDA	CIVIC DX	4 Door	4	Gas	2	0210	Regular	2000	31	32	31	31	29	23	23	22	21	19	19	17	14	13	11	
HONDA	CIVIC DX-A	2 Door	4	Gas	2	0258	Regular	1730022975		32	31													
HONDA	CIVIC DX-A	4 Door	4	Gas	2	0210	Regular	1730022976	31	32	31													
HONDA	CIVIC DX-G	2 Door	4	Gas	2	0258	Regular	226821	32	32	31	32	32							23	20	17		
HONDA	CIVIC DX-G	4 Door	4	Gas	2	0210	Regular	1730002112	31	32	31	31	29	23	23	22	21	19						
HONDA	CIVIC DX-SE	2 Door	4	Gas	2	0258	Regular	224453						29										
HONDA	CIVIC EX	2 Door	4	Gas	2	0258	Regular	1730000160			32	31	32	32							20	17	14	13
HONDA	CIVIC EX	4 Door	4	Gas	2	0210	Regular	822	31	32	31	31	29	23	23	22	21	19	19	17	14	13	11	
HONDA	CIVIC EX (US MDL)	2 Door	4	Gas	2	0259	Regular	1730007416	32					31				26		25	22	19	17	15
HONDA	CIVIC EX-G	4 Door	4	Gas	2	0210	Regular	226827												19	17	14		
HONDA	CIVIC EX-L	2 Door	4	Gas	2	0258	Regular	1730022977	32	32	31													
HONDA	CIVIC EX-L	4 Door	4	Gas	2	0210	Regular	1730022978	31	32	31													
HONDA	CIVIC EX-V	4 Door	4	Gas	2	0210	Regular	823																
HONDA	CIVIC GL	4 Door	4	Gas	2	0210	Regular	2002																
HONDA	CIVIC GX	4 Door	4	Gas	2	0210	Regular	1730022979			32	31												
HONDA	CIVIC HX	2 Door	4	Gas	2	0258	Regular	1730009617													20	17		
HONDA	CIVIC HYBRID	4 Door	4	Gas/Elec.	2	0221	Regular	1730004930	31	31	30	30	29	29	29	28								
HONDA	CIVIC LX	2 Door	4	Gas	2	0258	Regular	1730002261	32	32	31	32	32	29	27	25	24	22						
HONDA	CIVIC LX	4 Door	4	Gas	2	0251	Regular	2995	31	32	31	31	29	26	26	25	23	21	18	16	13	11	10	
HONDA	CIVIC LX SPORT	4 Door	4	Gas	2	0251	Regular	1730004931								25								
HONDA	CIVIC LX-G	4 Door	4	Gas	2	0251	Regular	226887					29	26	26	25	23	21	18	16	13			
HONDA	CIVIC LX-SE	4 Door	4	Gas	2	0251	Regular	25331						26	26	25			18	16				
HONDA	CIVIC LX-SR	2 Door	4	Gas	2	0258	Regular	1730022980	32	32	31													
HONDA	CIVIC LX-SR	4 Door	4	Gas	2	0251	Regular	1730022981			31													
HONDA	CIVIC REVERB	2 Door	4	Gas	2	0258	Regular	1730007318						29										

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
JEEP	COMPASS LIMITED	Sport Utility 4 Door	4	Gas	2	7240	Regular	1730014891		24	24	24	23											
JEEP	COMPASS LIMITED	Sport Utility 4 Door	4	Gas	4	7238	Regular	1730013523		29	29	29	27											
JEEP	COMPASS NORTH	Sport Utility 4 Door	4	Gas	2	7239	Regular	1730022769		24	24	23	22											
JEEP	COMPASS NORTH	Sport Utility 4 Door	4	Gas	4	7237	Regular	1730022770		29	29	29	27											
JEEP	COMPASS SPORT	Sport Utility 4 Door	4	Gas	2	7239	Regular	1730014892		24	24	23	22											
JEEP	COMPASS SPORT	Sport Utility 4 Door	4	Gas	4	7237	Regular	1730013524		29	29	29	27											
JEEP	GRAND CHEROKEE	Sport Utility 4 Door	6	Gas	2	7183	Regular	1698																13
JEEP	GRAND CHEROKEE	Sport Utility 4 Door	6	Gas	4	7181	Regular	225109																13
JEEP	GRAND CHEROKEE	Sport Utility 4 Door	8	Gas	2	7183	Regular	1699																13
JEEP	GRAND CHEROKEE	Sport Utility 4 Door	8	Gas	4	7181	Regular	225110																13
JEEP	GRAND CHEROKEE 5.9 LIMITED	Sport Utility 4 Door	8	Gas	4	7182	Regular	1730013740														21		
JEEP	GRAND CHEROKEE FREEDOM	Sport Utility 4 Door	6	Gas	2	7183	Regular	1730013525							25									
JEEP	GRAND CHEROKEE FREEDOM	Sport Utility 4 Door	8	Gas	2	7183	Regular	1730013526							25									
JEEP	GRAND CHEROKEE LAREDO	Ambulance	6	Gas	4	7181	Regular	1730002392																
JEEP	GRAND CHEROKEE LAREDO	Sport Utility 4 Door	6	Diesel	4	7241	Regular	1730022201			30	29	29											
JEEP	GRAND CHEROKEE LAREDO	Sport Utility 4 Door	6	Gas	2	7183	Regular	225256		30	30	29	29	26	25	26	26	23		20	21	18	15	13
JEEP	GRAND CHEROKEE LAREDO	Sport Utility 4 Door	6	Gas	4	7181	Regular	225258		30	30	30	29	28	27	27	27	25	24	21	19	17	15	13
JEEP	GRAND CHEROKEE LAREDO	Sport Utility 4 Door	8	Gas	2	7183	Regular	225257			30	29	29	26	25	26	26	23		20	21	18	15	13
JEEP	GRAND CHEROKEE LAREDO	Sport Utility 4 Door	8	Gas	4	7181	Regular	225259		30	30	30	29	28	27	27	27	25	24	21	19	17	15	13
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	6	Diesel	2	7248	Regular	1730025308				31	31											
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	6	Diesel	4	7242	Regular	1730022287			31	29	29											
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	6	Gas	2	7184	Regular	225177		32	32						25		24	23	23	21	18	15
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	6	Gas	4	7182	Regular	225179							28	28	27	27	26	24	23	21	20	16
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	8	Diesel	4	7242	Regular	1730022202					29											
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	8	Gas	2	7184	Regular	225178			32	31	31	28	27	25	25	24	24	23	23	21	18	
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	8	Gas	4	7182	Regular	225180		32	32	30	29	29	28	28	27	27	26	24	23	21	20	16
JEEP	GRAND CHEROKEE ORVIS	Sport Utility 4 Door	6	Gas	2	7184	Regular	225181														21	18	
JEEP	GRAND CHEROKEE ORVIS	Sport Utility 4 Door	6	Gas	4	7182	Regular	225183														21	20	16
JEEP	GRAND CHEROKEE ORVIS	Sport Utility 4 Door	8	Gas	2	7184	Regular	225182														21	18	
JEEP	GRAND CHEROKEE ORVIS	Sport Utility 4 Door	8	Gas	4	7182	Regular	225184														21	20	
JEEP	GRAND CHEROKEE OVERLAND	Sport Utility 4 Door	6	Diesel	2	7248	Regular	1730025309				31	31											
JEEP	GRAND CHEROKEE OVERLAND	Sport Utility 4 Door	6	Diesel	4	7242	Regular	1730022632			31	29	29											
JEEP	GRAND CHEROKEE OVERLAND	Sport Utility 4 Door	8	Diesel	4	7242	Regular	1730022203					29											
JEEP	GRAND CHEROKEE OVERLAND	Sport Utility 4 Door	8	Gas	2	7184	Regular	1730014893			32	31	31											

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
MAZDA	CX-9 GS	Sport Utility 4 Door	6	Gas	4	7761	Regular	1730015233		28	28	27	27											
MAZDA	CX-9 GT	Sport Utility 4 Door	6	Gas	2	7760	Regular	1730015234				24	24											
MAZDA	CX-9 GT	Sport Utility 4 Door	6	Gas	4	7761	Regular	1730015235		28	28	27	27											
MAZDA	EUNOS	Roadster	4	Gas	2	0359	Regular	1730014114																
MAZDA	GLC	2 Door	4	Gas	2	0304	Regular	2408																
MAZDA	GLC	2 Door Hatchback	4	Gas	2	0304	Regular	1730006861																
MAZDA	GLC	4 Door	4	Gas	2	0337	Regular	2410																
MAZDA	GLC	Station Wagon	4	Gas	2	0316	Regular	2409																
MAZDA	GLC DECOR	4 Door Hatchback	4	Gas	2	0329	Regular	1730006862																
MAZDA	GLC LX	4 Door	4	Gas	2	0338	Regular	2486																
MAZDA	MAZDA3 GS	4 Door	4	Gas	2	7724	Regular	1730005662		31	29	29	28	25	23	21								
MAZDA	MAZDA3 GT	4 Door	4	Gas	2	7725	Regular	1730005663		32	31	31	31	30	29	27								
MAZDA	MAZDA3 GX	4 Door	4	Gas	2	7724	Regular	1730005664		31	29	29	28	25	23	21								
MAZDA	MAZDA3 I	4 Door	4	Gas	2	7724	Regular	1730009506					28	25	23	21								
MAZDA	MAZDA3 S	4 Door	4	Gas	2	7724	Regular	1730009507					28	25	23	21								
MAZDA	MAZDA3 S	4 Door Hatchback	4	Gas	2	7726	Regular	1730009508					29	28	26	24								
MAZDA	MAZDA3 SP23	4 Door	4	Gas	2	7725	Regular	1730009509							29									
MAZDA	MAZDA3 SP23	4 Door Hatchback	4	Gas	2	7726	Regular	1730009510							26									
MAZDA	MAZDA3 SPORT GS	4 Door Hatchback	4	Gas	2	7726	Regular	1730005665		31	30	30	29	28	26	24								
MAZDA	MAZDA3 SPORT GT	4 Door Hatchback	4	Gas	2	7726	Regular	1730005666		31	30	30	29	28	26	24								
MAZDA	MAZDA3 SPORT GX	4 Door Hatchback	4	Gas	2	7774	Regular	1730024897		29	27	27												
MAZDA	MAZDA3 TOURING EDITION	4 Door	4	Gas	2	7725	Regular	1730024738					31											
MAZDA	MAZDA5 GS	Station Wagon	4	Gas	2	7741	Regular	1730008814		28	28	28	28	25										
MAZDA	MAZDA5 GT	Station Wagon	4	Gas	2	7741	Regular	1730008815		28	28	28	28	25										
MAZDA	MAZDA6 GS-I4	4 Door	4	Gas	2	7719	Regular	1730004212		28	29	30	28	27	25	25	24							
MAZDA	MAZDA6 GS-V6	4 Door	6	Gas	2	7720	Regular	1730004213		29	30	30	30	28	27	25	24							
MAZDA	MAZDA6 GT-I4	4 Door	4	Gas	2	7719	Regular	1730004214		28	29	30	28	27	25	25	24							
MAZDA	MAZDA6 GT-V6	4 Door	6	Gas	2	7720	Regular	1730004215		29	30	30	30	28	27	25	24							
MAZDA	MAZDA6 I	4 Door	4	Gas	2	7719	Regular	1730009618				30	28	27		25								
MAZDA	MAZDA6 I SPORT	4 Door	4	Gas	2	7719	Regular	1730009619			29	30	28	27	25									
MAZDA	MAZDA6 I SPORT	4 Door Hatchback	4	Gas	2	7727	Regular	1730009620						27	25	24								
MAZDA	MAZDA6 S	4 Door	6	Gas	2	7720	Regular	1730009621					30	28	27									
MAZDA	MAZDA6 S GRAND TOURING	4 Door	6	Gas	2	7720	Regular	1730009622			30		30	28	27									
MAZDA	MAZDA6 S SPORT	4 Door	6	Gas	2	7720	Regular	1730009623			30		30	28	27									

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
TOYOTA	CAMRY	4 Door	6	Gas	2	7615	Regular	1603														15	13	12
TOYOTA	CAMRY	Station Wagon	4	Gas	2	0560	Regular	1601																8
TOYOTA	CAMRY CE	4 Door	4	Gas	2	0450	Regular	225632			25	24	24	23	23	21		20	19	18	16	14	11	
TOYOTA	CAMRY CE V6	4 Door	6	Gas	2	7615	Regular	225633					27	25	24	22		19	19	19	17	15	13	
TOYOTA	CAMRY DLX	4 Door	4	Gas	2	0450	Regular	2732																
TOYOTA	CAMRY DLX	Station Wagon	4	Gas	2	0560	Regular	2731																
TOYOTA	CAMRY DX	4 Door	4	Gas	2	0450	Regular	1730008825																10
TOYOTA	CAMRY DX V6	4 Door	6	Gas	2	7615	Regular	1730012808																12
TOYOTA	CAMRY HYBRID	4 Door	4	Gas/Elec.	2	7747	Regular	1730013072	24	24	24	24	23											
TOYOTA	CAMRY LE	2 Door	4	Gas	2	7622	Regular	2733																10
TOYOTA	CAMRY LE	4 Door	4	Gas	2	0450	Regular	2735	25	25	25	24	24	23	23	21	20	20	19	18	16	14	11	10
TOYOTA	CAMRY LE	4 Door	4	Gas	4	0567	Regular	1730000108																
TOYOTA	CAMRY LE	4 Door Hatchback	4	Gas	2	0466	Regular	1730006979																
TOYOTA	CAMRY LE	Station Wagon	4	Gas	2	0560	Regular	2734																8
TOYOTA	CAMRY LE	Station Wagon	6	Gas	2	0560	Regular	2736																
TOYOTA	CAMRY LE V6	2 Door	6	Gas	2	7623	Regular	2076																12
TOYOTA	CAMRY LE V6	4 Door	6	Gas	2	7615	Regular	2078	27	27	27	26	27	25	24	22	20	19	19	19	17	15	13	12
TOYOTA	CAMRY LE V6	Station Wagon	6	Gas	2	7621	Regular	2077																9
TOYOTA	CAMRY SE	4 Door	4	Gas	2	0450	Regular	1730004161	25	25	25	24	24	23	23	21	20							
TOYOTA	CAMRY SE V6	4 Door	6	Gas	2	7615	Regular	2189	27	27	27	26	27	25	24	22	20	19						
TOYOTA	CAMRY SOLARA SE	2 Door	4	Gas	2	7644	Regular	1730000445				26	25	24	24	23	22	21	19	17	16			
TOYOTA	CAMRY SOLARA SE	Convertible	4	Gas	2	7674	Regular	1730004244									18	16	14	13				
TOYOTA	CAMRY SOLARA SE V6	2 Door	6	Gas	2	7645	Regular	1730000446					26	25	24	23	23	22	22	21	18			
TOYOTA	CAMRY SOLARA SE V6	Convertible	6	Gas	2	7653	Regular	1730006229					24	22	22	21	21							
TOYOTA	CAMRY SOLARA SLE	2 Door	4	Gas	2	7644	Regular	1730013545				26	25											
TOYOTA	CAMRY SOLARA SLE V6	2 Door	6	Gas	2	7645	Regular	1730000447				26	26	25	24	23	23	22	22	21	18			
TOYOTA	CAMRY SOLARA SLE V6	Convertible	6	Gas	2	7653	Regular	1730001369				23	24	22	22	21	21	18	17	17				
TOYOTA	CAMRY SOLARA SPORT V6	2 Door	6	Gas	2	7645	Regular	1730013546					26											
TOYOTA	CAMRY SOLARA SPORT V6	Convertible	6	Gas	2	7653	Regular	1730013547					24											
TOYOTA	CAMRY XLE	4 Door	4	Gas	2	0450	Regular	1730002702	25	25	25	24	24	23	23	21	20	20						
TOYOTA	CAMRY XLE V6	4 Door	6	Gas	2	7615	Regular	225634	27	27	27	26	27	25	24	22	20	19	19	19	17	15	13	
TOYOTA	CANADIAN	2 Door	4	Gas	2	0404	Regular	2203																
TOYOTA	CARINA	2 Door	4	Gas	2		Regular	2225																
TOYOTA	CARINA	4 Door	4	Gas	2		Regular	2226																

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
1	20	All Purpose Motorhome	481	549	615	687	761	822	902	985	1054	1101	1192		
1	25	All Purpose Motorhome	451	514	577	644	713	771	845	923	988	1032	1117		
1	26	All Purpose Motorhome	445	508	569	636	704	761	834	911	975	1018	1103		
1	27	All Purpose Motorhome	439	501	561	627	694	750	823	899	961	1004	1088		
1	28	All Purpose Motorhome	433	494	554	618	685	740	811	886	948	991	1073		
1	29	All Purpose Motorhome	427	487	546	610	675	730	800	874	935	977	1058		
1	30	All Purpose Motorhome	421	480	538	601	666	720	789	862	922	963	1043		
1	0	All Purpose Passenger Vehicle	601	662	760	807	855	905	949	993	1041	1078	1093	1111	1134
1	5	All Purpose Passenger Vehicle	571	629	722	767	812	860	902	943	989	1024	1038	1055	1077
1	10	All Purpose Passenger Vehicle	541	596	684	726	769	814	854	894	937	970	984	1000	1021
1	15	All Purpose Passenger Vehicle	511	563	646	686	727	769	807	844	885	916	929	944	964
1	20	All Purpose Passenger Vehicle	481	530	608	646	684	724	759	794	833	862	874	889	907
1	25	All Purpose Passenger Vehicle	451	496	570	605	641	679	712	745	781	808	820	833	850
1	26	All Purpose Passenger Vehicle	445	490	562	597	633	670	702	735	770	798	809	822	839
1	27	All Purpose Passenger Vehicle	439	483	555	589	624	661	693	725	760	787	798	811	828
1	28	All Purpose Passenger Vehicle	433	477	547	581	616	652	683	715	750	776	787	800	816
1	29	All Purpose Passenger Vehicle	427	470	540	573	607	643	674	705	739	765	776	789	805
1	30	All Purpose Passenger Vehicle	421	463	532	565	598	633	664	695	729	755	765	778	794
1	0	All Purpose Snow Vehicle (HTA)	439												
1	0	All Purpose Trailer $2500 or less	10												
1	0	All Purpose Trailer $2501 or more		48	82	128	169	233	268	294	328	343	358	374	391
1	0	All Purpose Truck 4,540 kg or less GVW	447	523	550	581	604	634	659	682	717	746	776	821	846
1	5	All Purpose Truck 4,540 kg or less GVW	425	497	522	552	574	602	626	648	681	709	737	780	804
1	10	All Purpose Truck 4,540 kg or less GVW	402	471	495	523	544	571	593	614	645	671	698	739	761
1	15	All Purpose Truck 4,540 kg or less GVW	380	445	467	494	513	539	560	580	609	634	660	698	719
1	20	All Purpose Truck 4,540 kg or less GVW	358	418	440	465	483	507	527	546	574	597	621	657	677
1	25	All Purpose Truck 4,540 kg or less GVW	335	392	412	436	453	475	494	511	538	559	582	616	634
1	26	All Purpose Truck 4,540 kg or less GVW	331	387	407	430	447	469	488	505	531	552	574	608	626
1	27	All Purpose Truck 4,540 kg or less GVW	326	382	401	424	441	463	481	498	523	545	566	599	618
1	28	All Purpose Truck 4,540 kg or less GVW	322	377	396	418	435	456	474	491	516	537	559	591	609
1	29	All Purpose Truck 4,540 kg or less GVW	317	371	390	413	429	450	468	484	509	530	551	583	601
1	30	All Purpose Truck 4,540 kg or less GVW	313	366	385	407	423	444	461	477	502	522	543	575	592
1	0	Antique Vehicle - Bus	106												
1	0	Antique Vehicle - Motorcycle	106												
1	0	Antique Vehicle - Passenger Vehicle	106												
1	0	Antique Vehicle - Truck	106												
1	0	Artisan Truck 4,540 kg or less GVW	592	693	728	770	800	840	873	903	950	988	1028	1087	1121
1	5	Artisan Truck 4,540 kg or less GVW	562	658	692	731	760	798	829	858	902	939	977	1033	1065
1	10	Artisan Truck 4,540 kg or less GVW	533	624	655	693	720	756	786	813	855	889	925	978	1009
1	15	Artisan Truck 4,540 kg or less GVW	503	589	619	654	680	714	742	768	807	840	874	924	953
1	20	Artisan Truck 4,540 kg or less GVW	474	554	582	616	640	672	698	722	760	790	822	870	897
1	25	Artisan Truck 4,540 kg or less GVW	444	520	546	577	600	630	655	677	712	741	771	815	841
1	26	Artisan Truck 4,540 kg or less GVW	438	513	539	570	592	622	646	668	703	731	761	804	830
1	27	Artisan Truck 4,540 kg or less GVW	432	506	531	562	584	613	637	659	693	721	750	794	818
1	28	Artisan Truck 4,540 kg or less GVW	426	499	524	554	576	605	629	650	684	711	740	783	807
1	29	Artisan Truck 4,540 kg or less GVW	420	492	517	547	568	596	620	641	674	701	730	772	796
1	30	Artisan Truck 4,540 kg or less GVW	414	485	510	539	560	588	611	632	665	692	720	761	785
1	0	Artisan Truck 4,541 to 16,330 kg GVW		664	758	820	895	959	1032	1100	1168	1236	1305	1372	1441
1	5	Artisan Truck 4,541 to 16,330 kg GVW		631	720	779	850	911	980	1045	1110	1174	1240	1303	1369

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1156	1179	1204	1226	1249	1271	1294	1319	1343	1367	1391	1420	1448	1476	1494	1531	1564	1603	1647	1653	1659	1665	1671
1098	1120	1144	1165	1187	1207	1229	1253	1276	1299	1321	1349	1376	1402	1419	1454	1486	1523	1565	1570	1576	1582	1587
1040	1061	1084	1103	1124	1144	1165	1187	1209	1230	1252	1278	1303	1328	1345	1378	1408	1443	1482	1488	1493	1498	1504
983	1002	1023	1042	1062	1080	1100	1121	1142	1162	1182	1207	1231	1255	1270	1301	1329	1363	1400	1405	1410	1415	1420
925	943	963	981	999	1017	1035	1055	1074	1094	1113	1136	1158	1181	1195	1225	1251	1282	1318	1322	1327	1332	1337
867	884	903	919	937	953	970	989	1007	1025	1043	1065	1086	1107	1120	1148	1173	1202	1235	1240	1244	1249	1253
855	872	891	907	924	941	958	976	994	1012	1029	1051	1072	1092	1106	1133	1157	1186	1219	1223	1228	1232	1237
844	861	879	895	912	928	945	963	980	998	1015	1037	1057	1077	1091	1118	1142	1170	1202	1207	1211	1215	1220
832	849	867	883	899	915	932	950	967	984	1002	1022	1043	1063	1076	1102	1126	1154	1186	1190	1194	1199	1203
821	837	855	870	887	902	919	936	954	971	988	1008	1028	1048	1061	1087	1110	1138	1169	1174	1178	1182	1186
809	825	843	858	874	890	906	923	940	957	974	994	1014	1033	1046	1072	1095	1122	1153	1157	1161	1165	1170
406																						
858	894	958	969	1009	1043	1088	1100	1118	1155	1206	1231	1269	1317	1329	1347	1377	1399	1445	1452	1458	1465	1471
815	849	910	921	959	991	1034	1045	1062	1097	1146	1169	1206	1251	1263	1280	1308	1329	1373	1379	1385	1392	1397
772	805	862	872	908	939	979	990	1006	1039	1085	1108	1142	1185	1196	1212	1239	1259	1300	1307	1312	1318	1324
729	760	814	824	858	887	925	935	950	982	1025	1046	1079	1119	1130	1145	1170	1189	1228	1234	1239	1245	1250
686	715	766	775	807	834	870	880	894	924	965	985	1015	1054	1063	1078	1102	1119	1156	1162	1166	1172	1177
643	670	718	727	757	782	816	825	838	866	904	923	952	988	997	1010	1033	1049	1084	1089	1093	1099	1103
635	662	709	717	747	772	805	814	827	855	892	911	939	975	983	997	1019	1035	1069	1074	1079	1084	1089
626	653	699	707	737	761	794	803	816	843	880	899	926	961	970	983	1005	1021	1055	1060	1064	1069	1074
618	644	690	698	726	751	783	792	805	832	868	886	914	948	957	970	991	1007	1040	1045	1050	1055	1059
609	635	680	688	716	741	772	781	794	820	856	874	901	935	944	956	978	993	1026	1031	1035	1040	1044
601	626	671	678	706	730	762	770	783	808	844	862	888	922	930	943	964	979	1011	1016	1021	1025	1030
1137	1184	1269	1284	1336	1381	1441	1457	1480	1530	1598	1631	1681	1744	1761	1784	1824	1854	1915	1923	1932	1940	1949
1080	1125	1206	1220	1269	1312	1369	1384	1406	1453	1518	1549	1597	1657	1673	1695	1733	1761	1819	1827	1835	1843	1852
1023	1066	1142	1156	1202	1243	1297	1311	1332	1377	1438	1468	1513	1570	1585	1606	1642	1669	1723	1731	1739	1746	1754
966	1006	1079	1091	1136	1174	1225	1238	1258	1300	1358	1386	1429	1482	1497	1516	1550	1576	1628	1635	1642	1649	1657
910	947	1015	1027	1069	1105	1153	1166	1184	1224	1278	1305	1345	1395	1409	1427	1459	1483	1532	1538	1546	1552	1559
853	888	952	963	1002	1036	1081	1093	1110	1147	1198	1223	1261	1308	1321	1338	1368	1390	1436	1442	1449	1455	1462
841	876	939	950	989	1022	1066	1078	1095	1132	1183	1207	1244	1291	1303	1320	1350	1372	1417	1423	1430	1436	1442
830	864	926	937	975	1008	1052	1064	1080	1117	1167	1191	1227	1273	1286	1302	1332	1353	1398	1404	1410	1416	1423
819	852	914	924	962	994	1038	1049	1066	1102	1151	1174	1210	1256	1268	1284	1313	1335	1379	1385	1391	1397	1403
807	841	901	912	949	981	1023	1034	1051	1086	1135	1158	1194	1238	1250	1267	1295	1316	1360	1365	1372	1377	1384
796	829	888	899	935	967	1009	1020	1036	1071	1119	1142	1177	1221	1233	1249	1277	1298	1340	1346	1352	1358	1364
1510	1605	1702	1754	1780																		
1434	1525	1617	1666	1691																		

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
1	25	Pleasure Motorcycle-Touring 501 to 1000 cc	994	1088	1114	1183	1217	1279	1339	1410	1492	1513			
1	26	Pleasure Motorcycle-Touring 501 to 1000 cc	981	1074	1099	1168	1201	1262	1321	1391	1473	1493			
1	27	Pleasure Motorcycle-Touring 501 to 1000 cc	968	1059	1084	1152	1185	1245	1303	1372	1453	1472			
1	28	Pleasure Motorcycle-Touring 501 to 1000 cc	955	1045	1069	1136	1169	1228	1285	1354	1433	1452			
1	29	Pleasure Motorcycle-Touring 501 to 1000 cc	941	1030	1054	1120	1152	1211	1267	1335	1413	1432			
1	30	Pleasure Motorcycle-Touring 501 to 1000 cc	928	1016	1039	1105	1136	1194	1249	1316	1393	1412			
1	0	Pleasure Motorcycle-Touring 1001 cc or more	1424	1559	1594	1695	1742	1832	1916	2019	2137	2166			
1	5	Pleasure Motorcycle-Touring 1001 cc or more	1353	1481	1514	1610	1655	1740	1820	1918	2030	2058			
1	10	Pleasure Motorcycle-Touring 1001 cc or more	1282	1403	1435	1525	1568	1649	1724	1817	1923	1949			
1	15	Pleasure Motorcycle-Touring 1001 cc or more	1210	1325	1355	1441	1481	1557	1629	1716	1816	1841			
1	20	Pleasure Motorcycle-Touring 1001 cc or more	1139	1247	1275	1356	1394	1466	1533	1615	1710	1733			
1	25	Pleasure Motorcycle-Touring 1001 cc or more	1068	1169	1195	1271	1306	1374	1437	1514	1603	1624			
1	26	Pleasure Motorcycle-Touring 1001 cc or more	1054	1154	1180	1254	1289	1356	1418	1494	1581	1603			
1	27	Pleasure Motorcycle-Touring 1001 cc or more	1040	1138	1164	1237	1272	1337	1399	1474	1560	1581			
1	28	Pleasure Motorcycle-Touring 1001 cc or more	1025	1122	1148	1220	1254	1319	1380	1454	1539	1560			
1	29	Pleasure Motorcycle-Touring 1001 cc or more	1011	1107	1132	1203	1237	1301	1360	1433	1517	1538			
1	30	Pleasure Motorcycle-Touring 1001 cc or more	997	1091	1116	1186	1219	1282	1341	1413	1496	1516			
1	0	Pleasure Motorhome	362	414	463	517	573	619	679	742	793	829	898		
1	5	Pleasure Motorhome	344	393	440	491	544	588	645	705	753	788	853		
1	10	Pleasure Motorhome	326	373	417	465	516	557	611	668	714	746	808		
1	15	Pleasure Motorhome	308	352	394	439	487	526	577	631	674	705	763		
1	20	Pleasure Motorhome	290	331	370	414	458	495	543	594	634	663	718		
1	25	Pleasure Motorhome	271	310	347	388	430	464	509	556	595	622	673		
1	26	Pleasure Motorhome	268	306	343	383	424	458	502	549	587	613	665		
1	27	Pleasure Motorhome	264	302	338	377	418	452	496	542	579	605	656		
1	28	Pleasure Motorhome	261	298	333	372	413	446	489	534	571	597	647		
1	29	Pleasure Motorhome	257	294	329	367	407	439	482	527	563	589	638		
1	30	Pleasure Motorhome	253	290	324	362	401	433	475	519	555	580	629		
1	0	Pleasure Passenger Vehicle	479	528	606	643	682	721	756	791	830	859	871	885	904
1	5	Pleasure Passenger Vehicle	455	502	576	611	648	685	718	751	788	816	827	841	859
1	10	Pleasure Passenger Vehicle	431	475	545	579	614	649	680	712	747	773	784	796	814
1	15	Pleasure Passenger Vehicle	407	449	515	547	580	613	643	672	705	730	740	752	768
1	20	Pleasure Passenger Vehicle	383	422	485	514	546	577	605	633	664	687	697	708	723
1	25	Pleasure Passenger Vehicle	359	396	454	482	511	541	567	593	622	644	653	664	678
1	26	Pleasure Passenger Vehicle	354	391	448	476	505	534	559	585	614	636	645	655	669
1	27	Pleasure Passenger Vehicle	350	385	442	469	498	526	552	577	606	627	636	646	660
1	28	Pleasure Passenger Vehicle	345	380	436	463	491	519	544	570	598	618	627	637	651
1	29	Pleasure Passenger Vehicle	340	375	430	457	484	512	537	562	589	610	618	628	642
1	30	Pleasure Passenger Vehicle	335	370	424	450	477	505	529	554	581	601	610	619	633
1	0	Pleasure Truck 4,540 kg or less GVW	352	412	433	457	476	499	519	537	565	587	611	646	666
1	5	Pleasure Truck 4,540 kg or less GVW	334	391	411	434	452	474	493	510	537	558	580	614	633
1	10	Pleasure Truck 4,540 kg or less GVW	317	371	390	411	428	449	467	483	508	528	550	581	599
1	15	Pleasure Truck 4,540 kg or less GVW	299	350	368	388	405	424	441	456	480	499	519	549	566
1	20	Pleasure Truck 4,540 kg or less GVW	282	330	346	366	381	399	415	430	452	470	489	517	533
1	25	Pleasure Truck 4,540 kg or less GVW	264	309	325	343	357	374	389	403	424	440	458	484	499
1	26	Pleasure Truck 4,540 kg or less GVW	260	305	320	338	352	369	384	397	418	434	452	478	493
1	27	Pleasure Truck 4,540 kg or less GVW	257	301	316	334	347	364	379	392	412	429	446	472	486
1	28	Pleasure Truck 4,540 kg or less GVW	253	297	312	329	343	359	374	387	407	423	440	465	480
1	29	Pleasure Truck 4,540 kg or less GVW	250	293	307	324	338	354	368	381	401	417	434	459	473

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
921	940	959	977	996	1013	1031	1051	1071	1090	1109	1132	1154	1177	1191	1220	1246	1277	1313	1317	1322	1327	1332
875	893	911	928	946	962	979	998	1017	1035	1054	1075	1096	1118	1131	1159	1184	1213	1247	1251	1256	1261	1265
829	846	863	879	896	912	928	946	964	981	998	1019	1039	1059	1072	1098	1121	1149	1182	1185	1190	1194	1199
783	799	815	830	847	861	876	893	910	926	943	962	981	1000	1012	1037	1059	1085	1116	1119	1124	1128	1132
737	752	767	782	797	810	825	841	857	872	887	906	923	942	953	976	997	1022	1050	1054	1058	1062	1066
691	705	719	733	747	760	773	788	803	817	832	849	865	883	893	915	934	958	985	988	991	995	999
682	696	710	723	737	750	763	778	793	807	821	838	854	871	881	903	922	945	972	975	978	982	986
672	686	700	713	727	739	753	767	782	796	810	826	842	859	869	891	910	932	958	961	965	969	972
663	677	690	703	717	729	742	757	771	785	798	815	831	847	858	878	897	919	945	948	952	955	959
654	667	681	694	707	719	732	746	760	774	787	804	819	836	846	866	885	907	932	935	939	942	946
645	658	671	684	697	709	722	736	750	763	776	792	808	824	834	854	872	894	919	922	925	929	932
675	704	754	763	794	821	857	866	880	910	950	969	999	1036	1046	1060	1084	1102	1138	1143	1148	1153	1158
641	669	716	725	754	780	814	823	836	864	902	921	949	984	994	1007	1030	1047	1081	1086	1091	1095	1100
607	634	679	687	715	739	771	779	792	819	855	872	899	932	941	954	976	992	1024	1029	1033	1038	1042
574	598	641	649	675	698	728	736	748	773	807	824	849	881	889	901	921	937	967	972	976	980	984
540	563	603	610	635	657	686	693	704	728	760	775	799	829	837	848	867	882	910	914	918	922	926
506	528	565	572	595	616	643	649	660	682	712	727	749	777	784	795	813	826	853	857	861	865	868
499	521	558	565	588	608	634	641	651	673	703	717	739	767	774	784	802	815	842	846	850	853	857
493	514	550	557	580	599	626	632	642	664	693	707	729	756	764	774	791	804	831	834	838	842	845
486	507	543	549	572	591	617	624	634	655	684	698	719	746	753	763	780	793	819	823	827	830	834
479	500	535	542	564	583	608	615	625	646	674	688	709	736	743	753	770	782	808	812	815	819	822

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
2	15	All Purpose Motorcycle-Touring 501 to 1000 cc	1176	1288	1317	1400	1440	1514	1584	1669	1765	1790			
2	20	All Purpose Motorcycle-Touring 501 to 1000 cc	1107	1212	1240	1318	1355	1425	1490	1570	1662	1685			
2	25	All Purpose Motorcycle-Touring 501 to 1000 cc	1038	1136	1162	1235	1270	1336	1397	1472	1558	1579			
2	26	All Purpose Motorcycle-Touring 501 to 1000 cc	1024	1121	1147	1219	1254	1318	1379	1453	1537	1558			
2	27	All Purpose Motorcycle-Touring 501 to 1000 cc	1010	1106	1131	1202	1237	1300	1360	1433	1516	1537			
2	28	All Purpose Motorcycle-Touring 501 to 1000 cc	996	1091	1116	1186	1220	1282	1341	1413	1495	1516			
2	29	All Purpose Motorcycle-Touring 501 to 1000 cc	983	1076	1100	1169	1203	1265	1323	1394	1475	1495			
2	30	All Purpose Motorcycle-Touring 501 to 1000 cc	969	1060	1085	1153	1186	1247	1304	1374	1454	1474			
2	0	All Purpose Motorcycle-Touring 1001 cc or more	1529	1674	1712	1820	1871	1967	2058	2168	2295	2327			
2	5	All Purpose Motorcycle-Touring 1001 cc or more	1453	1590	1626	1729	1777	1869	1955	2060	2180	2211			
2	10	All Purpose Motorcycle-Touring 1001 cc or more	1376	1507	1541	1638	1684	1770	1852	1951	2065	2094			
2	15	All Purpose Motorcycle-Touring 1001 cc or more	1300	1423	1455	1547	1590	1672	1749	1843	1951	1978			
2	20	All Purpose Motorcycle-Touring 1001 cc or more	1223	1339	1370	1456	1497	1574	1646	1734	1836	1862			
2	25	All Purpose Motorcycle-Touring 1001 cc or more	1147	1255	1284	1365	1403	1475	1543	1626	1721	1745			
2	26	All Purpose Motorcycle-Touring 1001 cc or more	1131	1239	1267	1347	1385	1456	1523	1604	1698	1722			
2	27	All Purpose Motorcycle-Touring 1001 cc or more	1116	1222	1250	1329	1366	1436	1502	1583	1675	1699			
2	28	All Purpose Motorcycle-Touring 1001 cc or more	1101	1205	1233	1310	1347	1416	1482	1561	1652	1675			
2	29	All Purpose Motorcycle-Touring 1001 cc or more	1086	1189	1216	1292	1328	1397	1461	1539	1629	1652			
2	30	All Purpose Motorcycle-Touring 1001 cc or more	1070	1172	1198	1274	1310	1377	1441	1518	1606	1629			
2	0	All Purpose Motorhome	490	560	627	700	775	838	919	1004	1074	1122	1215		
2	5	All Purpose Motorhome	465	532	596	665	736	796	873	954	1020	1066	1154		
2	10	All Purpose Motorhome	441	504	564	630	697	754	827	904	967	1010	1093		
2	15	All Purpose Motorhome	416	476	533	595	659	712	781	853	913	954	1033		
2	20	All Purpose Motorhome	392	448	502	560	620	670	735	803	859	898	972		
2	25	All Purpose Motorhome	367	420	470	525	581	628	689	753	805	841	911		
2	26	All Purpose Motorhome	363	414	464	518	573	620	680	743	795	830	899		
2	27	All Purpose Motorhome	358	409	458	511	566	612	671	733	784	819	887		
2	28	All Purpose Motorhome	353	403	451	504	558	603	662	723	773	808	875		
2	29	All Purpose Motorhome	348	398	445	497	550	595	652	713	763	797	863		
2	30	All Purpose Motorhome	343	392	439	490	542	587	643	703	752	785	850		
2	0	All Purpose Passenger Vehicle	564	621	713	757	802	849	890	932	977	1011	1025	1042	1064
2	5	All Purpose Passenger Vehicle	536	590	677	719	762	807	845	885	928	960	974	990	1011
2	10	All Purpose Passenger Vehicle	508	559	642	681	722	764	801	839	879	910	922	938	958
2	15	All Purpose Passenger Vehicle	479	528	606	643	682	722	756	792	830	859	871	886	904
2	20	All Purpose Passenger Vehicle	451	497	570	606	642	679	712	746	782	809	820	834	851
2	25	All Purpose Passenger Vehicle	423	466	535	568	601	637	667	699	733	758	769	781	798
2	26	All Purpose Passenger Vehicle	417	460	528	560	593	628	659	690	723	748	758	771	787
2	27	All Purpose Passenger Vehicle	412	453	520	553	585	620	650	680	713	738	748	761	777
2	28	All Purpose Passenger Vehicle	406	447	513	545	577	611	641	671	703	728	738	750	766
2	29	All Purpose Passenger Vehicle	400	441	506	537	569	603	632	662	694	718	728	740	755
2	30	All Purpose Passenger Vehicle	395	435	499	530	561	594	623	652	684	708	717	729	745
2	0	All Purpose Snow Vehicle (HTA)	342												
2	0	All Purpose Trailer $2500 or less	7												
2	0	All Purpose Trailer $2501 or more		37	63	99	130	179	207	227	253	265	277	289	302
2	0	All Purpose Truck 4,540 kg or less GVW	436	511	537	567	590	619	644	666	701	728	758	802	827
2	5	All Purpose Truck 4,540 kg or less GVW	414	485	510	539	560	588	612	633	666	692	720	762	786
2	10	All Purpose Truck 4,540 kg or less GVW	392	460	483	510	531	557	580	599	631	655	682	722	744
2	15	All Purpose Truck 4,540 kg or less GVW	371	434	456	482	501	526	547	566	596	619	644	682	703
2	20	All Purpose Truck 4,540 kg or less GVW	349	409	430	454	472	495	515	533	561	582	606	642	662

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1084	1106	1129	1150	1172	1192	1214	1237	1260	1283	1305	1332	1358	1385	1402	1436	1467	1504	1545	1551	1556	1562	1568
1030	1051	1073	1092	1113	1132	1153	1175	1197	1219	1240	1265	1290	1316	1332	1364	1394	1429	1468	1473	1478	1484	1490
976	995	1016	1035	1055	1073	1093	1113	1134	1155	1174	1199	1222	1246	1262	1292	1320	1354	1390	1396	1400	1406	1411
921	940	960	977	996	1013	1032	1051	1071	1091	1109	1132	1154	1177	1192	1221	1247	1278	1313	1318	1323	1328	1333
867	885	903	920	938	954	971	990	1008	1026	1044	1066	1086	1108	1122	1149	1174	1203	1236	1241	1245	1250	1254
813	829	847	862	879	894	910	928	945	962	979	999	1018	1039	1051	1077	1100	1128	1159	1163	1167	1171	1176
802	818	835	851	867	882	898	915	932	949	966	986	1005	1025	1037	1063	1086	1113	1143	1148	1151	1156	1160
791	807	824	839	856	870	886	903	920	937	953	972	991	1011	1023	1048	1071	1098	1128	1132	1136	1140	1145
780	796	813	828	844	858	874	891	907	924	940	959	978	997	1009	1034	1056	1083	1112	1117	1120	1125	1129
770	785	802	816	832	846	862	878	895	911	927	946	964	983	995	1020	1042	1068	1097	1101	1105	1109	1113
759	774	790	805	820	834	850	866	882	898	913	932	951	969	981	1005	1027	1053	1081	1086	1089	1093	1098
313																						
838	873	936	946	985	1018	1063	1074	1092	1129	1178	1203	1239	1286	1298	1315	1345	1367	1412	1418	1424	1431	1437
796	829	889	899	936	967	1010	1020	1037	1073	1119	1143	1177	1222	1233	1249	1278	1299	1341	1347	1353	1359	1365
754	786	842	851	886	916	957	967	983	1016	1060	1083	1115	1157	1168	1183	1210	1230	1271	1276	1282	1288	1293
712	742	796	804	837	865	904	913	928	960	1001	1023	1053	1093	1103	1118	1143	1162	1200	1205	1210	1216	1221
670	698	749	757	788	814	850	859	874	903	942	962	991	1029	1038	1052	1076	1094	1130	1134	1139	1145	1150

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
2	29	Pleasure Motorhome	253	290	324	362	401	433	475	519	555	580	628		
2	30	Pleasure Motorhome	250	286	319	357	395	427	468	512	547	572	619		
2	0	Pleasure Passenger Vehicle	452	498	572	607	643	681	714	747	783	811	822	835	853
2	5	Pleasure Passenger Vehicle	429	473	543	577	611	647	678	710	744	770	781	793	810
2	10	Pleasure Passenger Vehicle	407	448	515	546	579	613	643	672	705	730	740	751	768
2	15	Pleasure Passenger Vehicle	384	423	486	516	547	579	607	635	666	689	699	710	725
2	20	Pleasure Passenger Vehicle	362	398	458	486	514	545	571	598	626	649	658	668	682
2	25	Pleasure Passenger Vehicle	339	373	429	455	482	511	535	560	587	608	616	626	640
2	26	Pleasure Passenger Vehicle	334	369	423	449	476	504	528	553	579	600	608	618	631
2	27	Pleasure Passenger Vehicle	330	364	418	443	469	497	521	545	572	592	600	610	623
2	28	Pleasure Passenger Vehicle	325	359	412	437	463	490	514	538	564	584	592	601	614
2	29	Pleasure Passenger Vehicle	321	354	406	431	457	484	507	530	556	576	584	593	606
2	30	Pleasure Passenger Vehicle	316	349	400	425	450	477	500	523	548	568	575	584	597
2	0	Pleasure Truck 4,540 kg or less GVW	340	398	418	442	460	483	502	519	546	568	591	625	644
2	5	Pleasure Truck 4,540 kg or less GVW	323	378	397	420	437	459	477	493	519	540	561	594	612
2	10	Pleasure Truck 4,540 kg or less GVW	306	358	376	398	414	435	452	467	491	511	532	562	580
2	15	Pleasure Truck 4,540 kg or less GVW	289	338	355	376	391	411	427	441	464	483	502	531	547
2	20	Pleasure Truck 4,540 kg or less GVW	272	318	334	354	368	386	402	415	437	454	473	500	515
2	25	Pleasure Truck 4,540 kg or less GVW	255	298	313	331	345	362	376	389	409	426	443	469	483
2	26	Pleasure Truck 4,540 kg or less GVW	252	295	309	327	340	357	371	384	404	420	437	462	477
2	27	Pleasure Truck 4,540 kg or less GVW	248	291	305	323	336	353	366	379	399	415	431	456	470
2	28	Pleasure Truck 4,540 kg or less GVW	245	287	301	318	331	348	361	374	393	409	426	450	464
2	29	Pleasure Truck 4,540 kg or less GVW	241	283	297	314	327	343	356	368	388	403	420	444	457
2	30	Pleasure Truck 4,540 kg or less GVW	238	279	293	309	322	338	351	363	382	398	414	437	451
2	0	Police/Emergency Passenger Vehicle	487	537	616	654	693	733	769	805	844	873	886	900	919
2	0	Police/Emergency Truck 4,540 kg or less GVW	614	614	614	614	614	614	614	614	614	614	614	614	614
2	0	Police/Emergency Truck 4,541 to 16,330 kg GVW		567	567	567	567	567	567	567	567	567	567	567	567
2	0	Police/Emergency Truck 16,331 kg or more GVW		493	493	493	493	493	493	493	493	493	493	493	493
2	0	Repairer	249												
2	0	Sand/Gravel Truck 10,891 to 16,330 kg GVW		514	587	636	694	743	800	852	905	958	1011	1063	1117
2	0	Sand/Gravel Truck 16,331 kg or more GVW		712	712	712	712	712	712	712	712	712	712	712	712
2	0	School Bus 20 seats or less	139	153	167	172	185	195	209	217	241	250	261	271	283
2	0	School Bus 21 to 35 seats	153	172	185	195	209	217	228	241	269	281	292	305	316
2	0	School Bus 36 to 50 seats	172	195	209	217	228	241	263	269	289	302	314	324	339
2	0	School Bus 51 seats or more	195	217	228	241	263	269	276	289	328	345	356	371	384
2	0	Taxi/Livery Passenger Vehicle	3291												
2	0	Tow Truck 4,540 kg or less GVW	401	470	494	522	543	570	592	613	645	670	697	738	760
2	0	Tow Truck 4,541 to 16,330 kg GVW		585	667	722	789	845	910	969	1029	1089	1149	1209	1269
2	0	Tow Truck 16,331 kg or more GVW		450	450	450	450	450	450	450	450	450	450	450	450
2	0	Transit Bus 20 seats or less	406	434	472	561	661	763	798	833	868	902	938	974	1013
2	0	Transit Bus 21 to 35 seats	434	472	561	661	763	820	855	891	925	960	1001	1040	1081
2	0	Transit Bus 36 to 50 seats	472	561	661	763	820	882	915	953	985	1026	1066	1109	1154
2	0	Transit Bus 51 seats or more	573	677	780	839	902	969	1004	1040	1077	1122	1164	1212	1260
2	0	U Drive Bus	950												
2	0	U Drive Moped	159	236	281	331	359	370	387	405	423	440			
2	0	U Drive Motorhome	749												
2	0	U Drive Passenger Vehicle	420	463	531	563	597	632	663	694	727	753	763	776	792
2	0	U Drive Truck 4,540 kg or less GVW	379	443	466	492	512	537	559	578	608	632	657	696	717
2	0	U Drive Truck 4,541 to 16,330 kg GVW		266	304	329	359	384	414	441	468	495	523	550	577

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
869	887	906	922	940	956	973	992	1011	1028	1046	1068	1089	1111	1124	1151	1176	1206	1239	1243	1248	1252	1257
826	843	861	876	893	908	924	942	960	977	994	1015	1035	1055	1068	1093	1117	1146	1177	1181	1186	1189	1194
782	798	815	830	846	860	876	893	910	925	941	961	980	1000	1012	1036	1058	1085	1115	1119	1123	1127	1131
739	754	770	784	799	813	827	843	859	874	889	908	926	944	955	978	1000	1025	1053	1057	1061	1064	1068
695	710	725	738	752	765	778	794	809	822	837	854	871	889	899	921	941	965	991	994	998	1002	1006
652	665	679	691	705	717	730	744	758	771	784	801	817	833	843	863	882	904	929	932	936	939	943
643	656	670	682	696	707	720	734	748	761	774	790	806	822	832	852	870	892	917	920	924	926	930
634	648	661	673	686	698	710	724	738	750	764	780	795	811	821	840	858	880	904	907	911	914	918
626	639	652	664	677	688	701	714	728	740	753	769	784	800	809	829	847	868	892	895	899	901	905
617	630	643	655	667	679	691	704	718	730	743	758	773	789	798	817	835	856	880	883	886	889	892
608	621	634	645	658	669	681	694	708	720	732	748	762	778	787	806	823	844	867	870	874	876	880
653	681	730	738	768	794	829	838	851	880	919	938	966	1002	1012	1025	1048	1065	1101	1105	1110	1115	1120
620	647	693	701	730	754	788	796	808	836	873	891	918	952	961	974	996	1012	1046	1050	1054	1059	1064
588	613	657	664	691	715	746	754	766	792	827	844	869	902	911	922	943	958	991	994	999	1003	1008
555	579	620	627	653	675	705	712	723	748	781	797	821	852	860	871	891	905	936	939	943	948	952
522	545	584	590	614	635	663	670	681	704	735	750	773	802	810	820	838	852	881	884	888	892	896
490	511	547	553	576	595	622	628	638	660	689	703	724	751	759	769	786	799	826	829	832	836	840
483	504	540	546	568	588	613	620	630	651	680	694	715	741	749	758	776	788	815	818	821	825	829
477	497	533	539	561	580	605	612	621	642	671	685	705	731	739	748	765	777	804	807	810	814	818
470	490	526	531	553	572	597	603	613	634	662	675	696	721	729	738	755	767	793	796	799	803	806
464	484	518	524	545	564	589	595	604	625	652	666	686	711	719	728	744	756	782	785	788	792	795
457	477	511	517	538	556	580	587	596	616	643	657	676	701	708	717	734	745	771	773	777	780	784
936	956	975	993	1012	1030	1048	1069	1089	1108	1127	1150	1173	1196	1211	1240	1267	1299	1335	1339	1344	1349	1354
614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614
567	567	567	567	567																		
493	493	493	493	493																		
1170	1244	1319	1359	1380																		
712	712	712	712	712																		
294																						
328																						
352																						
400																						
771	803	861	871	906	937	978	988	1004	1038	1084	1106	1140	1183	1194	1210	1237	1257	1299	1304	1310	1316	1322
1330	1414	1499	1545	1568																		
450	450	450	450	450																		
1053																						
1123																						
1200																						
1308																						
807	824	841	856	873	888	904	921	938	955	971	992	1011	1031	1043	1069	1092	1119	1150	1154	1159	1163	1167
727	758	812	821	855	884	922	932	947	979	1022	1044	1075	1116	1127	1141	1167	1186	1225	1230	1236	1241	1247
605	643	682	705	716																		

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
3	28	All Purpose Motorhome	431	492	552	616	683	737	809	883	945	988	1070		
3	29	All Purpose Motorhome	425	486	544	608	673	727	798	871	932	974	1055		
3	30	All Purpose Motorhome	419	479	536	599	664	717	787	859	919	960	1040		
3	0	All Purpose Passenger Vehicle	707	779	893	948	1005	1064	1115	1167	1224	1267	1285	1305	1333
3	5	All Purpose Passenger Vehicle	672	740	848	901	955	1011	1059	1109	1163	1204	1221	1240	1266
3	10	All Purpose Passenger Vehicle	636	701	804	853	904	958	1003	1050	1102	1140	1156	1174	1200
3	15	All Purpose Passenger Vehicle	601	662	759	806	854	904	948	992	1040	1077	1092	1109	1133
3	20	All Purpose Passenger Vehicle	566	623	714	758	804	851	892	934	979	1014	1028	1044	1066
3	25	All Purpose Passenger Vehicle	530	584	670	711	754	798	836	875	918	950	964	979	1000
3	26	All Purpose Passenger Vehicle	523	576	661	702	744	787	825	864	906	938	951	966	986
3	27	All Purpose Passenger Vehicle	516	569	652	692	734	777	814	852	894	925	938	953	973
3	28	All Purpose Passenger Vehicle	509	561	643	683	724	766	803	840	881	912	925	940	960
3	29	All Purpose Passenger Vehicle	502	553	634	673	714	755	792	829	869	900	912	927	946
3	30	All Purpose Passenger Vehicle	495	545	625	664	703	745	780	817	857	887	899	913	933
3	0	All Purpose Snow Vehicle (HTA)	402												
3	0	All Purpose Trailer $2500 or less	6												
3	0	All Purpose Trailer $2501 or more		27	46	72	95	131	151	165	185	193	202	211	220
3	0	All Purpose Truck 4,540 kg or less GVW	500	586	615	650	676	710	738	764	803	835	868	919	948
3	5	All Purpose Truck 4,540 kg or less GVW	475	557	584	617	642	674	701	726	763	793	825	873	901
3	10	All Purpose Truck 4,540 kg or less GVW	450	527	553	585	608	639	664	688	723	751	781	827	853
3	15	All Purpose Truck 4,540 kg or less GVW	425	498	523	552	575	603	627	649	683	710	738	781	806
3	20	All Purpose Truck 4,540 kg or less GVW	400	469	492	520	541	568	590	611	642	668	694	735	758
3	25	All Purpose Truck 4,540 kg or less GVW	375	439	461	487	507	532	553	573	602	626	651	689	711
3	26	All Purpose Truck 4,540 kg or less GVW	370	434	455	481	500	525	546	565	594	618	642	680	702
3	27	All Purpose Truck 4,540 kg or less GVW	365	428	449	474	493	518	539	558	586	610	634	671	692
3	28	All Purpose Truck 4,540 kg or less GVW	360	422	443	468	487	511	531	550	578	601	625	662	683
3	29	All Purpose Truck 4,540 kg or less GVW	355	416	437	461	480	504	524	542	570	593	616	652	673
3	30	All Purpose Truck 4,540 kg or less GVW	350	410	430	455	473	497	517	535	562	584	608	643	664
3	0	Antique Vehicle - Bus	106												
3	0	Antique Vehicle - Motorcycle	106												
3	0	Antique Vehicle - Passenger Vehicle	106												
3	0	Antique Vehicle - Truck	106												
3	0	Artisan Truck 4,540 kg or less GVW	413	483	508	537	558	586	609	630	663	689	717	758	782
3	5	Artisan Truck 4,540 kg or less GVW	392	459	483	510	530	557	579	598	630	655	681	720	743
3	10	Artisan Truck 4,540 kg or less GVW	372	435	457	483	502	527	548	567	597	620	645	682	704
3	15	Artisan Truck 4,540 kg or less GVW	351	411	432	456	474	498	518	535	564	586	609	644	665
3	20	Artisan Truck 4,540 kg or less GVW	330	386	406	430	446	469	487	504	530	551	574	606	626
3	25	Artisan Truck 4,540 kg or less GVW	310	362	381	403	418	439	457	472	497	517	538	568	586
3	26	Artisan Truck 4,540 kg or less GVW	306	357	376	397	413	434	451	466	491	510	531	561	579
3	27	Artisan Truck 4,540 kg or less GVW	301	353	371	392	407	428	445	460	484	503	523	553	571
3	28	Artisan Truck 4,540 kg or less GVW	297	348	366	387	402	422	438	454	477	496	516	546	563
3	29	Artisan Truck 4,540 kg or less GVW	293	343	361	381	396	416	432	447	471	489	509	538	555
3	30	Artisan Truck 4,540 kg or less GVW	289	338	356	376	391	410	426	441	464	482	502	531	547
3	0	Artisan Truck 4,541 to 16,330 kg GVW		522	594	642	701	752	809	862	915	970	1026	1081	1137
3	5	Artisan Truck 4,541 to 16,330 kg GVW		496	564	610	666	714	769	819	869	921	975	1027	1080
3	10	Artisan Truck 4,541 to 16,330 kg GVW		470	535	578	631	677	728	776	823	873	923	973	1023
3	15	Artisan Truck 4,541 to 16,330 kg GVW		444	505	546	596	639	688	733	778	824	872	919	966
3	20	Artisan Truck 4,541 to 16,330 kg GVW		418	475	514	561	602	647	690	732	776	821	865	910
3	25	Artisan Truck 4,541 to 16,330 kg GVW		391	445	481	526	564	607	646	686	727	769	811	853

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1358	1386	1415	1441	1469	1494	1521	1550	1579	1607	1635	1669	1702	1735	1756	1799	1838	1884	1936	1943	1950	1957	1964
1290	1317	1344	1369	1396	1419	1445	1472	1500	1527	1553	1586	1617	1648	1668	1709	1746	1790	1839	1846	1852	1859	1866
1222	1247	1273	1297	1322	1345	1369	1395	1421	1446	1471	1502	1532	1561	1580	1619	1654	1696	1742	1749	1755	1761	1768
1154	1178	1203	1225	1249	1270	1293	1317	1342	1366	1390	1419	1447	1475	1493	1529	1562	1601	1646	1652	1657	1663	1669
1086	1109	1132	1153	1175	1195	1217	1240	1263	1286	1308	1335	1362	1388	1405	1439	1470	1507	1549	1554	1560	1566	1571
1018	1039	1061	1081	1102	1120	1141	1162	1184	1205	1226	1252	1276	1301	1317	1349	1378	1413	1452	1457	1462	1468	1473
1005	1026	1047	1066	1087	1106	1126	1147	1168	1189	1210	1235	1259	1284	1299	1331	1360	1394	1433	1438	1443	1448	1453
991	1012	1033	1052	1072	1091	1110	1131	1153	1173	1194	1218	1242	1267	1282	1313	1342	1375	1413	1418	1423	1429	1434
978	998	1019	1038	1058	1076	1095	1116	1137	1157	1177	1202	1225	1249	1264	1295	1323	1356	1394	1399	1404	1409	1414
964	984	1005	1023	1043	1061	1080	1100	1121	1141	1161	1185	1208	1232	1247	1277	1305	1338	1375	1380	1384	1389	1394
951	970	990	1009	1028	1046	1065	1085	1105	1125	1144	1168	1191	1214	1229	1259	1287	1319	1355	1360	1365	1370	1375

228																						
961	1001	1073	1085	1130	1167	1218	1231	1251	1294	1350	1379	1420	1474	1488	1508	1541	1567	1618	1625	1632	1640	1647
913	951	1019	1031	1073	1109	1157	1169	1188	1229	1282	1310	1349	1400	1414	1433	1464	1489	1537	1544	1550	1558	1565
865	901	966	976	1017	1050	1096	1108	1126	1165	1215	1241	1278	1327	1339	1357	1387	1410	1456	1462	1469	1476	1482
817	851	912	922	960	992	1035	1046	1063	1100	1147	1172	1207	1253	1265	1282	1310	1332	1375	1381	1387	1394	1400
769	801	858	868	904	934	974	985	1001	1035	1080	1103	1136	1179	1190	1206	1233	1254	1294	1300	1306	1312	1318
721	751	805	814	847	875	913	923	938	970	1012	1034	1065	1105	1116	1131	1156	1175	1213	1219	1224	1230	1235
711	741	794	803	836	864	901	911	926	958	999	1020	1051	1091	1101	1116	1140	1160	1197	1202	1208	1214	1219
702	731	783	792	825	852	889	899	913	945	985	1007	1037	1076	1086	1101	1125	1144	1181	1186	1191	1197	1202
692	721	773	781	814	840	877	886	901	932	972	993	1022	1061	1071	1086	1110	1128	1165	1170	1175	1181	1186
682	711	762	770	802	829	865	874	888	919	958	979	1008	1047	1056	1071	1094	1113	1149	1154	1159	1164	1169
673	701	751	759	791	817	853	862	876	906	945	965	994	1032	1042	1056	1079	1097	1133	1137	1142	1148	1153

793	826	885	895	932	966	1005	1016	1032	1067	1114	1138	1187	1216	1228	1256	1278	1317	1343	1341	1347	1353	1359
753	785	841	850	885	918	955	965	980	1014	1058	1081	1128	1155	1167	1193	1214	1251	1276	1274	1280	1285	1291
714	743	796	805	839	869	904	914	929	960	1003	1024	1068	1094	1105	1130	1150	1185	1209	1207	1212	1218	1223
674	702	752	761	792	821	854	864	877	907	947	967	1009	1034	1044	1068	1086	1119	1142	1140	1145	1150	1155
634	661	708	716	746	773	804	813	826	854	891	910	950	973	982	1005	1022	1054	1074	1073	1078	1082	1087
595	619	664	671	699	724	754	762	774	800	835	853	890	912	921	942	958	988	1007	1006	1010	1015	1019
587	611	655	662	690	715	744	752	764	790	824	842	878	900	909	929	946	975	994	992	997	1001	1006
579	603	646	653	680	705	734	742	753	779	813	831	867	888	896	917	933	961	980	979	983	988	992
571	595	637	644	671	696	724	732	743	768	802	819	855	876	884	904	920	948	967	966	970	974	978
563	586	628	635	662	686	714	721	733	758	791	808	843	863	872	892	907	935	954	952	956	961	965
555	578	619	626	652	676	703	711	722	747	780	797	831	851	860	879	895	922	940	939	943	947	951
1194	1271	1349	1392	1415																		
1134	1207	1282	1322	1344																		
1075	1144	1214	1253	1273																		
1015	1080	1147	1183	1203																		
955	1017	1079	1114	1132																		
895	953	1012	1044	1061																		

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
3	5	Pleasure Motorcycle-Touring 1001 cc or more	1073	1173	1201	1276	1312	1379	1443	1520	1609	1631			
3	10	Pleasure Motorcycle-Touring 1001 cc or more	1016	1111	1138	1209	1243	1307	1367	1440	1525	1545			
3	15	Pleasure Motorcycle-Touring 1001 cc or more	960	1050	1074	1142	1174	1234	1291	1360	1440	1459			
3	20	Pleasure Motorcycle-Touring 1001 cc or more	903	988	1011	1074	1105	1162	1215	1280	1355	1374			
3	25	Pleasure Motorcycle-Touring 1001 cc or more	847	926	948	1007	1036	1089	1139	1200	1270	1288			
3	26	Pleasure Motorcycle-Touring 1001 cc or more	835	914	935	994	1022	1074	1124	1184	1254	1271			
3	27	Pleasure Motorcycle-Touring 1001 cc or more	824	902	923	980	1008	1060	1109	1168	1237	1253			
3	28	Pleasure Motorcycle-Touring 1001 cc or more	813	889	910	967	994	1045	1094	1152	1220	1236			
3	29	Pleasure Motorcycle-Touring 1001 cc or more	802	877	897	954	981	1031	1078	1136	1203	1219			
3	30	Pleasure Motorcycle-Touring 1001 cc or more	790	864	885	940	967	1016	1063	1120	1186	1202			
3	0	Pleasure Motorhome	466	532	596	666	737	796	873	954	1021	1066	1155		
3	5	Pleasure Motorhome	443	505	566	633	700	756	829	906	970	1013	1097		
3	10	Pleasure Motorhome	419	479	536	599	663	716	786	859	919	959	1039		
3	15	Pleasure Motorhome	396	452	507	566	626	677	742	811	868	906	982		
3	20	Pleasure Motorhome	373	426	477	533	590	637	698	763	817	853	924		
3	25	Pleasure Motorhome	349	399	447	499	553	597	655	715	766	799	866		
3	26	Pleasure Motorhome	345	394	441	493	545	589	646	706	756	789	855		
3	27	Pleasure Motorhome	340	388	435	486	538	581	637	696	745	778	843		
3	28	Pleasure Motorhome	336	383	429	480	531	573	629	687	735	768	832		
3	29	Pleasure Motorhome	331	378	423	473	523	565	620	677	725	757	820		
3	30	Pleasure Motorhome	326	372	417	466	516	557	611	668	715	746	808		
3	0	Pleasure Passenger Vehicle	565	622	714	757	803	850	891	932	977	1012	1026	1043	1065
3	5	Pleasure Passenger Vehicle	537	591	678	719	763	807	846	885	928	961	975	991	1012
3	10	Pleasure Passenger Vehicle	508	560	643	681	723	765	802	839	879	911	923	939	958
3	15	Pleasure Passenger Vehicle	480	529	607	643	683	722	757	792	830	860	872	887	905
3	20	Pleasure Passenger Vehicle	452	498	571	606	642	680	713	746	782	810	821	834	852
3	25	Pleasure Passenger Vehicle	424	466	535	568	602	637	668	699	733	759	769	782	799
3	26	Pleasure Passenger Vehicle	418	460	528	560	594	629	659	690	723	749	759	772	788
3	27	Pleasure Passenger Vehicle	412	454	521	553	586	620	650	680	713	739	749	761	777
3	28	Pleasure Passenger Vehicle	407	448	514	545	578	612	642	671	703	729	739	751	767
3	29	Pleasure Passenger Vehicle	401	442	507	537	570	603	633	662	694	719	728	741	756
3	30	Pleasure Passenger Vehicle	395	435	500	530	562	595	624	652	684	708	718	730	745
3	0	Pleasure Truck 4,540 kg or less GVW	365	428	449	475	494	518	539	558	587	610	634	671	692
3	5	Pleasure Truck 4,540 kg or less GVW	347	407	427	451	469	492	512	530	558	579	602	637	657
3	10	Pleasure Truck 4,540 kg or less GVW	328	385	404	427	445	466	485	502	528	549	571	604	623
3	15	Pleasure Truck 4,540 kg or less GVW	310	364	382	404	420	440	458	474	499	518	539	570	588
3	20	Pleasure Truck 4,540 kg or less GVW	292	342	359	380	395	414	431	446	470	488	507	537	554
3	25	Pleasure Truck 4,540 kg or less GVW	274	321	337	356	370	388	404	418	440	457	475	503	519
3	26	Pleasure Truck 4,540 kg or less GVW	270	317	332	351	366	383	399	413	434	451	469	497	512
3	27	Pleasure Truck 4,540 kg or less GVW	266	312	328	347	361	378	393	407	429	445	463	490	505
3	28	Pleasure Truck 4,540 kg or less GVW	263	308	323	342	356	373	388	402	423	439	456	483	498
3	29	Pleasure Truck 4,540 kg or less GVW	259	304	319	337	351	368	383	396	417	433	450	476	491
3	30	Pleasure Truck 4,540 kg or less GVW	255	300	314	332	346	363	377	391	411	427	444	470	484
3	0	Police/Emergency Passenger Vehicle	744	819	940	997	1058	1119	1173	1228	1287	1332	1351	1373	1402
3	0	Police/Emergency Truck 4,540 kg or less GVW	844	844	844	844	844	844	844	844	844	844	844	844	844
3	0	Police/Emergency Truck 4,541 to 16,330 kg GVW		779	779	779	779	779	779	779	779	779	779	779	779
3	0	Police/Emergency Truck 16,331 kg or more GVW		756	756	756	756	756	756	756	756	756	756	756	756
3	0	Repairer	288												
3	0	Sand/Gravel Truck 10,891 to 16,330 kg GVW		580	662	716	782	838	902	961	1020	1079	1139	1198	1258
3	0	Sand/Gravel Truck 16,331 kg or more GVW		865	865	865	865	865	865	865	865	865	865	865	865
3	0	School Bus 20 seats or less	199	225	236	253	269	282	282	313	347	363	376	392	408
3	0	School Bus 21 to 35 seats	225	253	269	278	282	313	331	347	394	409	424	443	459
3	0	School Bus 36 to 50 seats	253	282	282	313	331	347	368	394	400	415	432	449	467
3	0	School Bus 51 seats or more	282	313	331	347	368	394	397	404	408	424	442	458	478
3	0	Taxi/Livery Passenger Vehicle	4652												
3	0	Tow Truck 4,540 kg or less GVW	463	542	570	602	626	657	684	707	744	773	804	851	878
3	0	Tow Truck 4,541 to 16,330 kg GVW		603	688	745	813	871	938	999	1061	1123	1185	1246	1309
3	0	Tow Truck 16,331 kg or more GVW		579	579	579	579	579	579	579	579	579	579	579	579
3	0	Transit Bus 20 seats or less	556	599	644	771	906	1047	1096	1144	1193	1241	1290	1342	1395
3	0	Transit Bus 21 to 35 seats	599	644	771	906	1047	1127	1174	1223	1272	1320	1376	1430	1487

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1085	1107	1130	1151	1173	1193	1215	1238	1261	1284	1306	1333	1359	1386	1403	1437	1468	1505	1546	1552	1557	1563	1569
1031	1052	1073	1093	1114	1133	1154	1176	1198	1220	1241	1266	1291	1317	1333	1365	1395	1430	1469	1474	1479	1485	1491
976	996	1017	1036	1056	1074	1093	1114	1135	1156	1175	1200	1223	1247	1263	1293	1321	1354	1391	1397	1401	1407	1412
922	941	960	978	997	1014	1033	1052	1072	1091	1110	1133	1155	1178	1193	1221	1248	1279	1314	1319	1323	1329	1334
868	886	904	921	938	954	972	990	1009	1027	1045	1066	1087	1109	1122	1150	1174	1204	1237	1242	1246	1250	1255
814	830	847	863	880	895	911	928	946	963	979	1000	1019	1039	1052	1078	1101	1129	1159	1164	1168	1172	1177
803	819	836	852	868	883	899	916	933	950	966	986	1006	1026	1038	1063	1086	1114	1144	1148	1152	1157	1161
792	808	825	840	856	871	887	904	921	937	953	973	992	1012	1024	1049	1072	1099	1129	1133	1137	1141	1145
781	797	814	829	845	859	875	891	908	924	940	960	978	998	1010	1035	1057	1084	1113	1117	1121	1125	1130
770	786	802	817	833	847	863	879	895	912	927	946	965	984	996	1020	1042	1069	1098	1102	1105	1110	1114
759	775	791	806	821	835	850	867	883	899	914	933	951	970	982	1006	1028	1053	1082	1086	1090	1094	1098
702	731	784	793	825	853	890	900	914	945	987	1007	1038	1077	1087	1101	1126	1144	1182	1187	1193	1198	1203
667	694	745	753	784	810	845	855	868	898	938	957	986	1023	1033	1046	1070	1087	1123	1128	1133	1138	1143
632	658	706	714	742	768	801	810	823	850	888	906	934	969	978	991	1013	1030	1064	1068	1074	1078	1083
597	621	666	674	701	725	756	765	777	803	839	856	882	915	924	936	957	972	1005	1009	1014	1018	1023
562	585	627	634	660	682	712	720	731	756	790	806	830	862	870	881	901	915	946	950	954	958	962
526	548	588	595	619	640	667	675	685	709	740	755	778	808	815	826	844	858	886	890	895	898	902
519	541	580	587	610	631	659	666	676	699	730	745	768	797	804	815	833	847	875	878	883	887	890
512	534	572	579	602	623	650	657	667	690	721	735	758	786	794	804	822	835	863	867	871	875	878
505	526	564	571	594	614	641	648	658	680	711	725	747	775	783	793	811	824	851	855	859	863	866
498	519	557	563	586	606	632	639	649	671	701	715	737	765	772	782	799	812	839	843	847	851	854
491	512	549	555	577	597	623	630	640	661	691	705	727	754	761	771	788	801	827	831	835	839	842
1429	1458	1489	1516	1545	1571	1600	1631	1661	1691	1720	1756	1790	1826	1847	1893	1934	1982	2037	2044	2051	2059	2066
844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844
779	779	779	779	779																		
756	756	756	756	756																		
1319	1402	1486	1531	1554																		
865	865	865	865	865																		
424																						
478																						
487																						
496																						
890	927	993	1005	1046	1081	1128	1141	1159	1198	1251	1277	1316	1365	1378	1396	1428	1451	1499	1505	1512	1519	1525
1372	1458	1546	1593	1617																		
579	579	579	579	579																		
1451																						
1548																						

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
4	26	All Purpose Motorcycle-Touring 501 to 1000 cc	1063	1163	1190	1265	1300	1367	1430	1507	1595	1617			
4	27	All Purpose Motorcycle-Touring 501 to 1000 cc	1048	1148	1174	1248	1283	1348	1411	1486	1573	1595			
4	28	All Purpose Motorcycle-Touring 501 to 1000 cc	1034	1132	1158	1230	1265	1330	1392	1466	1552	1573			
4	29	All Purpose Motorcycle-Touring 501 to 1000 cc	1020	1116	1142	1213	1247	1311	1372	1446	1530	1551			
4	30	All Purpose Motorcycle-Touring 501 to 1000 cc	1005	1100	1126	1196	1230	1293	1353	1425	1508	1529			
4	0	All Purpose Motorcycle-Touring 1001 cc or more	1436	1572	1608	1709	1757	1847	1933	2036	2155	2185			
4	5	All Purpose Motorcycle-Touring 1001 cc or more	1364	1493	1528	1624	1669	1755	1836	1934	2047	2076			
4	10	All Purpose Motorcycle-Touring 1001 cc or more	1292	1415	1447	1538	1581	1662	1740	1832	1939	1966			
4	15	All Purpose Motorcycle-Touring 1001 cc or more	1221	1336	1367	1453	1493	1570	1643	1731	1832	1857			
4	20	All Purpose Motorcycle-Touring 1001 cc or more	1149	1258	1286	1367	1406	1478	1546	1629	1724	1748			
4	25	All Purpose Motorcycle-Touring 1001 cc or more	1077	1179	1206	1282	1318	1385	1450	1527	1616	1639			
4	26	All Purpose Motorcycle-Touring 1001 cc or more	1063	1163	1190	1265	1300	1367	1430	1507	1595	1617			
4	27	All Purpose Motorcycle-Touring 1001 cc or more	1048	1148	1174	1248	1283	1348	1411	1486	1573	1595			
4	28	All Purpose Motorcycle-Touring 1001 cc or more	1034	1132	1158	1230	1265	1330	1392	1466	1552	1573			
4	29	All Purpose Motorcycle-Touring 1001 cc or more	1020	1116	1142	1213	1247	1311	1372	1446	1530	1551			
4	30	All Purpose Motorcycle-Touring 1001 cc or more	1005	1100	1126	1196	1230	1293	1353	1425	1508	1529			
4	0	All Purpose Motorhome	810	926	1037	1159	1283	1386	1520	1661	1777	1856	2011		
4	5	All Purpose Motorhome	769	880	985	1101	1219	1317	1444	1578	1688	1763	1910		
4	10	All Purpose Motorhome	729	833	933	1043	1155	1247	1368	1495	1599	1670	1810		
4	15	All Purpose Motorhome	688	787	881	985	1091	1178	1292	1412	1510	1578	1709		
4	20	All Purpose Motorhome	648	741	830	927	1026	1109	1216	1329	1422	1485	1609		
4	25	All Purpose Motorhome	607	694	778	869	962	1039	1140	1246	1333	1392	1508		
4	26	All Purpose Motorhome	599	685	767	858	949	1026	1125	1229	1315	1373	1488		
4	27	All Purpose Motorhome	591	676	757	846	937	1012	1110	1213	1297	1355	1468		
4	28	All Purpose Motorhome	583	667	747	834	924	998	1094	1196	1279	1336	1448		
4	29	All Purpose Motorhome	575	657	736	823	911	984	1079	1179	1262	1318	1428		
4	30	All Purpose Motorhome	567	648	726	811	898	970	1064	1163	1244	1299	1408		
4	0	All Purpose Passenger Vehicle	726	800	918	974	1033	1093	1145	1199	1257	1301	1319	1341	1369
4	5	All Purpose Passenger Vehicle	690	760	872	925	981	1038	1088	1139	1194	1236	1253	1274	1301
4	10	All Purpose Passenger Vehicle	653	720	826	877	930	984	1030	1079	1131	1171	1187	1207	1232
4	15	All Purpose Passenger Vehicle	617	680	780	828	878	929	973	1019	1068	1106	1121	1140	1164
4	20	All Purpose Passenger Vehicle	581	640	734	779	826	874	916	959	1006	1041	1055	1073	1095
4	25	All Purpose Passenger Vehicle	544	600	688	730	775	820	859	899	943	976	989	1006	1027
4	26	All Purpose Passenger Vehicle	537	592	679	721	764	809	847	887	930	963	976	992	1013
4	27	All Purpose Passenger Vehicle	530	584	670	711	754	798	836	875	918	950	963	979	999
4	28	All Purpose Passenger Vehicle	523	576	661	701	744	787	824	863	905	937	950	966	986
4	29	All Purpose Passenger Vehicle	515	568	652	692	733	776	813	851	892	924	936	952	972
4	30	All Purpose Passenger Vehicle	508	560	643	682	723	765	801	839	880	911	923	939	958
4	0	All Purpose Snow Vehicle (HTA)	369												
4	0	All Purpose Trailer $2500 or less	5												
4	0	All Purpose Trailer $2501 or more		25	42	66	87	120	138	151	169	176	184	193	201
4	0	All Purpose Truck 4,540 kg or less GVW	540	632	664	702	730	766	797	825	867	902	938	992	1023
4	5	All Purpose Truck 4,540 kg or less GVW	513	600	631	667	693	728	757	784	824	857	891	942	972
4	10	All Purpose Truck 4,540 kg or less GVW	486	569	598	632	657	689	717	742	780	812	844	893	921
4	15	All Purpose Truck 4,540 kg or less GVW	459	537	564	597	620	651	677	701	737	767	797	843	870
4	20	All Purpose Truck 4,540 kg or less GVW	432	506	531	562	584	613	638	660	694	722	750	794	818
4	25	All Purpose Truck 4,540 kg or less GVW	405	474	498	526	547	574	598	619	650	676	703	744	767
4	26	All Purpose Truck 4,540 kg or less GVW	400	468	491	519	540	567	590	610	642	667	694	734	757
4	27	All Purpose Truck 4,540 kg or less GVW	394	461	485	512	533	559	582	602	633	658	685	724	747
4	28	All Purpose Truck 4,540 kg or less GVW	389	455	478	505	526	552	574	594	624	649	675	714	737
4	29	All Purpose Truck 4,540 kg or less GVW	383	449	471	498	518	544	566	586	616	640	666	704	726
4	30	All Purpose Truck 4,540 kg or less GVW	378	442	465	491	511	536	558	577	607	631	657	694	716
4	0	Antique Vehicle - Bus	106												
4	0	Antique Vehicle - Motorcycle	106												
4	0	Antique Vehicle - Passenger Vehicle	106												
4	0	Antique Vehicle - Truck	106												
4	0	Artisan Truck 4,540 kg or less GVW	409	479	503	532	553	580	603	624	657	683	710	751	775
4	5	Artisan Truck 4,540 kg or less GVW	389	455	478	505	525	551	573	593	624	649	674	713	736
4	10	Artisan Truck 4,540 kg or less GVW	368	431	453	479	498	522	543	562	591	615	639	676	697
4	15	Artisan Truck 4,540 kg or less GVW	348	407	428	452	470	493	513	530	558	581	603	638	659

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1395	1424	1453	1480	1508	1534	1562	1592	1622	1650	1679	1714	1748	1782	1804	1848	1888	1935	1988	1996	2003	2010	2017
1325	1353	1380	1406	1433	1457	1484	1512	1541	1567	1595	1628	1661	1693	1714	1756	1794	1838	1889	1896	1903	1909	1916
1255	1282	1308	1332	1357	1381	1406	1433	1460	1485	1511	1543	1573	1604	1624	1663	1699	1741	1789	1796	1803	1809	1815
1186	1210	1235	1258	1282	1304	1328	1353	1379	1402	1427	1457	1486	1515	1533	1571	1605	1645	1690	1697	1703	1708	1714
1116	1139	1162	1184	1206	1227	1250	1274	1298	1320	1343	1371	1398	1426	1443	1478	1510	1548	1590	1597	1602	1608	1614
1046	1068	1090	1110	1131	1150	1171	1194	1216	1237	1259	1285	1311	1336	1353	1386	1416	1451	1491	1497	1502	1507	1513
1032	1054	1075	1095	1116	1135	1156	1178	1200	1221	1242	1268	1294	1319	1335	1368	1397	1432	1471	1477	1482	1487	1493
1018	1040	1061	1080	1101	1120	1140	1162	1184	1204	1226	1251	1276	1301	1317	1349	1378	1413	1451	1457	1462	1467	1472
1004	1025	1046	1066	1086	1104	1125	1146	1168	1188	1209	1234	1259	1283	1299	1331	1359	1393	1431	1437	1442	1447	1452
990	1011	1032	1051	1071	1089	1109	1130	1152	1171	1192	1217	1241	1265	1281	1312	1340	1374	1411	1417	1422	1427	1432
976	997	1017	1036	1056	1074	1093	1114	1135	1155	1175	1200	1224	1247	1263	1294	1322	1354	1392	1397	1402	1407	1412
209																						
1037	1081	1158	1172	1220	1260	1316	1330	1351	1397	1458	1489	1534	1592	1607	1628	1664	1692	1748	1755	1763	1771	1779
985	1027	1100	1113	1159	1197	1250	1263	1283	1327	1385	1415	1457	1512	1527	1547	1581	1607	1661	1667	1675	1682	1690
933	973	1042	1055	1098	1134	1184	1197	1216	1257	1312	1340	1381	1433	1446	1465	1498	1523	1573	1579	1587	1594	1601
881	919	984	996	1037	1071	1119	1130	1148	1187	1239	1266	1304	1353	1366	1384	1414	1438	1486	1492	1499	1505	1512
830	865	926	938	976	1008	1053	1064	1081	1118	1166	1191	1227	1274	1286	1302	1331	1354	1398	1404	1410	1417	1423
778	811	868	879	915	945	987	997	1013	1048	1093	1117	1150	1194	1205	1221	1248	1269	1311	1316	1322	1328	1334
767	800	857	867	903	932	974	984	1000	1034	1079	1102	1135	1178	1189	1205	1231	1252	1294	1299	1305	1311	1316
757	789	845	856	891	920	961	971	986	1020	1064	1087	1120	1162	1173	1188	1215	1235	1276	1281	1287	1293	1299
747	778	834	844	878	907	948	958	973	1006	1050	1072	1104	1146	1157	1172	1198	1218	1259	1264	1269	1275	1281
736	768	822	832	866	895	934	944	959	992	1035	1057	1089	1130	1141	1156	1181	1201	1241	1246	1252	1257	1263
726	757	811	820	854	882	921	931	946	978	1021	1042	1074	1114	1125	1140	1165	1184	1224	1228	1234	1240	1245
785	818	877	887	923	954	996	1007	1023	1057	1104	1127	1161	1205	1216	1232	1260	1281	1323	1329	1334	1340	1346
746	777	833	843	877	906	946	957	972	1004	1049	1071	1103	1145	1155	1170	1197	1217	1257	1263	1267	1273	1279
706	736	789	798	831	859	896	906	921	951	994	1014	1045	1084	1094	1109	1134	1153	1191	1196	1201	1206	1211
667	695	745	754	785	811	847	856	870	898	938	958	987	1024	1034	1047	1071	1089	1125	1130	1134	1139	1144

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
4	10	Pleasure Motorcycle-Touring 1001 cc or more	994	1089	1114	1184	1218	1280	1339	1411	1493	1514			
4	15	Pleasure Motorcycle-Touring 1001 cc or more	939	1028	1052	1119	1150	1209	1265	1333	1410	1430			
4	20	Pleasure Motorcycle-Touring 1001 cc or more	884	968	990	1053	1082	1138	1190	1254	1327	1346			
4	25	Pleasure Motorcycle-Touring 1001 cc or more	829	907	928	987	1015	1066	1116	1176	1244	1261			
4	26	Pleasure Motorcycle-Touring 1001 cc or more	818	895	916	974	1001	1052	1101	1160	1228	1245			
4	27	Pleasure Motorcycle-Touring 1001 cc or more	807	883	904	961	988	1038	1086	1145	1211	1228			
4	28	Pleasure Motorcycle-Touring 1001 cc or more	796	871	891	948	974	1024	1071	1129	1194	1211			
4	29	Pleasure Motorcycle-Touring 1001 cc or more	785	859	879	934	961	1010	1056	1113	1178	1194			
4	30	Pleasure Motorcycle-Touring 1001 cc or more	773	847	867	921	947	995	1042	1098	1161	1177			
4	0	Pleasure Motorhome	489	558	625	699	774	836	917	1002	1072	1119	1213		
4	5	Pleasure Motorhome	465	530	594	664	735	794	871	952	1018	1063	1152		
4	10	Pleasure Motorhome	440	502	562	629	697	752	825	902	965	1007	1092		
4	15	Pleasure Motorhome	416	474	531	594	658	711	779	852	911	951	1031		
4	20	Pleasure Motorhome	391	446	500	559	619	669	734	802	858	895	970		
4	25	Pleasure Motorhome	367	418	469	524	580	627	688	751	804	839	910		
4	26	Pleasure Motorhome	362	413	462	517	573	619	679	741	793	828	898		
4	27	Pleasure Motorhome	357	407	456	510	565	610	669	731	783	817	885		
4	28	Pleasure Motorhome	352	402	450	503	557	602	660	721	772	806	873		
4	29	Pleasure Motorhome	347	396	444	496	550	594	651	711	761	794	861		
4	30	Pleasure Motorhome	342	391	437	489	542	585	642	701	750	783	849		
4	0	Pleasure Passenger Vehicle	576	635	729	773	820	867	909	952	998	1033	1048	1064	1087
4	5	Pleasure Passenger Vehicle	547	603	693	734	779	824	864	904	948	981	996	1011	1033
4	10	Pleasure Passenger Vehicle	518	571	656	696	738	780	818	857	898	930	943	958	978
4	15	Pleasure Passenger Vehicle	490	540	620	657	697	737	773	809	848	878	891	904	924
4	20	Pleasure Passenger Vehicle	461	508	583	618	656	694	727	762	798	826	838	851	870
4	25	Pleasure Passenger Vehicle	432	476	547	580	615	650	682	714	748	775	786	798	815
4	26	Pleasure Passenger Vehicle	426	470	539	572	607	642	673	704	739	764	776	787	804
4	27	Pleasure Passenger Vehicle	420	464	532	564	599	633	664	695	729	754	765	777	794
4	28	Pleasure Passenger Vehicle	415	457	525	557	590	624	654	685	719	744	755	766	783
4	29	Pleasure Passenger Vehicle	409	451	518	549	582	616	645	676	709	733	744	755	772
4	30	Pleasure Passenger Vehicle	403	444	510	541	574	607	636	666	699	723	734	745	761
4	0	Pleasure Truck 4,540 kg or less GVW	396	464	487	515	535	562	584	604	636	661	688	728	750
4	5	Pleasure Truck 4,540 kg or less GVW	376	441	463	489	508	534	555	574	604	628	654	692	712
4	10	Pleasure Truck 4,540 kg or less GVW	356	418	438	463	481	506	526	544	572	595	619	655	675
4	15	Pleasure Truck 4,540 kg or less GVW	337	394	414	438	455	478	496	513	541	562	585	619	637
4	20	Pleasure Truck 4,540 kg or less GVW	317	371	390	412	428	450	467	483	509	529	550	582	600
4	25	Pleasure Truck 4,540 kg or less GVW	297	348	365	386	401	421	438	453	477	496	516	546	562
4	26	Pleasure Truck 4,540 kg or less GVW	293	343	360	381	396	416	432	447	471	489	509	539	555
4	27	Pleasure Truck 4,540 kg or less GVW	289	339	356	376	391	410	426	441	464	483	502	531	547
4	28	Pleasure Truck 4,540 kg or less GVW	285	334	351	371	385	405	420	435	458	476	495	524	540
4	29	Pleasure Truck 4,540 kg or less GVW	281	329	346	366	380	399	415	429	452	469	488	517	532
4	30	Pleasure Truck 4,540 kg or less GVW	277	325	341	360	374	393	409	423	445	463	482	510	525
4	0	Police/Emergency Passenger Vehicle	697	767	880	934	991	1048	1099	1150	1206	1248	1266	1286	1313
4	0	Police/Emergency Truck 4,540 kg or less GVW	747	747	747	747	747	747	747	747	747	747	747	747	747
4	0	Police/Emergency Truck 4,541 to 16,330 kg GVW		624	624	624	624	624	624	624	624	624	624	624	624
4	0	Police/Emergency Truck 16,331 kg or more GVW		478	478	478	478	478	478	478	478	478	478	478	478
4	0	Repairer	267												
4	0	Sand/Gravel Truck 10,891 to 16,330 kg GVW		509	581	629	687	736	792	844	896	948	1001	1052	1105
4	0	Sand/Gravel Truck 16,331 kg or more GVW		766	766	766	766	766	766	766	766	766	766	766	766
4	0	School Bus 20 seats or less	181	204	217	230	245	256	272	288	316	332	343	356	371
4	0	School Bus 21 to 35 seats	204	230	245	256	272	288	303	316	359	374	388	406	422
4	0	School Bus 36 to 50 seats	230	256	272	288	303	316	346	359	363	377	395	410	425
4	0	School Bus 51 seats or more	256	288	303	316	346	359	362	368	374	388	406	422	440
4	0	Taxi/Livery Passenger Vehicle	4133												
4	0	Tow Truck 4,540 kg or less GVW	352	412	433	457	476	499	519	537	565	587	611	646	667
4	0	Tow Truck 4,541 to 16,330 kg GVW		504	575	623	680	728	784	835	887	938	990	1041	1094
4	0	Tow Truck 16,331 kg or more GVW		452	452	452	452	452	452	452	452	452	452	452	452
4	0	Transit Bus 20 seats or less	440	472	505	606	713	823	862	900	939	975	1016	1058	1099
4	0	Transit Bus 21 to 35 seats	496	533	642	750	868	934	973	1016	1058	1100	1143	1189	1235
4	0	Transit Bus 36 to 50 seats	505	606	713	823	885	954	995	1031	1068	1112	1155	1201	1249

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1107	1130	1154	1175	1197	1218	1240	1264	1288	1310	1333	1361	1388	1415	1432	1467	1499	1536	1579	1584	1590	1596	1602
1052	1073	1096	1116	1137	1157	1178	1201	1224	1244	1266	1293	1319	1344	1360	1394	1424	1459	1500	1505	1510	1516	1522
996	1017	1039	1057	1077	1096	1116	1138	1159	1179	1200	1225	1249	1273	1289	1320	1349	1382	1421	1426	1431	1436	1442
941	960	981	999	1017	1035	1054	1074	1095	1113	1133	1157	1180	1203	1217	1247	1274	1306	1342	1346	1351	1357	1362
886	904	923	940	958	974	992	1011	1030	1048	1066	1089	1110	1132	1146	1174	1199	1229	1263	1267	1272	1277	1282
830	847	865	881	898	913	930	948	966	982	1000	1021	1041	1061	1074	1100	1124	1152	1184	1188	1192	1197	1201
819	836	854	869	886	901	918	935	953	969	986	1007	1027	1047	1060	1086	1109	1137	1168	1172	1177	1181	1185
808	825	842	858	874	889	905	923	940	956	973	994	1013	1033	1045	1071	1094	1121	1153	1156	1161	1165	1169
797	814	831	846	862	877	893	910	927	943	960	980	999	1019	1031	1056	1079	1106	1137	1140	1145	1149	1153
786	802	819	834	850	865	880	897	914	930	946	966	985	1005	1017	1042	1064	1091	1121	1125	1129	1133	1137
775	791	808	822	838	853	868	885	902	917	933	953	972	990	1002	1027	1049	1075	1105	1109	1113	1117	1121
760	792	849	859	894	924	964	975	991	1024	1069	1091	1124	1167	1178	1194	1220	1240	1281	1287	1292	1298	1304
722	752	807	816	849	878	916	926	941	973	1016	1036	1068	1109	1119	1134	1159	1178	1217	1223	1227	1233	1239
684	713	764	773	805	832	868	877	892	922	962	982	1012	1050	1060	1075	1098	1116	1153	1158	1163	1168	1174
646	673	722	730	760	785	819	829	842	870	909	927	955	992	1001	1015	1037	1054	1089	1094	1098	1103	1108
608	634	679	687	715	739	771	780	793	819	855	873	899	934	942	955	976	992	1025	1030	1034	1038	1043
570	594	637	644	670	693	723	731	743	768	802	818	843	875	883	895	915	930	961	965	969	973	978
562	586	628	636	662	684	713	721	733	758	791	807	832	864	872	884	903	918	948	952	956	961	965
555	578	620	627	653	675	704	712	723	748	780	796	821	852	860	872	891	905	935	940	943	948	952
547	570	611	618	644	665	694	702	714	737	770	786	809	840	848	860	878	893	922	927	930	935	939
540	562	603	610	635	656	684	692	704	727	759	775	798	829	836	848	866	880	910	914	917	922	926
532	554	594	601	626	647	675	682	694	717	748	764	787	817	825	836	854	868	897	901	904	909	913
1338	1366	1394	1420	1447	1472	1499	1527	1556	1583	1611	1644	1677	1710	1730	1773	1811	1856	1908	1914	1921	1928	1935
747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747
624	624	624	624	624																		
478	478	478	478	478																		
1158	1231	1305	1345	1365																		
766	766	766	766	766																		
387																						
440																						
443																						
457																						
676	704	755	763	795	821	857	866	880	910	950	970	999	1037	1047	1061	1084	1102	1138	1143	1148	1153	1159
1146	1219	1292	1331	1351																		
452	452	452	452	452																		
1142																						
1285																						
1298																						

Grade 12 Essential Mathematics (40S)

Module 5
Vehicle Finance

Learning Activity Answer Keys

Module 5:
Vehicle Finance

Learning Activity 5.1

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Calculate 40% of 5600.
2. A computer costs $900. Estimate the cost, including taxes.
3. Evaluate for $n = 4$: $4n^2 + n - 9$
4. Solve for c: $\frac{8}{c} = 4$
5. The price of a $24,000 vehicle is reduced by 20%. What is the reduced price of the vehicle (not including taxes)?

Answers:

1. 2240 (50% of 5600 = 2800; 10% of 5600 = 560; 40% of 5600 = 2800 − 560 = 2240 or 10% of 5600 is 560; 40% of 5600 is 4 × 560 or 4 × 500 + 4 × 60 = 2000 + 240 = 2240)
2. $1008 (12% × $100 = $12; 12% × $900 = $12 × 9 = $108; Total cost = $900 + $108 = $1008)
3. 59 (4(16) + 4 − 9 = 64 + 4 − 9 = 59)
4. 2 $\left(c = \frac{8}{4} = 2\right)$
5. $19,200 (10% of $24,000 = $2400; 20% of $24,000 = $4800; Reduced price = $24000 − $4800 = $19,200)

Part B: Vehicle Decisions

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Use the Vehicle Features Chart to complete the questions that follow.

Vehicles Features Chart		
Vehicle Options	**Important To You**	**Rating**
Standard Transmission		
Automatic Transmission		
Fuel Consumption		
Air Bags—Driver/Passenger/Side		
Warranty		
Anti-lock Braking System		
Power Brakes		
Power Steering		
Power Seat Adjustments		
Power Mirror Adjustments		
Power Windows		
Central Door Locking		
Childproof Locks		
Integrated Child Restraint System		
Air Conditioning		
Rear Window Defroster		
Heated Seats		
Cruise Control		
Tinted Glass		
Sunroof		
Winter Tires		
Summer Tires		
All Season Tires		
Sound System		
Telephone		
Anti-theft Device		
Spoiler		

a) Check off at least 10 features that you consider important in a vehicle that you would like to purchase.

Answer:

Answers will vary.

b) Rate these features in order of importance to you. Use a scale of one (the most important) to 10 (the least important).

Answer:

Answers will vary.

2. State the highest allowable percentages for the Gross Debt Service ratio and the Total Debt Service ratio. Why is one percentage greater than the other?

Answer:

The Gross Debt Service ratio should not exceed 32%.

The Total Debt Service ratio should not exceed 40%.

The Total Debt Service ratio has a higher percentage because it includes more debt repayments than the Gross Debt Service ratio. Therefore, you should be spending no more than 40% of your gross income on all of your housing costs and other debt payments.

3. Tiago is a single dad with two young children. His gross monthly income is $4300. He lives in a bungalow in St. Vital, and his monthly mortgage payment is $1100. Annual property taxes are $1440. Tiago has monthly costs of $65 for heating, and $80 for his credit card debt. Tiago wants to purchase a new vehicle that has a biweekly payment of $130.

a) Calculate the Total Debt Service ratio.

Answer:

$$\text{Monthly property taxes} = \frac{1440}{12} = \$120$$

$$\text{Monthly car payment} = 130 \times 2 = \$260$$

$$\text{TDS ratio} = \frac{1100 + 120 + 65 + 80 + 260}{4300} \times 100 = 37.8\%$$

b) Can Tiago afford this car?

Answer:

Yes, Tiago can afford this car because the TDS is less than 40%.

c) Refer to the Vehicle Features Chart above. Which features might Tiago consider adding to his new vehicle? In your decision, take into account the fact that Tiago has young children.

Answer:

Answers may vary.

Tiago should include air bags, childproof locks, and an integrated child restraint system in his vehicle. These are all safety features that are especially important for parents with young children.

4. Aneko is a university student, and she commutes from a rural location to Winnipeg every day for school and work. She lives with her parents, so she does not have to pay for housing costs. However, she does have a student loan that she is repaying at $250 a month. Aneko also has a credit card debt that she is trying to pay off with $45 monthly payments. Her gross monthly income from her part-time job is $1150. Aneko wants to buy a new vehicle, and the biweekly loan payments will be $79.

a) Calculate the Total Debt Service ratio.

Answer:

Monthly Car Payment = $79 \times 2 = \$158$

$$\text{TDS ratio} = \frac{250 + 45 + 158}{1150} \times 100 = 39.4\%$$

b) Can Aneko afford this car?

Answer:

This is just under the maximum allowable percentage for the Total Debt Service ratio. Aneko may not have other expenses as she lives at home. Therefore, she could possibly afford this car. However, Aneko should talk to her parents before she makes this decision, as she will be counting on them to continue to provide housing and food for her!

c) Refer to the Vehicle Features Chart above. Which features might Aneko consider adding to her new vehicle?

Answer:

Answers may vary.

Aneko should include fuel consumption, winter tires, and an anti-theft device. Having a vehicle with low fuel consumption is important for someone who commutes to school and work. Winter tires are especially important during Winnipeg winters. An anti-theft device is a general safety feature that should be included with all vehicles.

d) Winnipeg winters always include lots of snow. Did you include winter tires as a feature that Aneko should purchase? Remember that these vehicle options are meant to be practical, and to help drivers get the most out of their vehicle.

Answer:

Answers may vary. A possible response is given below.

Yes, winter tires were included because they decrease stopping distance on ice since they are made of rubber that stays softer even in cold temperatures.

5. Cooper is trying to determine how much money he is able to spend on monthly vehicle payments. He is currently living in a bungalow with a monthly mortgage of $890. Heating costs an additional $93 a month. Cooper is also trying to pay off his credit card debt with $70 monthly payments. Cooper's monthly income is $3500.

   Based on the Total Debt Service ratio, what is the maximum amount of money Cooper can spend on a vehicle each month?

   Answer:

   40% of Cooper's income is: $\$3500 \times 0.4 = \$1400$

   Now, Cooper already spends $890 + $93 + $70 a month on his mortgage, heating, and credit card debt.

   $\$1400 - \$890 - \$93 - \$70 = \$347$

   Therefore, Cooper is left with $347 a month to spend on a vehicle, based on the Total Debt Service ratio.

Learning Activity 5.2

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Savanna was born in 1995. How old will she be in 2031?
2. Jackie wants to purchase a DVD for $20, a sweater for $60, a jacket for $120, a pair of jeans for $45, and hair products for $25. If the bank machine only gives out money in multiples of $20, how much money does Jackie need to withdraw from the bank machine to cover the costs of her purchases?
3. Burgandy needs to fundraise $2000 for her school trip. If she earns a profit of $4 from each box of chocolates she sells, how many boxes of chocolates does she need to sell to earn $2000?
4. Evaluate: $\frac{4}{7} + \frac{7}{2}$
5. Your credit card has a balance of $250. The minimum payment will be $10 or 10% of your balance—whichever is greater. How much is your minimum payment?

Answers:

1. 36 (2031 − 1995 = 36 years old)
2. $280 (Total costs = 20 + 60 + 120 + 45 + 25 = $270; Therefore, Jackie needs to withdraw $280, as 280 is a multiple of 20 and is high enough to cover all of her purchases.)
3. $500 \left(\frac{2000}{4} = 500 \text{ boxes of chocolate}\right)$
4. $\frac{57}{14} \left(\frac{8}{14} + \frac{49}{14} = \frac{57}{14}\right)$
5. $25 (Your minimum payment will be $25 as $25 is greater than $10. 10% of $250 = $25)

Part B: Purchasing a New Vehicle

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Find the Manufacturer's Suggested Retail Price for the following coupe. The base price is $14 765. Its optional equipment package consists of a preferred equipment group costing $1730, plus a three-speed automatic transmission costing $765, an AM/FM stereo with CD player costing $350, 15-inch steering wheel costing $170, a spoiler costing $150, and a gauge costing $40. In addition, there is an air-conditioning excise tax of $100 and a destination charge of $760.

   Answer:

Base Price		$14,765
Optional Equipment: Preferred Equipment Group Three-speed automatic transmission Radio with CD player 15-inch steering wheel Spoiler Gauge	 $1730 $765 $350 $170 $150 $40	
Total Options		$3205
Excise Tax (air-conditioning)		$100
Destination Charge		$760
Total Price (MSRP)		$18,830

2. Find the Manufacturer's Suggested Retail Price for the following pickup truck. The base price is $28,300. Its optional equipment package consists of a preferred equipment group costing $1375, an electronic auto overdrive costing $1260, a tilt steering wheel and electronic speed control costing $500, heavy-duty trailering equipment costing $215, and an AM/FM stereo with CD player costing $190. In addition, there is an air-conditioning excise tax of $100 and a destination charge of $790.

   Answer:

Base Price		$28,300
Optional Equipment: Preferred Equipment Group Electronic auto overdrive Tilt steering and speed control Trailering equipment Radio with CD player	 $1375 $1260 $500 $215 $190	
Total Options		$3540
Excise Tax (air-conditioning)		$100
Destination Charge		$790
Total Price (MSRP)		$32,730

3. Claire Cruise purchases the sports coupe in Question 1 from Deal-a-Car Dealership. She receives a trade-in allowance of $3500 for her old car. Calculate the total purchase price of her new vehicle, if, in addition to PST and GST, she pays a documentation fee of $129 and a tire tax of $14.

   Answer:

   Price before taxes = $18,830 + $129 + $14 − $3500 = $15,473

   Total Purchase Price = $15,473 × 1.12 = $17,329.76

4. Claire Cruise is able to make a down payment of $2000 on the sports coupe she purchases in Question 3. In order to finance the remaining portion, she takes out a five-year car loan at a fixed interest rate of $8\frac{3}{4}\%$.

   a) Calculate her monthly payment for the sports coupe.

      Answer:

      Amount of loan = $17,329.76 − $2000.00 = $15329.76

      Cost per $1000 per month = $20.64 (from Table 5.1)

      $$\text{Monthly Payment Due} = \frac{\$20.64 \times \$15,329.76}{1000} = \$316.41$$

b) Calculate her deferred payment for the sports coupe.

Answer:

Loan Payment = \$316.41 × 5 × 12 = \$18,984.60

Deferred Payment = \$18,984.60 + \$2000.00 = \$20,984.60

c) Calculate her finance charge for the sports coupe.

Answer:

Finance charge = \$20,984.60 − \$17,329.76 = \$3654.84

5. Otto Mobile purchases the truck in Question 2 from Deal-a-Car Dealership. Calculate the total purchase price of his new vehicle, if, in addition to PST and GST, he pays a documentation fee of \$100 and a tire tax of \$14.

Answer:

Price before taxes = \$32,730 + \$100 + \$14 = \$32,844

Total Purchase Price = \$32,844 × 1.12 = \$36,785.28

6. Otto Mobile is able to make a down payment of \$3500 on the truck in Question 5. In order to finance the remaining portion, he takes out a two-year car loan at a fixed interest rate of $8\frac{1}{2}\%$.

a) Calculate his monthly payment for the truck.

Answer:

Amount of loan = \$36,785.28 − \$3500.00 = \$33,285.28

Cost per \$1000 per month = \$45.46 (from Table 5.1)

Monthly Payment Due = $\dfrac{\$45.46 \times \$33,285.28}{1000} = \$1513.15$

b) Calculate his deferred payment for the truck.

Answer:

Loan Payment = \$1513.15 × 2 × 12 = \$36,315.60

Deferred Payment = \$36,315.60 + \$3500.00 = \$39,815.60

c) Calculate his finance charge for the truck.

Answer:

Finance Payment = \$39,815.60 − \$36,785.28 = \$3030.32

Learning Activity 5.3

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. If Dave drives at a steady speed of 50 km/h, how long will it take him to drive 10 km?
2. Janice is four times as old as Enrique. If the sum of their ages is 30, how old is Enrique?
3. Evaluate: 65×13
4. There are seven green and six blue balls in a box. If one ball is randomly selected, what is the probability that it is blue?
5. If $x = -1$ and $y = 2$, evaluate the expression: $3x^3 - xy$

Answers:

1. 12 minutes (It will take him one-fifth of an hour, or 12 minutes to drive 10 km.)
2. 6 years old

   4 × Enrique = Janice

   Janice + Enrique = 30

   (4 × Enrique) + Enrique = 30

   5 × Enrique = 30

   Enrique = 6 years old
3. 845 ($65 \times 10 = 650$; $65 \times 3 = 195$; $65 \times 13 = 650 + 195 = 845$)
4. $\frac{6}{13}$ $\left(\text{P(blue)} = \frac{6}{(7+6)} = \frac{6}{13}\right)$
5. -1 $(3(-1)^3 - (-1)(2) = -3 + 2 = -1)$

Part B: Leasing a New Vehicle

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Make a list of the pros and cons of leasing a vehicle. Are any items on both the pro and the con side?

   Answer:

   Answers may vary.

   Pros of Leasing a New Vehicle

   - Little or no down payment
   - Reduced monthly payments
   - Operate a newer vehicle under warranty
   - Option to return or purchase the vehicle at the end of the lease
   - Not required to do any selling or trading

   Cons of Leasing a New Vehicle

   - Always have monthly payments
   - Do not own a leased vehicle
   - Option to return or purchase the vehicle at the end of the lease
   - Must adhere to the terms of the lease agreement or you risk paying extra charges

   As you can see, the option to return or purchase the vehicle at the end of the lease can be both a pro and a con. The option can be a pro as you get to pick out a newer vehicle to drive. However, this could also be a con as you have to go through the hassle of trying to find a new vehicle to fit your needs.

2. List at least three pros and three cons of purchasing a new vehicle rather than leasing a new vehicle. Refer to the pros and cons of leasing a new vehicle if you need help.

   Answer:

   Answers may vary.

   Pros:

   - You actually own the vehicle and can use it any way you want
   - you can drive as much as you want
   - once you pay off the vehicle, you do not have to keep making monthly payments
   - you can sell the vehicle whenever you wish

   Cons:

   - You have higher monthly payments
   - once the warranty is up, you have to pay for repairs to the vehicle
   - you need to pay a larger down payment

3. Ida and Viktor Stover have four children. They must decide whether they should purchase a new vehicle or lease a new vehicle. In making this decision, the safety of their children is a very important factor. Also, they want to be environmentally friendly by choosing a green vehicle with lower emissions and better gas mileage. Discuss some of the pros and cons that relate to the Stovers' situation. Should the Stovers purchase or lease a new vehicle?

   Answer:

   Answers may vary.

   Leasing a vehicle:

   - The Stovers can keep trading in their vehicle for a newer vehicle.
   - Newer vehicles are generally safer and more environmentally friendly.

   Purchasing a vehicle:

   - The Stovers do not have to go through the hassle, especially with four children, of choosing a new vehicle every few years.
   - Also, the Stovers may want to go on family road trips without being limited by the number of kilometres they can drive.

   The Stovers should purchase a new vehicle, as it will still be environmentally friendly and safe, and a lot less expensive than leasing. Also, they can drive as many kilometres each year as they want without paying a penalty.

4. An extended cab truck leases for $229 a month plus taxes for a lease term of 30 months. A down payment of $3500 is required.

   a) Calculate the total lease monthly payment.

      Answer:

      Monthly payment = $229 × 1.12 = $256.48

   b) Calculate the total lease payment at the end of the lease term.

      Answer:

      Total of the monthly payments = $256.48 × 30 = $7694.40

      Total lease payment = down payment + total monthly payment

      = $3500.00 + $7694.40 = $11,194.40

5. The extended cab truck in Question 4 has a sale price of $20,050. The guaranteed residual value is 75% of the sale price, including taxes.

   a) Calculate the guaranteed residual value, including taxes.

      Answer:

      Guaranteed residual value = $20,050 × 0.75 = $15,037.50

      Total residual value = $15,037.50 × 1.12 = $16,842.00

   b) Calculate the total cost if the truck is purchased outright at the end of the lease.

      Answer:

      Total cost of the truck (at end of lease)

      = Total lease payments + Total residual value

      = $11,194.40 + $16,842.00

      = $28,036.40

   c) Calculate the difference between the total cost if the cab is purchased outright at the end of the lease and the cost of the cab if it is purchased outright at time of purchase.

      Answer:

      Total cost of truck (at time of purchase) = $20,050 × 1.12 = $22,456.00

      Difference = Total cost of truck (at end of lease) − Total cost of truck (at time of purchase) = $28,036.40 − $22,456.00 = $5580.40

6. A sport utility vehicle (SUV) sells for $34,200 plus tax and leases for $348 per month plus tax for a 48-month lease. A down payment of $3500 is required. The guaranteed residual value of the SUV at the end of the lease is $16,526. Determine the total lease payment and the total cost of the SUV if it is purchased at the end of the lease.

   Answer:

   Total monthly lease payment = $348.00 × 1.12 = $389.76

   Total of the monthly lease payments = $389.76 × 48 = $18,708.48

   Total lease payment = $18,708.48 + $3500.00 = $22,208.48

   Total guaranteed residual value = $16,526.00 × 1.12 = $18,509.12

   Total cost of SUV = total lease payment + total guaranteed residual value
   = $22,208.48 + $18,509.12 = $40,717.60

7. The minivan in Example 1 of this lesson sells for $28 500 plus tax and leases for $479 per month plus taxes for a lease term of 24 months. A down payment of $3275 is required. The guaranteed residual value of the vehicle has been changed from 65% to 70% of the sales price.

   a) Calculate the total monthly leasing payment.

      Answer:

      Monthly lease payment = $479.00 × 1.12 = $536.48

   b) Calculate the total amount paid by the end of the lease.

      Answer:

      Total paid by end of lease = $3275.00 + $536.48 × 24 = $16,150.52

   c) Calculate the total residual value of the minivan at 70%, including tax.

      Answer:

      Guaranteed residual value = $28,500.00 × 0.7 = $19,950.00

      Total guaranteed residual value = $19,950.00 × 1.12 = $22,344.00

   d) Calculate the total cost of the vehicle if it is purchased outright at the end of the lease.

      Answer:

      Total cost = $16,150.52 + $22,344.00 = $38,494.52

   e) Determine how much increasing the guaranteed residual value from 65% to 70% affects the total cost of a vehicle.

      Answer:

      Total cost @ 65%: $16,150.52 + $28,500.00 × 0.65 × 1.12 = $36,898.52

      Increasing the guaranteed residual value increased the total cost by:
      $38,494.52 − $36,898.52 = $1596.00

Learning Activity 5.4

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Janique is paid $5 each time she cuts a log. How much will she be paid if she cuts a log into quarters?

2. When Michelle first woke up, the temperature was −5° C. By the time Michelle got home from school, the temperature was 18° C. How much did the temperature rise during that day?

3. Evaluate: $\left[\left(\frac{3}{4}\right)-\left(\frac{1}{2}\right)\right]+\left[\left(\frac{1}{6}\right)+\left(\frac{5}{3}\right)\right]$

4. You and four friends want to attend a concert. Tickets are $18 each. However, if you all buy your tickets together, tickets only cost $85. How much will each of you save if you buy all of your tickets together?

5. Solve for x: $\frac{9}{6}=\frac{x}{8}$

Answers:

1. $15 (Janique will be paid $15 for three cuts.)

2. 23° C (18 − (−5) = 18 + 5 = 23° C)

3. $\frac{25}{12}\left(\left[\frac{9}{12}-\frac{6}{12}\right]+\left[\frac{2}{12}+\frac{20}{12}\right]=\frac{3}{12}+\frac{22}{12}=\frac{25}{12}\right)$

4. $1 ($10 × 5 = $50; $8 × 5 = $40; $18 × 5 = $50 + $40 = $90; $90 − $85 = $5. Therefore, if you save $5 between five people, you will each save $1.)

5. 12 $\left(\frac{(8\times 9)}{6}=x;\ \frac{72}{6}=x;\ 12=x\right)$

Part B: Used Vehicles

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Make an inspection checklist with four subheadings: Exterior, Interior, Engine, and Road Test. Include all the aspects of a vehicle mentioned in this lesson, as well as the ones you came up with. Add extra columns where you can indicate whether each aspect of the vehicle needs work, or if it seems okay.

   Answer:

   Answers may vary. A potential Inspection Checklist could look like this:

	Okay	Needs To Be Checked
Exterior		
Paint		
Rust		
Lights		
Windshield		
Windows		
Tires		
Shock Absorbers		
Frame		
Interior		
Overall Appearance		
Seats		
Seat Belts		
Pedals		
Instruments		
Features		
Lights		
Engine		
Leaks		
Under the Hood		
Exhaust		
Road Test		
Brakes		
Acceleration		
Handling		
Transmission		
Four-Wheel Drive		

2. Complete either Part A **or** Part B of this question.

   Part A: Using the inspection checklist you just created, you will inspect a vehicle. This vehicle can either belong to you, your parents, or your friends. If you do not have a driver's licence, the road test section of the checklist can be completed by the owner of the vehicle. They can determine if each item seems okay or if it needs to be checked. After you are done this inspection, pretend that you are interested in purchasing this vehicle. Based on your inspection, does this vehicle seem like a good vehicle to purchase, or does this vehicle require too many repairs?

   Part B: Look carefully at a vehicle or the picture of a vehicle. The picture could be in a newspaper or on the Internet. Using the inspection checklist you have just created, determine which items can be inspected just by looking at the vehicle. What does this tell you about judging a vehicle just by its appearance?

   Answer:

   Part A:

   Answers will vary.

   Part B:

   To some extent, the paint, rust, windows, and tires can be checked just by looking at a vehicle. All other items require a closer look. Therefore, it is necessary to test drive any vehicle you may want to purchase. You should also do a thorough check of as many features as possible. Just because a vehicle looks nice on the outside doesn't mean that the engine or the mechanical components are in good condition.

3. Clayton is a young man who lives at home with his parents. He has saved $4000 to buy his first vehicle. He has a part-time job working at a fast food restaurant. Discuss whether Clayton should buy a used vehicle or a new vehicle.

   Answer:

   Answers may vary.

   $4000 will buy a good used vehicle. Clayton does not have a full-time job; therefore, he may not be able to afford to buy a new car. Clayton also has the possibility of losing his job, as most part-time jobs do not offer job stability. Clayton may also be attending school, which would allow him less time to work and earn money for vehicle payments. Also, Clayton may not have enough credit to buy a new vehicle. Therefore, Clayton should buy a used vehicle, as long as the vehicle is in good condition.

4. Dominique wants to purchase a used truck listed at $7450 plus taxes at a licensed automobile dealership.

   a) Find the total purchase price of this vehicle.

      Answer:

      Total purchase price = $7450.00 × 1.12 = $8344.00

   b) Dominique decides to get a diagnostic test done on this vehicle. This test costs $66. Find the new total purchase price of the vehicle.

      Answer:

      Total cost of diagnostic test = $66.00 × 1.12 = $73.92

      New total purchase price = $8344.00 + $73.92 = $8417.92

5. Jammille wants to purchase a used two-door sedan that is being sold privately. The price the vendor is asking is $2600. A lien search costs $4. The safety check costs $40. Calculate the total purchase price of the sedan if the book value is $3500.

   Answer:

Asking price of the car	= $2600
PST on the book value of the car	= 7% × $3500
	= $245
Lien search	= $4
Safety inspection	= $40 + GST (GST in Manitoba is 5%)
	= $40 × 1.05
	= $42

   Total cost of the car = cost of the car + PST on the book value of the car + total cost of the diagnostic test + total cost of the repairs + lien search + safety inspection.

   = $2600 + $245 + $0 + $0 + $4 + $42

   = $2891

6. Holly wants to purchase a used car that is being sold privately. The price the vendor is asking is $3600. A lien search costs $4, and a diagnostic test costs $35. The technician reports that the car needs the following repairs: engine work, $50; electrical, $275; suspension, $250; exhaust, $170; and tires, $680. A safety check costs $45.

   a) Calculate the total cost of buying this car if the book value is $3775.

      Answer:

      Asking price of the car = $3600.00

      PST on the book value of the car = 7% × $3775.00
      = $264.25

      Total cost of the diagnostic test = diagnostic test + GST + PST
      = $35.00 × 1.12
      = $39.20

      Total cost of the repairs = repairs + PST + GST
      = ($50 + $275 + $250 + $170 + $680) × 1.12
      = $1425.00 × 1.12
      = $1596.00

      Lien search = $4

      Safety inspection = $45 + GST (GST in Manitoba is 5%)
      = $45.00 × 1.05
      = $47.25

      Total cost of the car = cost of the car + PST on the book value of the car + total cost of the diagnostic test + total cost of the repairs + lien search + safety inspection.
      = $3600.00 + $264.25 + $39.20 + $1596.00 + $4.00 + $47.25
      = $5550.70

b) Calculate the total cost of buying this car if the book value is $3500.

Answer:

Asking price of the car = $3600

PST on the purchase price of the car = 7% × $3600
= $252

Total cost of the diagnostic test = $39.20

Total cost of the repairs = $1596

Lien search = $4

Safety inspection = $47.25

Total cost of the car = cost of the car + PST on the purchase price of the car + total cost of the diagnostic test + total cost of the repairs + lien search + safety inspection.

= $3600.00 + $252.00 + $39.20 + $1596.00 + $4.00 + $47.25

= $5538.45

7. Ivana Carr has a choice of two cars. The first is a used car sold privately. The price the vendor is asking is $7500 but the book value of the car is $8000. A lien search costs $4. Ivana pays a technician $40 to do a diagnostic test on the car. The technician reports the car needs engine work for $190 and electrical work for $75. A safety check costs $40. The second car Ivana is considering is at a dealership. The dealership is listing the car at $7750.

a) Calculate the total purchase price of the car sold privately.

Answer:

Asking price of the car = $7500

PST on the book value of the car = 7% × $8000
= $560

Total cost of the diagnostic test = diagnostic test + GST + PST
= $40.00 × 1.12
= $44.80

Total cost of the repairs = repairs + PST + GST
= ($190 + $75) × 1.12
= $265.00 × 1.12
= $296.80

Lien search = $4

Safety inspection = \$40 + GST (GST in Manitoba is 5%)

= \$40 × 1.05

= \$42

Total cost of the car = cost of the car + PST on the book value of the car + total cost of the diagnostic test + total cost of the repairs + lien search + safety inspection.

= \$7500.00 + \$560.00 + \$44.80 + \$296.80 + \$4.00 + \$42.00

= \$8447.60

b) Calculate the total purchase price of the car sold at the dealership.

Answer:

Total purchase price = \$7750 × 1.12 = \$8680 at the dealership

c) Which car is less expensive and by how much?

Answer:

Difference = \$8680.00 − \$8447.60 = \$232.40

The car sold privately is cheaper by \$232.40.

Learning Activity 5.5

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Tanner is trying to calculate his Total Debt Service ratio. To do this, he needs to calculate 40% of his income. If Tanner makes $56,000 a year, what is 40% of his income?
2. Calculate the price including tax of a vehicle on sale for $24,000.
3. How many months are in seven years?
4. Evaluate: $\left(\frac{4}{5}\right) - \left(\frac{7}{3}\right)$
5. Complete the pattern: 8, 4, 2, 1, $\frac{1}{2}$, $\frac{1}{4}$, ___, ___

Answers:

1. $22,400 (50% of $56,000 = $28,000; 10% of $56,000 = $5600;
   40% of $56,000 = $28,000 − $5600 = $22,400
2. $26,880 (1% of $24,000 = $240; 2% of $24,000 = $480; 10% of $24,000 = $2400;
   Tax = 2400 + 480 = $2880; $24,000 + $2880 = $26,880)
3. 84 (12 × 7 = 84 months)
4. $-\frac{23}{15}$ $\left(\frac{12}{15} - \frac{35}{15} = -\frac{23}{15}\right)$
5. $\frac{1}{8}, \frac{1}{16}$ (Each term is half the preceding term.)

Part B: Vehicle Costs

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. A pickup truck travels 92 km on 10 L of gasoline when driven on a smooth, paved road. The truck is only able to travel 78 km on the same amount of gasoline on a gravel road.
   a) Determine the fuel consumption rate of the truck on the paved road.

      Answer:

      Fuel consumption rate on pavement = $\frac{10}{92} \times 100 = 10.9$ L/100 km

   b) Determine the fuel consumption rate of the truck on the gravel road.

      Answer:

      Fuel consumption rate = $\frac{10}{78} \times 100 = 12.8$ L/100 km

   c) What is the percent difference in fuel economy?

      Answer:

      Increase in fuel consumption rate = $12.8 - 10.9 = 1.9$ L/100 km

      Rate of percent = $\frac{1.9}{10.9} \times 100 = 17.4\%$

2. The fuel consumption rate of a two-door convertible is 8.5 L/100 km.
   a) How many litres of gasoline are required to drive 20 000 kilometres?

      Answer:

      Amount of gasoline = $\frac{8.5}{100} \times 20\,000 = 1700$ litres

   b) If the cost of gasoline averages 119.2¢ per litre, find the cost of driving the convertible 20 000 kilometres.

      Answer:

      Cost = $1700 \times \$1.192 = \$2026.40$

3. A van requires 46.1 L to drive 380 kilometres.

   a) Determine the fuel consumption rate of the van.

   Answer:

   Fuel consumption rate = $\frac{46.1}{380} \times 100 = 12.1$ L/100 km

   b) If the cost of gasoline is 118.3¢ per litre, find the cost of driving the van 380 kilometres.

   Answer:

   Cost = 46.1 × \$1.183 = \$54.54

4. Complete Option A **or** Option B.

   Option A: Find the fuel consumption rate of your own vehicle or the vehicle you inspected in Lesson 3. If you cannot drive, let the person who took your vehicle for a road test in Lesson 3 do the driving. To check the fuel economy of the vehicle, follow these steps:

   Step 1. Make sure the gas tank is full before you start driving.

   Step 2. Check the odometer at the beginning of the trip.

   Step 3. Drive 15 km.

   Step 4. At the end of your trip, fill up the gas tank again.

   Step 5. Check the odometer at the end of the trip.

   a) How many litres of gasoline did your vehicle consume? This will be the same number as the number of litres of gas used to fill up your tank.

   Answer:

   Answers will vary.

   b) What is the fuel consumption rate of your car?

   Answer:

   Answers will vary.

   $\frac{\text{Litres Used}}{15 \text{ km}} \times 100$

   c) Were you driving in the city or on the highway? If you were driving in the city, what can you say about the highway fuel economy of the vehicle? If you were driving on the highway, what can you say about the city fuel economy of the vehicle?

   Answer:

   Answers will vary. Highway driving fuel economy will be lower than city driving fuel economy.

Option B: Jannie takes her sedan for a drive through the city. At the beginning of her trip, the odometer reads 114 570; at the end of her trip, the odometer reads 114 637.

a) How far did Jannie drive?

Answer:

Distance = 114 637 − 114 570 = 67 km

b) If Jannie used 16.3 litres of gasoline, what is the fuel consumption rate of her vehicle?

Answer:

Fuel consumption rate = $\frac{16.3}{67} \times 100 = 24.3$ L/100 km

c) Would the highway fuel consumption rate be higher or lower than the rate you found in (b)?

Answer:

The highway fuel consumption rate would be lower than the rate found in (b).

6. Find two estimates for the cost of an oil change near the area where you live. Most dealerships, mechanic shops, and quick service stations do oil changes. It is also possible to get prices online, by phone, or by advertising signs near the above-mentioned places. Are both prices the same? Why do you think one price might be different than the other price?

Answer:

Answers will vary. Prices may vary depending upon the type of oil used and the price of labour in a certain area.

7. Find the total cost of servicing a vehicle that requires two headlights at $28.50 each, an exhaust pipe at $130, and a muffler and a tail pipe at $55.50. The time required for servicing the vehicle is 1.6 hours. The rate the service station charges for labour is $55 an hour.

Answer:

Costs of parts = $28.50 × 2 + $130.00 + $55.50 = $242.50

Labour cost = 1.6 × $55 = $88

Parts and labour = $242.50 + $88.00 = $330.50

Total including taxes = $330.50 × 1.12 = $370.16

8. Find two estimates for the cost of replacing four tires (include the price of the tires and the labour required to replace the tires).

   a) Were these estimates the same?

   Answer:

   Answers will vary.

   b) Did you choose the same type of tire in each instance?

   Answer:

   Answers will vary.

   c) What can you say about repair costs in general?

   Answer:

   Repair costs are not always the same.

9. The purchase price of a truck is $24,750.

   a) Calculate how much the truck depreciates in the first two years.

   Answer:

   Depreciation in the first year = $0.20 \times \$24{,}750 = \$4950$

   Value after first year = $\$24{,}750 - \$4950 = \$19{,}800$

   Depreciation in the second year = $0.20 \times \$19{,}800 = \$3960$

   Total depreciation in the first two years = $\$4950 + \$3960 = \$8910$

   b) Calculate the percent the truck depreciates in the first two years.

   Answer:

   $$\text{Rate of percent} = \frac{8910}{\$24{,}750} \times 100 = 36\%$$

10. A minivan sells for $22,400 and leases for $316 plus tax per month for a lease term of 24 months. A down payment of $2000 is required. The guaranteed residual value of the vehicle is $14,832.

    a) Calculate the value of the depreciated vehicle after two years.

    Answer:

    Depreciation in the first year = $0.20 \times \$22{,}400 = \$4480$

    Value after first year = $\$22{,}400 - \$4480 = \$17{,}920$

    Depreciation in the second year = $0.20 \times \$17{,}920 = \$3584$

    Value after second year = $\$17{,}920 - \$3584 = \$14{,}336$

    b) How does the depreciated value of the vehicle after two years compare to the guaranteed residual value?

    Answer:

    The depreciated value after two years is $\$14{,}832 - \$14{,}336 = \$496$ lower than the guaranteed residual value.

Learning Activity 5.6

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Charlise sees a vehicle priced at $27,500. If Charlise has a down payment of $5250, what is the size of her loan?

2. Shantelle is buying meat for a family reunion. She bought $8\frac{3}{4}$ pounds of hamburger, 20.25 pounds of chicken, and 9.5 pounds of steak. How many pounds of meat did Shantelle buy?

3. On a math test, 22 students earned an A. This number is 20% of the total number of students in the class. How many students are in the class?

4. Evaluate: $3 \times 5 + 6 - \frac{8}{2}$

5. Calculate 11% of 3410.

Answers:

1. $22,250 ($27,500 − $5250 = $22,250)

2. $38.5 \left(8\frac{3}{4} + 20.25 + 9.5 = 8.75 + 20.25 + 9.5 = 29 + 9.5 = 38.5\right)$

3. 110 students (20% is 22, so 5 × 20% is 100% and 5 × 22 is 110 students or 20% of 100 students is 20 students; 20% of 10 students is 2 students; ∴ there are 100 + 10 = 110 students)

4. $17 \left((3 \times 5) + 6 - \left(\frac{8}{2}\right) = 15 + 6 - 4 = 17\right)$

5. 375.1 (10% of 3410 = 341; 1% of 3410 = 34.1; 11% of 3410 = 341 + 34.1 = 375.1)

Part B: Vehicle Insurance

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Compare the cost of insuring a vehicle for pleasure use and insuring a vehicle for all purpose use in Territory 1.

   a) In which instance is the Autopac rate more expensive? Why do you think this is so?

      Answer:

      The Autopac rates are more expensive if you insure an All Purpose Passenger Vehicle. All Purpose Passenger Vehicles are used for pleasure, work, school, and business. However, Pleasure Passenger Vehicles have more limited uses. The more somebody drives a vehicle, the more likely he or she is to have an accident. This is why All Purpose Passenger Vehicles are more expensive to insure than Pleasure Passenger Vehicles.

   b) Is this true for all territories?

      Answer:

      Yes, this is true for all territories.

2. Compare the cost of insuring an all-purpose passenger vehicle in different territories, if the driver has a 0% discount.

   a) Which territory has the most expensive 2011 Autopac rates?

      Answer:

      Territory 1: $1671
      Territory 2: $1568
      Territory 3: $1964
      Territory 4: $2017
      Territory 4 has the most expensive 2011 Autopac rates.

   b) Which territory has the least expensive 2011 Autopac rates?

      Answer:

      Territory 1: $1671
      Territory 2: $1568
      Territory 3: $1964
      Territory 4: $2017
      Territory 2 has the least expensive 2011 Autopac rates.

c) Why do you think Autopac rates are different in different territories?

Answer:

Answers may vary. The following is a sample answer:

It costs more to repair a vehicle in northern Manitoba due to increased shipping costs of parts. Also, labour in northern Manitoba is more expensive. Therefore, the insurance costs have to be able to cover more expenses and thus are higher or more expensive. OR

Roads in northern Manitoba can be more challenging, especially in winter, and so accidents are more likely. OR

Drivers in a busy urban area like Winnipeg are more likely to have accidents than drivers in rural areas (Territory 2).

3. Demarco is a motorist living in Territory 1. He owns a 2007 Dodge Nitro RT. He uses the vehicle for personal use only. He has 9 merit points. Calculate his 2011 Autopac rate.

   Answer:

   The rating for a 2007 Dodge Nitro RT is 27.

   The 2011 Autopac rate for a Pleasure Passenger vehicle in Territory 1, with a merit discount of 25% and a basic rate of 27, is $893.

4. Laqueta is a motorist living in Territory 3. She owns a 2009 Honda Civic Hybrid. She uses the vehicle for work and personal reasons. She currently has 0 merit points.

   a) Calculate her 2011 Autopac rate.

      Answer:

      The rating for a 2009 Honda Civic Hybrid is 31.

      The 2011 Autopac rate for an All Purpose Passenger Vehicle in Territory 3 with a merit discount of 0% and a basic rate of 31 is $1936.

   b) If she obtains one more merit from safe driving this year, what will be her Autopac rate next year? Assume the rates stay the same and still use the 2011 Basic Rate Table.

      Answer:

      If she obtains one more merit, the Autopac rate for an All Purpose Passenger Vehicle in Territory 3 with a merit discount of 5% and a basic rate of 31 will be $1839.

c) By how much does her Autopac rate decrease?

Answer:

Decrease in Autopac rate = \$1936 − \$1839 = \$97

Laqueta will save \$97 the next year.

Note that 5% of \$1936 is \$96.80, which is close to \$97, so she really does get a 5% discount.

5. Desmond is a motorist living in Grand Rapids. He drives a 2008 diesel Jeep Grand Cherokee Limited six-cylinder, two-wheel-drive (2 WDR) vehicle. He has 6 demerits and uses this vehicle for driving to work, school, and for pleasure. Calculate his 2011 Autopac rate.

   Answer:

   The rating for a 2008 diesel Jeep Grand Cherokee Limited six-cylinder, two-wheel-drive vehicle is 31.

   Grand Rapids is in Territory 4.

   Desmond has 6 demerits, which gives him a merit discount of 0%.

   Therefore, the 2011 Autopac rate for an All Purpose Passenger Vehicle in Territory 4 with a merit discount of 0% and a basic rate of 31 will be \$1988.

6. Rosalie is a motorist living in Territory 3. She owns a 2010 Mazda3 GS. She uses the vehicle only for personal use. She has three merit points. The sale price of the vehicle, which Rosalie purchased outright in 2010, was \$15,600. The gasoline costs of the vehicle for the year 2011 are \$1375, while the maintenance and repair costs are \$280.

   a) Calculate her 2011 Autopac rate.

      Answer:

      The rating for a 2010 Mazda3 GS is 31.

      Three merit points gives a merit discount of 10%.

      Therefore, the 2011 Autopac rate for a Pleasure Passenger vehicle in Territory 3 with a merit discount of 10% and a basic rate of 31 is \$1391.

   b) Calculate the depreciation of the vehicle during the year 2011.

      Answer:

      2010 depreciation = 0.2 × \$15,600 = \$3120

      New value = \$15,600 − \$3120 = \$12,480

      2011 depreciation = 0.2 × \$12,480 = \$2496

c) Calculate the total cost of the vehicle during the year 2011.

Answer:

Total cost of vehicle in 2011 = \$1391 + \$2496 + \$1375 + \$280 = \$5542

Grade 12 Essential Mathematics (40S)

Module 6
Career Life

Module 6:
Career Life

Introduction

If you, like many students, are not certain about your future career, this module will help you to research and consider career options. If you have already chosen a career, this module will allow you to examine that choice more closely. Some students find that researching their chosen career confirms their choice. Other students find they are less certain about their choice and need to consider other career options.

This module is an opportunity for you to think about suitable career possibilities. Through their research, some students have discovered suitable careers they did not know existed. Other students have decided against pursuing careers they realized would not work for them. Even if you are not sure of your career choice when you complete this module, you should be better informed about choices available to you.

The format of this module is different than other modules in this course. Although the module is presented in lessons, the lessons do not include learning activities. Instead, each lesson has an assignment. Even though there is an assignment after each lesson, these assignments are generally shorter than assignments you have had in previous modules. Also, these assignments include a significant amount of research, and you will be asked to write some reports. You will, however, still need to do some calculations in this lesson!

You will be asked to write about your Career Life project on the final examination. Be sure to finish this project and send it in to be marked, so you can have some feedback on it before you write your final examination.

Instead of learning new mathematical content, you will be using mathematical skills from Module 1 and Module 5, which deal with Home Finance and Vehicle Finance. You will be applying these mathematical skills to calculate costs, such as housing and transportation, once you are established in your career.

Assignments in Module 6

When you have completed the assignments for Module 6, submit your completed assignments to the Distance Learning Unit either by mail or electronically through the learning management system (LMS). The staff will forward your work to your tutor/marker.

Lesson	Assignment Number	Assignment Title
	Cover Assignment	Personal Costs and Taxes
1	Assignment 6.1	Self-Assessment Report
2	Assignment 6.2	Career Descriptions
3	Assignment 6.3	Education/Training Requirements
4	Assignment 6.4	Expected Lifestyle Report
5	Assignment 6.5	Resumé and Reflection

Resource Sheet

The focus of this module is to help you explore career choices. There is less of a need for you to create a resource sheet for this module. On the final examination, you will be asked a few questions about your project.

Module 6 Cover Assignment: Personal Costs and Taxes

The table found on the following pages appeared in the Province of Manitoba's budget for 2011. The table compares the annual personal costs and taxes of two families in the 10 provinces of Canada in 2011. Two families are compared: a two-income family of four earning $60,000 and a two-income family of five earning $75,000 per year

This information can also be found online at www.gov.mb.ca/finance/budget11/papers/taxation.pdf.

As with most statistics, you should know who published the data so that you become aware of any possible bias.

You will use the stats presented on the following pages to compare personal costs and taxes.

2011 Comparison of Personal Costs and Taxes

Two-Earner Family of 4: $60,000	BC	AB	SK	MB	ON
Provincial Income Tax	1,147	1,677	725	**3,042**	315
Health Premiums	1,452	0	0	**0**	300
Subtotal PIT and Premiums	2,599	1,677	725	**3,042**	615
Family/Employment Tax Credits	0	(1,329)	0	**0**	0
Child Benefits	0	0	0	**0**	0
Property Taxes	3,309	1,873	2,791	**2,558**	2,950
Property Tax Credits	(570)	0	0	**(700)**	(86)
Provincial Sales Tax	1,077	0	676	**924**	1,769
Gasoline Tax	840	270	450	**345**	669
Carbon Tax Credit	(55)	0	0	**0**	0
Total Provincial Taxes, Credits and Premiums	7,200	2,491	4,642	**6,169**	5,917
Mortgage Costs	19,432	11,865	9,950	**7,809**	12,289
Child Care	14,880	8,868	11,352	**9,776**	7,999
Utilities	2,047	2,138	2,246	**1,958**	2,317
Auto Insurance	2,724	2,668	1,950	**2,004**	7,371
Total Living Costs	39,083	25,539	25,498	**21,547**	29,976
Total Personal Costs and Taxes	46,283	28,030	30,141	**27,716**	35,893

Two-Earner Family of 5: $75,000	BC	AB	SK	MB	ON
Provincial Income Tax	1,806	2,518	1,470	**4,165**	1,079
Health Premiums	1,452	0	0	**0**	516
Subtotal PIT and Premiums	3,258	2,518	1,470	**4,165**	1,595
Family/Employment Tax Credits	0	(1,709)	0	**0**	0
Child Benefits	0	0	0	**0**	0
Property Taxes	3,898	2,488	3,891	**3,366**	4,463
Property Tax Credits	(570)	0	0	**(700)**	0
Provincial Sales Tax	1,355	0	550	**1,105**	2,238
Gasoline Tax	840	270	450	**345**	669
Total Provincial Taxes, Credits and Premiums	8,781	3,567	6,361	**8,280**	8,965
Mortgage Costs	23,609	15,760	13,873	**11,206**	18,592
Child Care	23,400	14,940	15,678	**14,495**	12,500
Utilities	3,202	3,376	3,571	**3,072**	3,689
Auto Insurance	2,724	2,668	1,950	**2,004**	7,371
Total Living Costs	52,935	36,744	35,072	**30,777**	42,152
Total Personal Costs and Taxes	61,716	40,311	41,434	**39,058**	51,117

Sums may not add due to rounding.

QC	NB	NS	PE	NL	**Two-Earner Family of 4: $60,000**
4,548	2,402	2,667	2,992	2,460	Provincial Income Tax
1,385	0	0	0	0	Health Premiums
5,933	2,402	2,667	2,992	2,460	Subtotal PIT and Premiums
0	0	0	0	0	Family/Employment Tax Credits
(2,633)	(250)	0	0	0	Child Benefits
2,938	2,462	2,272	2,600	2,640	Property Taxes
0	0	0	0	0	Property Tax Credits
1,720	1,692	2,190	1,227	1,861	Provincial Sales Tax
777	537	750	474	726	Gasoline Tax
0	0	0	0	0	Carbon Tax Credit
8,735	6,843	7,879	7,293	7,687	Total Provincial Taxes, Credits and Premiums
8,081	5,387	6,840	4,903	6,626	Mortgage Costs
3,640	12,802	14,217	12,000	15,120	Child Care
2,451	2,974	2,810	3,923	3,354	Utilities
1,953	2,077	2,180	1,789	2,938	Auto Insurance
16,125	23,240	26,047	22,615	28,038	Total Living Costs
24,860	30,083	33,926	29,908	35,724	Total Personal Costs and Taxes

QC	NB	NS	PE	NL	**Two-Earner Family of 5: $75,000**
7,135	3,585	3,932	4,137	3,499	Provincial Income Tax
1,385	0	0	0	0	Health Premiums
8,520	3,585	3,932	4,137	3,499	Subtotal PIT and Premiums
0	0	0	0	0	Family/Employment Tax Credits
(3,116)	(182)	0	0	0	Child Benefits
5,163	4,842	2,890	4,012	4,210	Property Taxes
0	0	0	0	0	Property Tax Credits
2,082	2,130	2,678	1,328	2,160	Provincial Sales Tax
777	537	750	474	726	Gasoline Tax
13,426	10,912	10,250	9,951	10,595	Total Provincial Taxes, Credits and Premiums
14,202	10,594	8,702	7,567	10,567	Mortgage Costs
5,460	19,203	21,793	18,000	22,680	Child Care
3,911	4,779	4,481	6,341	5,412	Utilities
1,953	2,077	2,180	1,789	2,938	Auto Insurance
25,526	36,653	37,156	33,697	41,597	Total Living Costs
38,953	47,565	47,406	43,648	52,192	Total Personal Costs and Taxes

Sums may not add due to rounding.

Notes

Module 6 Cover Assignment

Personal Costs and Taxes

Total: 10 marks

Note: The numbers in brackets display a credit. These values are credited back to the families if they qualify. For example, in Manitoba, there is a property tax credit of $700. This means that families that qualify will get a tax reduction of $700.

1. Answer the following questions using the 2011 Comparison of Personal Costs and Taxes tables provided. *(2 marks)*

   a) For a two-income family of four earning $60,000, which province has the lowest total cost?

   _____

   What is that cost?

   _____

   b) For a two-income family of four earning $60,000, which province has the highest total cost?

   _____

   What is that cost?

   _____

continued

Module 6 Cover Assignment: Personal Costs and Taxes (continued)

2. Answer the following questions using the 2011 Comparison of Personal Costs and Taxes tables provided. *(2 marks)*

   a) For a two-income family of five earning $75,000, which province has the lowest total cost?

   _____

   What is that cost?

   _____

   b) For a two-income family of five earning $75,000, which province has the highest total cost?

   _____

   What is that cost?

   _____

3. Answer the following questions using the 2011 Comparison of Personal Costs and Taxes tables provided. *(3 marks)*

   a) For a two-income family of four earning $60,000, which individual costs are lowest in the province of Manitoba compared with other provinces?

   _____

   _____

   _____

   b) For a two-income family of five earning $75,000, which individual costs are lowest in the province of Manitoba compared with other provinces?

   _____

   _____

   _____

   c) Which individual costs are highest in the province of Manitoba compared with other provinces?

   _____

   _____

continued

Module 6 Cover Assignment: Personal Costs and Taxes (continued)

4. Excluding taxes, state two other major costs for a family that are not included in this table. *(1 mark)*

5. Answer the following questions using the 2011 Comparison of Personal Costs and Taxes tables provided. *(2 marks)*

   a) How do the total personal costs and taxes in the province of Manitoba compare to other provinces in Canada?

   b) Why do you believe this table was included in the 2011 Manitoba Budget?

Notes

Lesson 1: Self-Assessment

Lesson Focus

In this lesson, you will

- ❑ explore your personality traits, interests, skills, and values
- ❑ observe which types of careers are suited to your personality traits, interests, skills, and values

Lesson Introduction

You may already have an idea of what potential career you would like to have one day. If you *do not* have any idea, this lesson will help you to determine which types of careers are suitable for you. If you *do* have an idea of what career you wish to have one day, you still need to complete this lesson. You may be thinking about being a nurse or a doctor, but maybe you won't be able to handle working long hours or shift work. You may also be thinking about being a delivery driver, but then discover that you do not enjoy driving long distances by yourself.

Either way, the more you know about your strengths and weaknesses, the more likely you are to choose a career that is appropriate for you.

All About You!

At the end of this lesson, you are asked to write a self-assessment report. Before you start writing your report, you need to think about your personality traits, interests, skills, and values.

Personality Traits

Personality traits are words or phrases that could be used to complete the sentence "I am …."

Examples of personality traits include the following: active, ambitious, independent, adventurous, competitive, curious, demanding, honest, cheerful, responsible, serious, and brave.

On a sheet of paper, write down at least five personality traits that describe you.

Note: You are not restricted to the words or phrases on this list, or any of the following lists. You are free to use any other words or phrases that you feel best describe you.

Interests

Interests are words or phrases that could be used to complete the sentence "I really like …."

Examples of interests include the following: music, math, fashion, history, animals, cooking, travelling, dancing, reading, shopping, literature, physics, and physical activities.

On the same sheet of paper, write down at least five of your interests.

Skills

Skills are words or phrases that could be used to complete the sentence "I am really good at …."

Examples of skills include the following: planning, manual labour, problem solving, selling, making decisions, public speaking, working with others, learning new things, and helping others.

Again, on your sheet of paper, write down at least five skills that you have.

Values

Values are words or phrases that could be used to complete the sentence "I value …." Values are concepts or ideas that you respect or consider important in your everyday life.

Examples of values include the following: money, creativity, cooperation, the environment, humour, integrity, loyalty, power, health, work, and respect for yourself and others.

Finally, on your sheet of paper, write down at least five of your values.

Career Aptitude Questionnaires

Now that you have established your personality traits, interests, skills, and values, it will be easier to determine what type of career is suitable for you. You can find out more about suitable careers with career aptitude questionnaires. Career aptitude questionnaires are available on the Internet. The following is a list of possible sites where you will find career aptitude questionnaires:

- The Princeton Review Career Quiz: www.princetonreview.com/careers-after-college.aspx
- Career Personality Quiz: www.mycareerquizzes.com/career-personality-quiz
- Career Test: www.similarminds.com/career.html
- Skills and Knowledge Checklist: www.workingincanada.gc.ca/report_skillknowledge-eng.do
- You may also use any search engine to search for career aptitude questionnaires to find more career-finding exercises

If you have access to the Internet, you should use one or more of these sites to complete a career aptitude questionnaire in Assignment 1.1.

Writing a Report

After each lesson in this module, including this lesson, you are required to write a report. This report will consist of the information you found in this lesson. Here are some helpful hints for writing reports:

- Use appropriate language (e.g., no slang, abbreviations, etc.).
- Read the paper to yourself aloud at home before turning it in.
- Ask your learning partner to proofread your paper and offer constructive criticism.
- When using information from the Internet, be sure it comes from a reputable source (all sources listed in these lessons are reputable sources).
- Begin early because research takes time. In addition to the time needed to search for, evaluate, and read sources, you also need to allow enough time to get help if you need it.
- Do not copy information word for word. This is called plagiarizing!

How can you avoid plagiarism?

1. Always document your sources immediately! This way, you will not forget where you found your information.
2. Incorporate information using quotations. A quotation is a number of words or phrases copied directly from an information source, and should be identified with quotation marks. You need to state the source of the quotation.
3. Also, incorporate information using paraphrasing. A paraphrase uses an author's idea, but expresses it in your own words without quotation marks, since it's no longer a word-for-word quotation. Just changing a few words from the original is not a paraphrase!
4. Discover how to use various citation styles like MLA (Modern Language Association) to cite information.
5. Give credit where credit is due!

The above is not a complete list because using citations could be a lesson in itself. This is a quick guide to help you do your research ethically and efficiently. When in doubt, talk to your tutor/marker, librarian, family member, or teacher.

Lesson Summary

You have now listed some of your personality traits, interests, skills, and values. You will use these to complete Assignment 6.1, including your self-assessment report. Be sure to refer to the "helpful hints for writing reports" if you need help with this assignment. Also, you can ask your learning partner for help.

In Assignment 6.1, you will choose two careers that are suitable for you. It is therefore necessary to complete this assignment before continuing on to the next lesson. In the next lesson, you will be discovering more about your two career choices.

Assignment 6.1

Self-Assessment Report

Total: 19 marks

1. **Career Questionnaire** *(3 marks)*

   Complete either Option 1 or Option 2.

   Option 1: If you have access to the Internet

   If you have access to the Internet, refer to the previously mentioned websites in the Career Aptitude Questionnaires section in Lesson 1. Complete at least one of the questionnaires on these websites. You can complete more questionnaires if you wish to get a better idea of which type of career would be best suited to you.

   What are the results of at least one of the questionnaires?

   For Option 1, you will get three marks for handing in the results of the questionnaire.

   Option 2: If you don't have access to the Internet

   If you don't have access to the Internet, complete Sections I to IV of the questionnaire found on the following pages.

   For Option 2, you must include both the Career Aptitude Questionnaire and the Questionnaire Results in order to get three marks.

continued

Assignment 6.1: Self-Assessment Report (continued)

Career Aptitude Questionnaire			
Section I			
Am I interested in working with people?			
Statements	**Yes**	**Sometimes**	**No**
When I go to a social gathering, I like to try to talk to everybody.			
I like working with other people.			
I like building better relationships with other people.			
In my spare time, I choose to be with other people.			
I learn best in a classroom with a teacher and other students.			
I like helping people.			
I would rather work with people than with machines.			
People say that I am easy to get along with.			
I like getting to know all types of people, not just my friends or people my age.			
Caring about others is important to me.			
Total "Yes" Check Marks			
Total "Sometimes" Check Marks			

Section II			
Am I interested in working with things?			
Statements	**Yes**	**Sometimes**	**No**
When I have a problem, I am usually able to solve it myself.			
I like having my own personal space.			
I work best on my own.			
I like understanding how things work.			
I learn best by moving around and doing things.			
I would rather work with machines than with people.			
I like building things.			
I like analyzing things to see how they work.			
I like improving things to make them better.			
I like fixing things.			
Total "Yes" Check Marks			
Total "Sometimes" Check Marks			

continued

Assignment 6.1: Self-Assessment Report (continued)

Career Aptitude Questionnaire (continued)			
Section III			
Am I interested in managing people?			
Statements	**Yes**	**Sometimes**	**No**
I like checking that everyone has done what they were supposed to do.			
I enjoy getting people to organize themselves better.			
I enjoy solving other people's problems.			
In my spare time, I usually choose to be with other people.			
I am usually able to convince people of my point of view.			
I would rather lead than follow.			
I like organizing activities and events.			
I am comfortable imposing rules on other people.			
People often ask me to be in charge of things.			
I like things done a certain way—my way!			
Total "Yes" Check Marks			
Total "Sometimes" Check Marks			

Section IV			
Am I interested in creating things or ideas?			
Statements	**Yes**	**Sometimes**	**No**
When I have a problem, I like to think of my own solution.			
I am usually able to visualize something in my mind and recreate it artistically.			
I enjoy daydreaming.			
In my spare time, I usually choose to write or create something, or play music.			
I like to try new activities.			
People often say that I am a unique person.			
I like drawing, painting, or designing.			
I listen to music as often as I can.			
I often have new ideas.			
I like to do things differently than most other people.			
Total "Yes" Check Marks			
Total "Sometimes" Check Marks			

continued

Assignment 6.1: Self-Assessment Report (continued)

Fill in the Questionnaire Results table after you have completed the questionnaire.

Each "Yes" check mark is worth two points.

Each "Sometimes" check mark is worth one point.

Each "No" check mark is worth zero points.

Questionnaire Results		
Areas of Interest	**Total Points**	**Areas of Employment** (Remember that these examples are broad areas of employment, not specific jobs)
a) Working with People		Retailing, Human Resources, Health Care, Education, Social Work, Counselling, Religion, Tourism
b) Working with Things		Accounting, Computer Programming, Manufacturing, Engineering, Construction, Transportation, Trades
c) Managing People		Retail Management, Business Ownership, Restaurant Management, School Administration, Supervision
d) Creating Things or Ideas		Store Design, Advertising, Arts, Entertainment, Music, Graphic Arts, Television

Which of your areas of interest has the most points? This may give you an idea of potential careers for you.

Which of your areas of interest has the fewest points? This may give you an idea of careers that are not suited for you.

Note: Both the Career Aptitude Questionnaire and the Questionnaire Results need to be handed in with your assignment if you complete Option 2. If you complete Option 1, just the questionnaire results you received from completing your online questionnaire need to be handed in with your assignment.

continued

Assignment 6.1: Self-Assessment Report (continued)

2. **Career Choices** *(2 marks)*

   After completing Option 1 or Option 2, select two career choices that interest you based on your results from the questionnaire(s). You will get one mark for each career choice.

   Possible career choices include: hairstylist, graphic designer, teacher, nurse, doctor, lawyer, animal care worker, carpenter, chef, dentist, desktop publisher, crime scene investigator, fitness trainer, librarian, musician, journalist, a translator, etc.

   If you are still having trouble thinking of two possible career choices, ask your learning partner which career he or she thinks would be most suitable for you.

   My first career choice is _____.

   My second career choice is _____.

3. **Self-Assessment Report** *(14 marks – 2 marks per section)*

   Write a description of your personality type, interests, skills, and values. This self-assessment report should be between one and two pages (300–600 words). To help you with the description, a suggested order and format is given. If you would prefer to use a different order and format, feel free to do so. If you would like to include additional information, do so as well.

   Your report does not need to be in paragraph form or in complete sentences. Point form is fine as long as you include all of the information required.

   You will get two marks per section if you include all of the criteria mentioned in the self-assessment report outline.

   Your self-assessment report should contain the following information:

   Section 1

   - Introduction
     - An introduction to the report
   - Sources
     - List the websites you have used for the Career Aptitude Questionnaire (if any)

   Section 2

   - Personality traits
     - In your own words, describe your personality.
     - Explain what you have learned about your personality traits from this lesson and/or the questionnaire(s). Did the questionnaire(s) identify new characteristics? Explain.

continued

Assignment 6.1: Self-Assessment Report (continued)

Section 3

- Interests
  - Describe your interests. How do your interests complement your personality?
  - Explain what you have learned about your interests from this lesson and/or the questionnaire(s). Did the questionnaire(s) identify new areas you may be interested in exploring? Explain.

Section 4

- Skills
  - Describe your skills. How do your personality and interests affect your skills?
  - Explain what you have learned about your skills from this lesson and/or the questionnaire(s). Did the questionnaire(s) identify new skills? Explain.

Section 5

- Values
  - Describe your values. How do your personality, interests, and skills affect your values?
  - Explain what you have learned about your values from this lesson and/or the questionnaire(s). Did the questionnaire(s) identify new skills? Explain.

Section 6

- Suitable Careers
  - Do you agree or disagree with the questionnaire results regarding the type of career that would be suitable for you?
  - Which two careers do you believe would be most suitable for you? Explain.
  - How do these two careers relate to your personality traits, interests, skills, and values? Explain.

Section 7

- What have you learned from the questionnaire(s)?
  - What are the most important things you have learned about yourself in terms of your future career from the activities in this lesson and the questionnaires(s)?

Lesson 2: Career Descriptions

Lesson Focus

In this lesson, you will

❑ explore both of your career choices

Lesson Introduction

In the previous lesson, you identified some of your personality traits, interests, skills, and values. You also chose two careers based on your personality. From these two career possibilities, you will choose the one that interests you the most. This career will be referred to as your career choice. The second career will be referred to as your alternate career choice.

You need to do research for both of your career choices in this lesson. Salaries, job descriptions, and employment opportunities are just three of the topics you will explore. The research you complete in this lesson may help you decide whether you want to pursue one of your chosen careers after you complete high school.

Career Information

Before you continue with the rest of the lesson, you need to state the two careers that you find interesting.

The career I am most interested in is _____.

My alternate career choice is _____.

Researching Your Career

At the end of this lesson, you are asked to write two career descriptions. One career description will focus on your career choice, and the other one will focus on your alternate career choice. In order to write these descriptions, you need to research both of your career choices.

If you have access to the Internet, you can find a lot of information to do your research. The following websites should be helpful. You may also use any search engine to search for this information. If you do use a search engine, be sure to use sites that provide information about *Canadian* careers.

- www.youth.gc.ca
  The Youth Resource Network of Canada offers a lot of information about the world of employment, such as career choices, training and education, job offers, and much more.

- www.edu.gov.mb.ca/labour/hdo_home.html
  This site identifies occupations that are currently in high demand in Manitoba, and are expected to be in high demand for the next two years.

- www.mb.workinfonet.ca
  Manitoba WorkInfonet lets you access career planning tips and resources or see what counseling services are available in your community.

- www.jobbank.gc.ca
  Looking for work? This site is a national registry where a wide variety of jobs are posted daily.

- www.schoolfinder.com
  This site provides information about different Canadian universities and community colleges, as well as where to apply for scholarships.

- www.workingincanada.gc.ca
  This site provides information about job postings, employment potential, main duties, education and training, wages, licensing and certification, and the job skills and requirements for many careers in Canada.

- www.gov.mb.ca/opportunities
  This site allows you to access information on jobs, education and training, student aid, housing and rental options, and so much more.

- www.manitobacareerdevelopment.ca
  This site contains a decision-making model to help guide you through the process of career planning, as well as links to websites that will help you to develop your skills and search for a job.

If you don't have access to the Internet, other options for researching your career choices include

- talking to professionals in your chosen careers, either by phone or in person
- talking to a guidance counselor at a nearby school, either by phone or in person
- talking to a librarian about your career choices, either at a school library or a public library
- attending a Career Symposium (e.g., the Rotary Career Symposium at the Winnipeg Convention Centre)

Career Symposiums

Career symposiums are events in which you can meet with representatives from many different types of careers. Also, many displays are set up that provide further information about these careers. If you attend a career symposium, you will have a chance to learn about internships, volunteer opportunities, and academic programs that are suitable for your chosen careers.

Career symposiums in Manitoba include the following:

- Brandon Career Symposium
  - www.career-symposium.ca/start.asp
- Rotary Career Symposium (Winnipeg)
  - http://careersymposium.ca/index.php

Information to Research

In order to complete Assignment 6.2, you need to learn as much as possible about your two career choices. You must use at least two different sources of information. The information you need to find for both career choices includes the following:

- Duties and responsibilities
- A typical day at work
- Current employment opportunities
- Future employment opportunities
- Starting position and advancement opportunities
- Starting salary/wages
- Increments in salary/wages (also known as raises)
- Benefits
- Positive and negative aspects of the careers

Be sure to start your research before you finish this lesson and start working on the assignment. You will need this information to complete Assignment 6.2.

Lesson Summary

In this lesson, you were introduced to resources that should help you write your career descriptions. You also should have started researching both of your career choices. In Assignment 6.2, you will be organizing the information you find into two career descriptions. Be sure to complete Assignment 6.2 before you continue on to the next lesson.

In the next lesson, you will be researching the educational requirements for your career choices.

Assignment 6.2

Career Descriptions

Total: 27 marks

1. **Career Description** *(16 marks)*

   Write a description of your career choice. This description should be from one to two pages long (300–600 words).

   A suggested order and format is given to help you with the expectations of this description. If you would prefer to use a different order and format, feel free to do so. If you would like to include additional information, do so as well. You may have completed a similar assignment for another course in the past. If so, you may use that work as a resource, but you must do a new assignment for this course matching the criteria given below.

   Your description does not need to be in paragraph form or in complete sentences. Writing your answer in point form is fine as long as you include all the required information.

   You will earn the specified number of marks per section noted in the career description outline if you include all of the required information.

   Your Career Choice Description should include the following information:

   Section *(1 mark)*

   - Job title
   - Sources of information (at least two sources)

   Section 2 *(3 marks)*

   - Description of the career (Describe duties or responsibilities, typical activities, or a typical day at work.)

   Section 3 *(2 marks)*

   - Why you chose this career
     - Why do you feel this career would be a good choice for you?
     - How does it fit with your skills, personality, values, and interests?

continued

Assignment 6.2: Career Descriptions (continued)

Section 4 *(6 marks)*

- Current employment opportunities in career
- Future employment opportunities in career
- Starting position and advancement opportunities
- Starting salary/wages
- Increments in salary/wages (raises)
- Benefits
  - Some benefits might include a pension plan, life insurance, and health insurance.

Section 5 *(2 marks)*

- Positive and negative aspects of the career (such as health or stress issues)
  - What aspects of this career appeal to you the most?
  - What aspects of this career appeal to you the least?

Section 6 *(2 marks)*

- What are the most important things you have learned about your career choice?
- What surprised you the most about your career choice?

2. **Alternate Career Choice Description** *(11 marks)*

   Write a description of your alternate career choice. The length of this description should be at least one page (300 words).

   A suggested order and format for this description is given below. If you would prefer to use a different order and format, feel free to do so. If you would like to include additional information, please do so.

   Your description does not need to be in paragraph form or in complete sentences. Writing your answer in point form is fine as long as you include all the required information.

   You will get the specified number of marks per section noted in the Alternate Career Description outline if you include all the required information.

continued

Assignment 6.2: Career Descriptions (continued)

Your Alternate Career Choice Description should include the following information:

Section 1 *(1 mark)*

- Job title
- Sources of information (at least two sources)

Section 2 *(4 marks)*

- Description of the career (Describe duties or responsibilities, typical activities, or a typical day at work.)
- Why you chose this career
  - Why do you feel this career would be a good choice for you?

Section 3 *(4 marks)*

- Current employment opportunities of career
- Future employment opportunities of career
- Starting salary/wages
- Increments in salary/wages

Section 4 *(2 marks)*

- What are the most important things you have learned about your alternate career?
- What surprised you the most about your alternate choice?

Notes

Lesson 3: Education/Training Requirements

Lesson Focus

In this lesson, you will

- ❑ explore the education or training required for both of your career choices
- ❑ create a sample budget for the time you spend in education or training

Lesson Introduction

In the previous lesson, you selected two careers and chose one of them as your career choice and one as your alternate career choice. Have you ever wondered how you will actually become a professional in either of your chosen careers? Will you have to attend university or college? Do you need to complete a practicum or on-the-job training? How do you get accepted into the training or education program? Do you need to pay for the education or training? How will you manage the cost of the education or training required, as well as your other expenses such as a cell phone or a vehicle? You will be answering all of these questions in this lesson and the following assignment.

Education/Training

Most careers require some sort of education or training before you are eligible to work in that career. This training could be at a university, college, or another training institution. In order to get accepted into this training, some requirements may be needed. For example, you may need to take specific high school courses in order to get accepted into the program.

Education/Training Requirements

You may have already found information on the education or training requirements for your career choices during your research in Lesson 2. If you have not, an outline of the information you need to find is included in Assignment 6.3.

To find information on the education or training required for your career choices, you can use any of the sources or methods listed in Lesson 2. As well, some educational institutions have brochures explaining their programs. Include any brochures or information you are able to obtain in Assignment 6.3.

Additional Education/Training Requirements

Have you ever attended school and had a day off because of a teachers' in-service? In-services are a day off for students, but not for teachers. During these in-service days, teachers attend professional development classes where they learn about new educational resources and new ways to teach students. In most other careers as well, training or education is provided to inform employees about new information. You should be aware that after you have completed your initial education or training, you may be required to participate in additional training or education during the course of your career.

Creating a Budget

Throughout your education or training, you will likely have to pay for tuition, books, and living expenses. It is therefore necessary for you to create a budget for this period of time. In Lesson 4, you will also create a budget for the time when you are established in the career of your choice.

If you chose a career that requires no education or training costs, you will still need to complete a monthly budget. However, this monthly budget will be based on the income you receive when you begin your career. When you start your career, you may not be working full time. Also, you will not earn as much money as you will once you are established in your career. Therefore, you still need to create a budget for this period.

To help you create a budget for either situation, there is a Monthly Budget form included at the end of this lesson. If you plan to live at home with family, many of the expense categories may not apply to you. Therefore, they can be left blank.

Example 1

Gwendolyn is creating a monthly budget for the time she plans to spend at university. Gwendolyn plans to enter the Education program, which costs $3200 a year. Her textbooks cost an additional $1000 a year. She is living at home with her parents, so she has no household costs; however, Gwendolyn does have a cell phone and a vehicle. Her cell phone costs $45 a month. Her vehicle is paid off, so she only has to pay vehicle insurance, which costs $100 a month. Gasoline costs an additional $120 a month. She is currently working at Safeway and making an average of $150 a week. Gwendolyn also shops regularly for clothes and shoes that costs her $100 a month. She also likes to have $100 a month for entertainment, such as going out to movies and for dinner. Create a monthly budget form for Gwendolyn.

Solution

A copy of Gwendolyn's budget is found on the following page.

Gwendolyn is in a deficit situation. She is spending more money than she earns each month. If Gwendolyn had money saved up, she could possibly pay her expenses with her savings. Also, Gwendolyn might consider getting another job or working more hours in order to make more money. Gwendolyn might also have to give up regular shopping or entertainment for a few months while she attends university. She could also work full-time during the summer months, which would increase her average monthly income. Another possibility is for Gwendolyn to take out a loan in order to pay for her tuition.

MONTHLY BUDGET FORM

	Monthly Amount	Annual Amount	
			AVERAGE MONTHLY INCOME
1) ***NET INCOME***			1) $ 650.00
Primary Income	$ 650	$ 7,800.00	
Secondary Income	$	$	
Other Income	$	$	
Total Annual Income		$ 7,800.00	***MONTHLY SAVINGS***
2) ***MONTHLY SAVINGS*** (10% of Average Monthly Income)			2) $ 65.00
	Monthly Amount	**Annual Amount**	
3) ***MONTHLY EXPENSES***			
Mortgage/Rent/Room & Board	$	$	
Car Payments	$	$	
Telecommunications	$ $45	$ 540.00	
Hydro	$	$	
Other Utilities	$	$	
Cable	$	$	
Groceries/Restaurants	$	$	
Clothing/Gifts	$ $100	$ 1,200.00	
Car Maintenance	$	$	
Gasoline	$ $120	$ 1,440.00	
Health and Disability Insurance	$	$	
Personal Care	$	$	
Entertainment	$ $100	$ 1,200.00	
Household Costs	$	$	
Childcare	$	$	***TOTAL MONTHLY EXPENSES***
Pet Care (food, vet)	$	$	
Other	$	$	
TOTAL MONTHLY EXPENSES			3) $ 365.00
	Monthly Amount	**Annual Amount**	
4) ***ANNUAL EXPENSES***			
Car Insurance	$ 100.00	$ 1,200.00	
Life Insurance	$	$	
Property Taxes	$	$	
Home Insurance	$	$	
Vacations	$	$	***TOTAL MONTHLY CONTRIBUTIONS***
Newspapers & Periodicals	$	$	
Other (tuition/books)	$ 350.00	$ 4,200.00	
TOTAL MONTHLY EXPENSES			4) $ 450.00

5) ***SUMMARY***		
1. AVERAGE MONTHLY INCOME		1) $ 650.00
2. SAVINGS	2) $ 65.00	
3. TOTAL MONTHLY EXPENSES	3) $ 365.00	
4. TOTAL MONTHLY CONTRIBUTIONS	4) $ 450.00	
TOTAL AMOUNTS 2 + 3 + 4		$ 880.00
5. AMOUNT AVAILABLE FOR OTHER SAVINGS OR EXPENDITURES (DEFICIT)		5) $ –230.00

Note: *If the person is in a deficit position, the budget needs to be analyzed for possible adjustments to spending.*

Lesson Summary

In this lesson, you may have realized that education and/or training are required for one or both of your career choices. You also observed the importance of creating a monthly budget for the time spent in education *or* training or for the time when you begin your career. This monthly budget will help you keep your finances in order. In Assignment 6.3, you are asked to create your own monthly budget.

In the next lesson, you will complete another monthly budget for the time that you are established in your career choice. Therefore, it is important that you complete the following assignment before moving on to the next lesson.

Notes

Assignment 6.3

Education/Training Requirements

Total: 24 marks

1. **Education/Training for Your Career Choice** *(14 marks)*

   You may have completed a similar assignment for another course in the past. If so, you may use that work as a resource, but you must do a new assignment for this course matching the criteria given below.

   Complete Option A if there is *formal* education or training required for your career choice.

   Complete Option B if there is *on-the-job* training required for your career choice.

   Option A: Formal Education or Training:

   Write a description of the formal education or training required for your career choice. This description should be from one to two pages long (300–600 words).

   A suggested order and format is given for your description. If you would prefer to use a different order and format, feel free to do so. If you would like to include additional information, do so as well.

   Your description does not need to be in paragraph form or in complete sentences. Point form is fine as long as you include all of the required information.

   You will get the specified number of marks per section noted in the education/training for your Career Choice Description outline if you include all of the information mentioned.

   The education/training requirements of your career choice should include the following:

   Section 1 *(1 mark)*

   - Job title
   - Sources of information

continued

Assignment 6.3: Education/Training Requirements (continued)

Section 2 *(4 marks)*

- Educational/training requirements (degree(s), diplomas, certificate(s), etc.)
- Number of years of education/training
- Describe the courses, labs, internships, practicums, and on-the-job training required. List any prerequisites for getting accepted into the program, or related requirements/expectations.

Section 3 *(2 marks)*

- Universities, colleges, or other training institutions that provide the education/training for your chosen career
- Requirements in order to be accepted into the program

Section 4 *(2 marks)*

- Identify your first choice of university, college, or training institution.
- Justify this choice.

  Please indicate at least two institutions where the training is offered. If the training is offered only at one institution, indicate this.

Section 5 *(5 marks)*

- Cost of tuition
- Cost of books
- Cost of room and board while enrolled in the program
- Other living expenses while enrolled in the program
- Total cost of the program

Remember to include any brochures or relevant information from educational institutions with your description.

Option B: On-the-Job Training:

Write a description of the on-the-job training you need to complete when you first start in your career choice. In all jobs, some training takes place before you are qualified to work independently. This description should be from one to two pages long (300–600 words).

A suggested order and format is given for your description. If you would prefer to use a different order and format, feel free to do so. If you would like to include additional information, do so as well.

continued

Assignment 6.3: Education/Training Requirements (continued)

Your description does not need to be in paragraph form or in complete sentences. Point form is fine as long as you include all of the required information.

You will get the specified number of marks per section noted in the On-the-Job Training Description outline if you include all of the information mentioned.

The description of your on-the-job training should include the following:

Section 1 *(1 mark)*

- Job title
- Sources of information

Section 2 *(3 marks)*

- Description of the training.
  - Include all areas you will be trained in, such as machinery, customer service, cashier, etc.
  - Include a description of the typical training day, including the types of hours you will work (such as shift work, evenings, weekends, days, or nights).
- Length of the training period

Section 3 *(3 marks)*

- Where your training will take place
  - Are there any other places/people that offer this training?
  - Justify your choice of training place/person
- Requirements (if any) to be accepted into the training
  - Do you need a Grade 12 Diploma?

Section 4 *(4 marks)*

- Cost of training
  - Is this cost covered by the company?
  - Will you be paid for your on-the-job training? If so, will you be paid a higher wage/salary when you complete your training?
- Cost of room and board while in training
- Other living expenses while in training
- Total cost of the expenses you will acquire while in training

continued

Assignment 6.3: Education/Training Requirements (continued)

Section 5 *(3 marks)*

- After your training, what steps can you take to advance yourself in your career?
- Is more training necessary in order for you to have a higher wage/salary?

2. **Monthly Budget for Your Career Choice** *(5 marks)*

Complete Option A if there is *formal* education or training required for your career choice.

Complete Option B if there is *on-the-job* training required for your career choice.

Option A: Formal Education or Training:

Complete a sample monthly budget for the time you plan to spend in the education or training program required for your career choice. In Question 1, you found the cost of tuition, books, and living expenses while you are enrolled in this program. Use these values to complete your sample monthly budget. You can either complete the Monthly Budget form provided at the end of this lesson or you can create a worksheet of your own.

If you are living at home with family, many of the expense categories may not apply to you and can be left blank. You can also include your net income from any part-time or summer positions. Include your educational expenses as an annual expense.

Is your sample budget in a deficit position? Will you be able to pay for your education/training? If not, explain how you will finance your education/training.

You will get four marks if you complete a reasonable monthly budget and one additional mark if you include answers as to whether or not your budget is in a deficit position.

Option B: On-the-Job Training:

Complete a sample monthly budget for the time when you first start your career and are completing on-the-job training. In Question 1, you found the cost of the training (if there was any) and the cost of your room and board, as well as other living expenses. Include these values in your monthly budget.

Remember, at the start of your career, you may not be working full time. Also, you will be earning a lower salary/wage than you will when you are established in your career. Take these considerations into account when you are completing your monthly budget.

continued

Assignment 6.3: Education/Training Requirements (continued)

You can either complete the Monthly Budget Form provided at the end of this lesson or you can create a worksheet of your own. If you plan to live at home with family, many of the expense categories may not apply to you and can be left blank. You can also include your net income from any other part-time jobs.

Is your sample budget in a deficit position? Will you be able to pay for all your living expenses when you first start your career? If not, explain how you will finance your living expenses during this period.

You will get four marks if you complete a reasonable monthly budget, and one additional mark if you include answers as to whether or not your budget is in a deficit position.

3. **Education/Training for Your Alternate Career Choice** *(5 marks)*

   For your alternate career choice, write a short description (100–200 words) describing the education or training requirements.

   Your description does not need to be in paragraph form or in complete sentences. Point form is fine as long as you include all the required information.

   You will get five marks if you include all of the criteria mentioned in the education/training for your alternate career choice outline.

   You must include the following in your description:

   - Educational or training requirements (degree, diploma, certificates, licenses, etc.)
   - Number of years of education or training
   - Description of the courses, labs, internships, practicums, on-the-job training required
   - Approximate cost of the education or training

   Remember to include any brochures or relevant information from educational institutions (such as print-outs from websites) with your description.

MONTHLY BUDGET FORM

	Monthly Amount	Annual Amount	
			AVERAGE MONTHLY INCOME
1) ***NET INCOME***			1) $ _____
Primary Income	$ _____	$ _____	
Secondary Income	$ _____	$ _____	
Other Income	$ _____	$ _____	
Total Annual Income		$ _____	***MONTHLY SAVINGS***
2) ***MONTHLY SAVINGS*** (10% of Average Monthly Income)			2) $ _____

3) ***MONTHLY EXPENSES***	Monthly Amount	Annual Amount	
Mortgage or Rent	$ _____	$ _____	
Car Payments	$ _____	$ _____	
Telecommunications	$ _____	$ _____	
Hydro	$ _____	$ _____	
Other Utilities	$ _____	$ _____	
Cable	$ _____	$ _____	
Groceries/Restaurants	$ _____	$ _____	
Clothing/Gifts	$ _____	$ _____	
Car Maintenance	$ _____	$ _____	
Gasoline	$ _____	$ _____	
Health and Disability Insurance	$ _____	$ _____	
Personal Care	$ _____	$ _____	
Entertainment	$ _____	$ _____	
Household Costs	$ _____	$ _____	
Childcare	$ _____	$ _____	***TOTAL MONTHLY EXPENSES***
Pet Care	$ _____	$ _____	
Other	$ _____	$ _____	
TOTAL MONTHLY EXPENSES			3) $ _____

4) ***ANNUAL EXPENSES***	Monthly Amount	Annual Amount	
Car Insurance	$ _____	$ _____	
Life Insurance	$ _____	$ _____	
Property Taxes	$ _____	$ _____	
Home Insurance	$ _____	$ _____	
Vacations	$ _____	$ _____	***TOTAL MONTHLY CONTRIBUTIONS***
Newspapers & Periodicals	$ _____	$ _____	
Other	$ _____	$ _____	
TOTAL MONTHLY EXPENSES			4) $ _____

5) ***SUMMARY***

1. AVERAGE MONTHLY INCOME		1) $ _____
2. SAVINGS	2) $ _____	
3. TOTAL MONTHLY EXPENSES	3) $ _____	
4. TOTAL MONTHLY CONTRIBUTIONS	4) $ _____	
TOTAL AMOUNTS 2 + 3 + 4		$ _____
5. AMOUNT AVAILABLE FOR OTHER SAVINGS OR EXPENDITURES (DEFICIT)		5) $ _____

Note: *If the person is in a deficit position, the budget needs to be analyzed for possible adjustments to spending.*

Lesson 4: What Do You Expect Your Life to Be Like?

Lesson Focus

In this lesson, you will

- ❑ look at the type of housing you can afford based on your career choice
- ❑ look at the type of transportation you can afford based on your career choice
- ❑ create a sample monthly budget for your career choice
- ❑ explore your expected lifestyle based on your career choice

Lesson Introduction

Have you ever wondered if you could afford a hot tub, swimming pool, home gym, *and* tropical vacations in your chosen career? In this lesson, you will discover more about what you can and cannot afford based on the income from your career choice. Many people have big dreams, such as owning a mansion or having their own in-ground swimming pool. However, not everybody can afford all of these luxuries, and so they may get themselves into debt.

In this lesson, you will describe the lifestyle you would expect to lead once you are established in the career of your choice. To help you avoid financial disasters, you will also be creating your own monthly budget based on your career choice and lifestyle. This budget will help determine what you can and cannot afford based on your chosen career.

Your Expected Lifestyle

In the assignment following this lesson, you are asked to write a report based on your expected lifestyle. Your expected lifestyle is the way you want to live once you are established in the career of your choice. Your expected lifestyle includes where you want to live, the quality of your home and vehicle, how you expect to spend your time (the number of hours you work, participate in activities such as sports, travel, etc.), how often you dine at restaurants, whether you expect to live alone or support a family, and so on. In your report, you will need to include some of the above information.

It may be difficult at this time for you to think so far into the future. Therefore, you may find it helpful to speak to older family members and friends.

Personal Situation

Your Expected Lifestyle report will include a section on your future personal situation—whether you are living alone or with a significant other, and whether you plan to support a family. If you plan to live with a significant other, your partner may be able to contribute to the family income. If you plan to raise children, you must be prepared to spend a lot of money for family expenses.

Where you live affects your career options and your transportation options. For example, if you live in a rural area, public transportation is not widely available, and you will most likely need to own a vehicle. Also, you will most likely need to live fairly close to your place of work.

Affordable Housing

In Module 1, you calculated the affordability of a house based on the Gross Debt Service (GDS) ratio. In your Expected Lifestyle Report, you will include a calculation of your own GDS ratio based on the income you expect to receive once you are established in your career.

All calculations done in this lesson and the following assignment will be based on the income you will receive once you are established in your career. This value will be greater than the income you receive when you first start your career.

Example 1

Jacob is a firefighter with an annual gross income of $59,600. Jacob lives with his wife Amber, who is a social worker with an annual gross income of $51,800. They wish to buy a used bungalow for $215,000. They have saved $15,000 for a down payment. The monthly property taxes are approximately $165, and the monthly heating costs are approximately $84. Their financial institution offers them an interest rate of 7.5% for a 25-year mortgage.

a) Calculate the maximum price Amber and Jacob can afford to spend on a home.

b) Can they afford the $215,000 bungalow? If so, how much will their monthly mortgage payment be?

Solution

a) Gross monthly household income: $\left(\frac{\$59,600 + \$51,800}{12}\right) = \$9283.33$

Complete the Maximum Affordable Home Price chart from Module 1, Lesson 1.

Chart 1.1: Interest Rate Factors can also be found in Module 1, Lesson 1.

Maximum Affordable Home Price		
Gross monthly household income		$ 9,283.33
Multiply: (GDS ratio)	32%	
Total affordable household expenses		$ 2,970.67
Subtract:		
Monthly property taxes	$ 165.00	
Monthly heating costs	$ 84.00	
one-half of condo/strata fees (if applicable)	$ 0.00	
Monthly affordable mortgage payment		$ 2,721.67
Divide: Interest factor (from Chart 1.1)	0.00732	
Amount of affordable mortgage		$371,812.84
Add: cash down payment	$ 15,000.00	
Maximum affordable home price		$386,812.84

The maximum affordable home price for Amber and Jacob is $386,812.84.

b) Yes, they can afford the $215,000 bungalow.

The mortgage after the down payment = $215,000 − $15,000 = $200,000.

Use the Amortization Table from Module 1, Lesson 2.

The monthly payment per $1000 for 25 years at 7.5% = $7.32.

Monthly payment = $\frac{\$7.32 \times \$200,000}{1000} = \$1464.$

When you do affordable housing calculations in Assignment 6.4, you need to estimate the amounts listed below. However, the amount that always stays the same is your gross monthly income. This value is determined by your projected annual income once you are established in your chosen career. You should have determined this value in Lesson 2. This value should be in Section 4 of your Career Choice Description in Assignment 6.2.

Your *total* gross monthly income includes the total household income from all sources, including the income earned by your spouse.

If you wish to purchase a home, you have to estimate the following amounts:

- Total gross monthly income (including your spouses' income if applicable)
- Cost of home
- Down payment
- Property taxes
- Heating costs
- Mortgage rate
- Condo/strata fees (if applicable)

If you wish to live in an apartment, you have to estimate the following amounts:

- Total gross monthly income (including spouses' income if applicable)
- Rent
- Utilities

Affordable Transportation

In Module 5, you used the Total Debt Service (TDS) ratio to calculate whether a vehicle was affordable. In your Expected Lifestyle report, you will include a calculation of your own TDS ratio based on the income you will receive once you are established in the career of your choice.

Example 2

Jacob and Amber (from Example 1) want to determine how much money they are able to spend on a vehicle. Their monthly mortgage is $1464. Heating costs are $84 a month and monthly property taxes are $165.

a) What is the maximum amount of money per month that Jacob and Amber can spend on a vehicle based on the Total Debt Service ratio?

b) Jacob and Amber see a 2010 Dodge Nitro SE four-wheel-drive vehicle on sale for $23,900 including all fees and taxes. Can they afford this vehicle if they have a down payment of $2000 and finance it for five years at an interest rate of 8%?

c) What are the 2010 Autopac rates for this vehicle if Jacob and Amber live in Territory 1, have no merits, and use this vehicle as an all-purpose vehicle?

Solution

a) Total Debt Service Ratio (TDS) $= \dfrac{\text{Monthly Housing Costs} + \text{All Other Monthly Debts}}{\text{Gross Monthly Income}} \times 100$

Total Debt Service (TDS) ratio should not exceed 40%.

Maximum debt = \$9283.33 × 0.4 = \$3713.33

Now, Jacob and Amber already spend \$1464 + \$84 + \$165 a month on their mortgage, heating costs, and property taxes.

Loan amount available = \$3713.33 − \$1464 − \$84 − \$165 = \$2000.33

Therefore, Jacob and Amber are left with \$2000.33 a month to spend on a vehicle, based on the Total Debt Service ratio.

b) Amount of the vehicle loan: \$23,900 − \$2000 = \$21,900

The monthly payment per \$1000 loan at an interest rate of 8% for a repayment period of five years is \$20.28 (see Table 5.1).

Monthly payment $= \dfrac{\$20.28 \times \$21,900}{1000} = \$444.13$

Yes, Jacob and Amber can easily afford this vehicle, as they are able to spend a maximum of \$2000.33 a month on a vehicle.

c) The rating group for a 2010 Dodge Nitro SE four-wheel-drive vehicle is 30. The Autopac rate for an all-purpose passenger vehicle in Territory 1 with no merit discount and in a rating group of 30 is \$1603. This will give Jacob and Amber an additional monthly cost of $\dfrac{\$1603}{12} = \$133.58$ for vehicle insurance.

If you have a moderate to high income like Jacob and Amber do, you will most likely be able to afford a new vehicle. However, if you have a lower income and/or are living alone, you might not be able to afford a new vehicle. Other options include leasing a vehicle, buying a used vehicle, taking the bus, or some other form of transportation (such as walking or biking if you live close enough to your workplace and other places you need to go).

Based on the type of transportation you choose, you will have to estimate many costs including the cost of the vehicle, the cost of a bus pass, and other expenses such as repairs and fuel.

Monthly Budget

In Lesson 3, you created a monthly budget for the time you planned to spend in the education or training program required for your career choice. In Assignment 6.4 following this lesson, you will create a monthly budget for the time when you are established in your career. The values you find for your housing and transportation costs once you are established in your career will be included in this budget.

Other expenses such as your telecommunications, cable, groceries, clothing, and home insurance need to be estimated. If you are unsure of how much these costs might be, you can ask your learning partner or tutor/marker for help.

Lesson Summary

In this lesson, you calculated the amounts you can afford to spend on housing and transportation based on your projected income when you are established in your chosen career. Now, you will be putting this knowledge to use in Assignment 6.4. If you need help with certain calculations, you can always ask your learning partner for help. You can also go back to Module 1 and Module 5 and review the material on mortgages, purchasing a vehicle, and vehicle insurance.

In the next lesson, you will be writing a resumé.

Assignment 6.4

Expected Lifestyle Report

Total: 21 marks

1. **Expected Lifestyle Report** *(16 marks)*

   Write a report based on the lifestyle you plan on having once you are established in your career. A suggested order and format is given for your report. If you would prefer to use a different order or format, feel free to do so. If you would like to include additional information, do so as well.

   Your report does not need to be in paragraph form or in complete sentences. Point form is fine as long as you include all of the information required.

   You will get the specified number of marks per section noted in the Expected Lifestyle report outline if you include all of the information mentioned.

   The report on your expected lifestyle should include the following information:

   Section 1 *(2 marks)*

   - Job title
   - Projected number of years from present
   - Number of years you will have been working in your career choice

   Section 2 *(2 marks)*

   - Annual salary once you are established in your career
   - Benefits
     - Some of the benefits might include a pension plan, life insurance, and health insurance.

   Section 3 *(2 marks)*

   - Describe your personal situation when you are established in your career. Although you may be unsure of your personal situation in the future, choose a situation you feel will be likely.
     - Do you expect to be living on your own or with a partner? Do you expect to have children?
     - Where will you live? Do you expect to be living in the province of Manitoba and, if so, where? Do you expect to be living outside the province of Manitoba and, if so, where?

continued

Assignment 6.4: Expected Lifestyle Report (continued)

Section 4 *(5 marks)*

- Affordable housing
  - Find how much you can afford to spend on housing costs based on your GDS ratio. Recall that this value should be 32% of your total gross monthly household income.
  - Based on your GDS ratio, what type of housing will you be able to afford once you are established in your career? Do you expect to be renting an apartment, or owning a house or condominium?
    - If you expect to be living in an apartment, find the approximate monthly cost of renting an apartment. If you need help, refer to Module 1, Lesson 5, which deals with renting costs.
    - If you expect to own a house or condominium, find your maximum affordable home price by completing the Housing Form at the end of this lesson. If you need help, refer to Module 1, Lessons 1 and 2, which deal with the cost of home ownership.

      Recall that you can find the maximum affordable home price by using the Gross Debt Service ratio and a value from the Interest Rate Factor table. Since the Interest Rate Factor table is based on a 25-year amortization rate, assume that any mortgage you will take out will be for 25 years. Also, assume that the mortgage is a fixed-rate mortgage.
    - Based on your maximum affordable home price, estimate the amount you are willing to spend on a home. This value can either be less than or equal to your maximum affordable home price. Calculate your monthly mortgage payments based on the amount you are willing to spend on a home and the interest rate you used to calculate your maximum affordable home price.

Section 5 *(4 marks)*

- Affordable transportation
  - What type of transportation will you be able to afford once you are established in your career? Do you expect to use public transportation or drive a vehicle?
    - If you wish to use public transportation, estimate your monthly costs (such as a bus pass).
    - If you will be driving a vehicle, describe the type of vehicle you expect to have. Will you purchase it or lease it?

      If you lease the vehicle, what are the approximate monthly leasing payments?

continued

Assignment 6.4: Expected Lifestyle Report (continued)

If you purchase it, will you purchase a new vehicle or a used one? Will you pay for the vehicle outright or will you finance it with monthly payments? If you finance the vehicle with monthly payments, what are the approximate monthly payments? If you pay for the vehicle outright, what is the approximate cost of this vehicle? (Include this as a one-time annual expense in your monthly budget.)

- What will your annual Autopac rates be for the vehicle you choose? What will your gasoline costs be each month?
- If you expect to use some other form of transportation (such as walking or biking), estimate how much this will cost (such as buying a bike or walking shoes).

Section 6 *(1 mark)*

- What do you believe are the most important things you have learned about your expected lifestyle once you are working in your career?

2. **Expected Lifestyle Budget** *(5 marks)*

Complete a sample of a monthly budget for the time when you are established in your career.

You can either complete the Monthly Budget Form provided at the end of this lesson or create a worksheet of your own.

You will get four marks if you complete a reasonable monthly budget and one additional mark if you include a summary with the budget.

The budget is divided into the following sections:

- **Net Income**
  - What is your expected income? Include any expected income from other family members or your partner.
    - Remember, your net income is not your gross income. You will have many deductions, including ones for Canada Pension Plan, Employment Insurance premiums, and income tax. Although you may not know the exact amount of these deductions, make a reasonable estimate of what their total will be. You will have to subtract this total from your gross income to calculate your net income. You can always ask your learning partner for help estimating the amounts of deductions.

continued

Assignment 6.4: Expected Lifestyle Report (continued)

- **Savings**
  - Remember to "pay yourself first."
- **Monthly Expenses**
  - Use the amount you found for your rent or mortgage payment in Paragraph 4.
  - Use the amount for transportation you found in Paragraph 5.
    - If you decided to purchase or lease a vehicle, include car insurance costs under Annual Expenses and gasoline costs under Monthly Expenses.
  - Make reasonable estimates for your other expenses. This is an opportunity to learn about living expenses from older family members or friends.
- **Annual Expenses**
  - Again, make reasonable estimates of your annual expenses.
- **Summary**
  - Do you have an amount left for further savings or expenditures, or do you have a deficit? If you are in a deficit position, what adjustments can you make to your budget?

Maximum Affordable Home Price		
Gross monthly household income		$_____
Multiply: (GDSR)	_____	
Total affordable household expenses		$_____
Subtract:		
Monthly property taxes	$_____	
Monthly heating costs	$_____	
one-half of condo/strata fees (if applicable)	$_____	
Monthly affordable mortgage payment		$_____
Divide: Interest factor (from Chart 1.1)	_____	
Amount of affordable mortgage		$_____
Add: cash down payment	$_____	
Maximum affordable home price		$_____

MONTHLY BUDGET FORM

	Monthly Amount	Annual Amount	
			AVERAGE MONTHLY INCOME
1) ***NET INCOME***			1) $ _____
Primary Income	$ _____	$ _____	
Secondary Income	$ _____	$ _____	
Other Income	$ _____	$ _____	
Total Annual Income		$ _____	***MONTHLY SAVINGS***
2) ***MONTHLY SAVINGS*** (10% of Average Monthly Income)			2) $ _____

3) ***MONTHLY EXPENSES***	Monthly Amount	Annual Amount	
Mortgage or Rent	$ _____	$ _____	
Car Payments	$ _____	$ _____	
Telecommunications	$ _____	$ _____	
Hydro	$ _____	$ _____	
Other Utilities	$ _____	$ _____	
Cable	$ _____	$ _____	
Groceries/Restaurants	$ _____	$ _____	
Clothing/Gifts	$ _____	$ _____	
Car Maintenance	$ _____	$ _____	
Gasoline	$ _____	$ _____	
Health and Disability Insurance	$ _____	$ _____	
Personal Care	$ _____	$ _____	
Entertainment	$ _____	$ _____	
Household Costs	$ _____	$ _____	
Childcare	$ _____	$ _____	***TOTAL MONTHLY EXPENSES***
Pet Care	$ _____	$ _____	
Other	$ _____	$ _____	
TOTAL MONTHLY EXPENSES			3) $ _____

4) ***ANNUAL EXPENSES***	Monthly Amount	Annual Amount	
Car Insurance	$ _____	$ _____	
Life Insurance	$ _____	$ _____	
Property Taxes	$ _____	$ _____	
Home Insurance	$ _____	$ _____	
Vacations	$ _____	$ _____	***TOTAL MONTHLY CONTRIBUTIONS***
Newspapers & Periodicals	$ _____	$ _____	
Other	$ _____	$ _____	
TOTAL MONTHLY EXPENSES			4) $ _____

5) ***SUMMARY***

1. AVERAGE MONTHLY INCOME		1) $ _____
2. SAVINGS	2) $ _____	
3. TOTAL MONTHLY EXPENSES	3) $ _____	
4. TOTAL MONTHLY CONTRIBUTIONS	4) $ _____	
TOTAL AMOUNTS 2 + 3 + 4		$ _____
5. AMOUNT AVAILABLE FOR OTHER SAVINGS OR EXPENDITURES (DEFICIT)		5) $ _____

Note: *If the person is in a deficit position, the budget needs to be analyzed for possible adjustments to spending.*

Lesson 5: Resumé

Lesson Focus

In this lesson, you will

❑ write a resumé

Lesson Introduction

You are well on your way to being prepared for your future career. However, once you complete the education and training requirements, you do not automatically receive your dream career. You first need to find a company that is hiring people for the position that interests you. Then, you need to apply for this position. To apply for this position, you need a resumé. Your resumé is the first thing a hiring supervisor or manager will see. It is, therefore, very important that your resumé is flawless and portrays your best side.

Your Resumé

You may already know how to write a resumé from previous courses. If you do not know how to write a resumé, this lesson will help you with the basics of resumé writing. This lesson will help you polish up your resumé to make it look more professional.

Tips for Resumé Writing

A **resumé** is a brief summary prepared by someone applying for a job, stating his or her personal, educational, and professional qualifications and experience.

- Your name should be listed first on your resumé. It should also in bold print and in a larger font.
- Your contact details should be listed right after your name.
- Your resumé should be customized to the job for which you are applying.
- You should list meaningful achievements that apply to the job opportunity.
- You don't need to list all of your work experiences—only the most recent and relevant work experiences are necessary.

- Only list hobbies if they are relevant to the job you are applying for.
- Use bullet points instead of paragraphs.
- Make sure there are no errors in your resumé.
- Do not rely entirely on spell check.
- Do not use slang.
- Do not include irrelevant information, such as your political viewpoint or religious beliefs, unless you are applying for a job where this type of information is necessary, such as a Minister of Religion.

Sample Resumé

A sample resumé is provided on the following page.

Lesson Summary

In this lesson, you reviewed the process of writing a resumé. In the following assignment, you are asked to write your own resumé. Be sure to complete Assignment 6.5, which is the last assignment in this module.

Violet Kadoomba

100 Broadway, Brandon MB R0R 0R0 204-555-0000 (H) 204-555-9999 (C) Email _____ @hotmail.com

Education

Certified Plumber	Eastern Manitoba College Beausejour MB	June 2005
Grade 12 Diploma	Mynarski Regional Secondary School Assiniboia MB	June 2004

Employment History

July 2005 to Present — **Certified Plumber**, Roberts and Dollard Builders, Waskeda MB

Responsibilities

- Working within a team environment in a labour-intensive position
- Performing plumbing maintenance and repairs
- Working with maintenance and safety as required

2003 to 2004 (Summers) — **Apprentice Plumber**, Great Pine Lodge, Dallas MB

Responsibilities

- Providing routine maintenance as required
- Operating the Black Jack table

1998 to 2001 — **Paper Carrier**, Swan River MB

Responsibilities

- Providing quality customer service
- Collecting money from customers on accounts
- Delivering newspapers on a timely basis

Extracurricular Activities

- Member, Varsity Women's Basketball Team, Mynarski Regional Secondary School, 2002 to 2004
- Member, Jazz Band, Mynarski Regional Secondary School, 2002 to 2004
- Volunteer, Thompson General Hospital, 2002 to 2003
- Volunteer, Rural Forum, Career Symposium, 2002 to 2003

References

Joachim Freed, Instructor	Mynarski Regional Secondary School Assiniboia MB	204-555-5555 (W)
Chithra Bath, Employment Counsellor	Great Western Employment Services Brandon MB	204-555-0833 (W)
Ying Li, Teacher	Mynarski Regional Secondary School Assiniboia MB	204-555-3941 (W)

Assignment 6.5

Resumé and Reflection

Total: 29 marks

1. **Resumé** *(25 marks)*

   Write a resumé that should be included with your application for the job that is your first choice for a career. Assume you have just received the education or training requirements needed to pursue that career choice. Also, assume that you have been participating in hobbies and other work experiences relevant to your career choice.

   In Assignment 6.2, you created a description of your chosen career. Assume that your description is the advertisement for this job, and that you have decided to apply for it. Be sure to customize your resumé to show that you are well suited for the job.

   Your resumé should be from one to two pages in length. You will be marked using the following rubric. Make sure that your resumé includes all of the criteria mentioned. You can also refer to the resumé writing tips and the sample resumé given in the lesson if you need additional help with writing your resumé.

continued

Assignment 6.5: Resumé and Reflection (continued)

Resumé Marking Rubric				
Resumé Components	**4 or 5 Marks**	**2 or 3 Marks**	**0 to 1 Mark**	**Total Marks**
Name, Address, Phone Number, Cell Phone, Email Address	Contact information is at the top of the resumé. Three or more points are included.	Contact information is not at the top of the resumé or only two points are included.	Contact information is not at the top of the resumé and may not be included at all.	____ **/ 5**
Education/Training	The education/ training required to get into career choice is clearly stated and explained.	The education/ training required to get into career choice is partially stated and/or explained.	The education/ training required to get into career is barely mentioned or not included at all.	____ **/ 5**
Work Experiences/ Hobbies	Work experiences and hobbies applicable to career choice are mentioned and explained.	Work experiences and hobbies applicable to career choice are partially mentioned and explained.	Work experiences and hobbies applicable to career choice are barely mentioned or not included at all.	____ **/ 5**
Writing Conventions (spelling, capitalization, grammar) & Organization	The resumé is organized and free of errors.	The resumé has a few errors or is not organized very well.	The resumé has many errors and/or is not organized well.	____ **/ 5**
Customized for Career Choice	The resumé is clearly customized for applying for a certain career choice.	The resumé is somewhat customized for applying for a certain career choice.	The resumé is not customized for applying for a certain career choice.	____ **/ 5**
				Total: _____ /25

continued

Assignment 6.5: Resumé and Reflection (continued)

2. **Reflection** *(4 marks)*

   Write a reflection about your career choice. A suggested order and format is given for this reflection. If you would prefer to use a different order and format, feel free to do so. If you would like to include additional information, do so as well.

   Your reflection does not need to be in paragraph form or in complete sentences. Point form is fine as long as you include all of the information required.

   You will get the specified number of marks per section noted in the Reflection outline if you include all of the information mentioned.

   Your reflection should be about half a page in length and include the following information:

   Section 1

   After researching your career choice, are you still planning to choose it as your real career? Are you planning to choose your alternate career as your real career? Are you planning to choose a different career? Explain.

   Section 2

   What do you believe are the most important things you have learned from researching both your career choice and your alternate career choice?

   Section 3

   Has discovering more about your career choices been a positive learning experience for you? Why or why not? Explain.

Notes

Module 6 Summary

Congratulations! You are now closer to making a decision about your future career!

In this module, you found which types of careers are applicable to your specific personality traits, interests, skills, and values. You then chose two careers that you were most interested in and completed additional research on these two careers. You discovered things such as education or training requirements and what a typical day of work would look like. You also learned how to create two monthly budgets for different times in your career life, including the time when you would be established in your career. This monthly budget should provide you with enough information to know whether or not you can afford your expected lifestyle, or if you need to make some changes.

In the next module, you will be studying statistics. The module will focus on calculating, explaining, and analyzing data.

Submitting Your Assignments

It is now time for you to submit the Module 6 Cover Assignment and Assignments 6.1 to 6.5 to the Distance Learning Unit so that you can receive some feedback on how you are doing in this course. Remember that you must submit all the assignments in this course before you can receive your credit.

Make sure you have completed all parts of your Module 6 assignments and organize your material in the following order:

- ❑ Module 6 Cover Sheet (found at the end of the course Introduction)
- ❑ Module 6 Cover Assignment: Personal Costs and Taxes
- ❑ Assignment 6.1: Self-Assessment Report
- ❑ Assignment 6.2: Career Descriptions
- ❑ Assignment 6.3: Education/Training Requirements
- ❑ Assignment 6.4: Expected Lifestyle Report
- ❑ Assignment 6.5: Resumé and Reflection

For instructions on submitting your assignments, refer to How to Submit Assignments in the course Introduction.

Notes

Grade 12 Essential Mathematics (40S)

Module 7
Statistics

Module 7: Statistics

Introduction

Statistics is the branch of mathematics that deals with the collection, organization, and analysis of data. Statistics are frequently mentioned in the news, in radio and television commercials, and on the Internet, including the Statistics Canada website. Throughout this module, statistics from the Statistics Canada website are used to provide information. References to the website itself are also mentioned, so that you may visit the website if you are interested.

Statistics are very frequently used by the media to influence your point of view. Statements such as "92% of the people surveyed…" or "nine out of ten doctors recommend…" are designed to persuade consumers to agree with the people surveyed or the doctors' recommendations. As a consumer, you need to understand this information and how to interpret it. This will allow you to recognize biases, and thus make informed decisions.

In previous mathematics courses, you considered a number of ways of organizing and analyzing data. You were introduced to three measures of central tendency: the mean, the median, and the mode. In this module, you will study two additional measures of central tendency. You will also study percentiles and how to interpret statistical information.

Assignments in Module 7

When you have completed the assignments for Module 7, submit your completed assignments to the Distance Learning Unit either by mail or electronically through the learning management system (LMS). The staff will forward your work to your tutor/marker.

Lesson	Assignment Number	Assignment Title
	Cover Assignment	Problem Analysis
2	Assignment 7.1	Mean, Median, Mode, and Outliers
4	Assignment 7.2	Five Measures of Central Tendency
5	Assignment 7.3	Analyzing Percentiles

Resource Sheet

When you write your final examination, you are encouraged to take a Final Examination Resource Sheet with you into the examination. This sheet will be one letter-sized page, 8½ " by 11", with both sides in your handwriting or typewritten. You will submit it with your examination, but you do not receive any marks for it.

Many students have found that preparing a resource sheet is an excellent way to review. It provides you with a summary of the important facts of each module. You should complete a resource sheet for each module to help with your studying and reviewing. Lesson summaries and module summaries are included for you to use as a guide.

You may use the following list of instructions to help you with preparing your resource sheet for the material in Module 7. On this sheet, you should record mathematics terms and definitions, formulas, sample questions, or a list of places where you often make mistakes. You should also identify special areas that require extra attention or review by writing the page numbers.

After you have completed each module's resource sheet, you may summarize the sheets from Modules 5, 6, 7, and 8 to prepare your Final Examination Resource Sheet. The final examination for this course is based on Modules 5 to 8.

Resource Sheet for Module 7

As you go through the lessons of this module, you may want to consider the following suggestions regarding the creation of a resource sheet.

1. List all the important mathematics terms, and define them if necessary.
2. List all the formulas and perhaps a sample problem that shows how each formula is used.
3. If necessary, write the solutions to some problems, showing in detail how you did the calculations.
4. Copy any questions that represent the key points of the lesson, and perhaps include the solutions as well.
5. Identify the problems you found most difficult, and copy the page numbers onto the resource sheet so that you can review them before writing the examination. You may also copy the problems and the solutions onto your resource sheet, and later write them onto your Final Examination Resource Sheet.
6. Write any comments, ideas, shortcuts, or other reminders that may be helpful during an examination.

Module 7 Cover Assignment: Problem Analysis

Mathematics often involves recognizing patterns and making predictions based on the patterns you have found. Problem analysis is required in many lines of work, even when the problems are not mathematical in nature. As you solve problems in this Cover Assignment, you will use what you know about patterns and numbers to find solutions to problems you may have never seen before. You may try a few approaches and be unsuccessful for awhile as you gradually gain a deeper understanding of the problem. Be patient with yourself. As is usually the case when doing problem analysis, finding solutions to real problems takes some time.

Notes

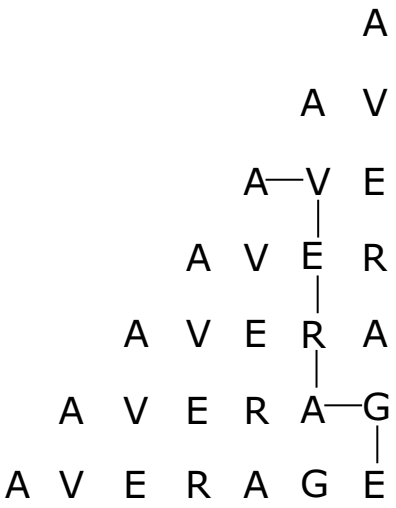
Module 7 Cover Assignment

Problem Analysis

Total: 8 marks

For each of the following problems, you must not only give the answer, but also an explanation of how you obtained that answer.

1. How many paths, each consisting of a sequence of horizontal and vertical moves, can be formed to trace out the word AVERAGE? One such path is shown in the example. *(2 marks)*



continued

Cover Assignment 7: Problem Analysis (continued)

2. A certain book has 500 pages, numbered 1, 2, 3, and so on. How many times does the digit "7" appear in the page numbers? *(2 marks)*

3. Five consecutive integers have a mean of 25. What is the sum of the largest and smallest of these integers? Refer to Lesson 1 in this module for a definition of the term *mean*. *(2 marks)*

4. A mathematics test consists of 10 questions. Five marks are scored for each correct answer and two marks are deducted for each incorrect answer. If a student attempts all 10 questions and scores 29 points, how many answers are correct? *(2 marks)*

Lesson 1: Review of Mean, Median, and Mode

Lesson Focus

In this lesson, you will

- ❑ review the calculation the mean, median, and mode for a set of data

Lesson Introduction

Measures of central tendency are used frequently in everyday life. An example of a **mean** is the batting average of a baseball player, or the "normal" daily high temperature for today, as announced in a weather forecast. An example of a **median** is the "typical" price of a home as stated by a real estate agent when you are trying to buy a home in a certain neighbourhood. An example of **mode** is the outcome of an election where your local Member of the Legislative Assembly (MLA) is elected by getting the most votes.

Measures of Central Tendency

In previous courses, you were introduced to the terms *mean*, *median*, and *mode*. These are all measures of **central tendency**, as they all represent a central value of the data. Together, these three measures of central tendency give a more complete representation of the data.

Mean

To calculate the **mean** of a set of numbers, you add the numbers and divide the sum by the number of numbers in the set.

You have probably encountered the mean when dealing with report cards, your marks, and averages. In everyday language, the word *average* is generally taken to have the same meaning as the word *mean*. However, the word *mean* is used in statistics.

Example 1

Find the mean of the following set of test marks:

78, 72, 75, 67, and 78

Solution

The sum of all the test marks is: 67 + 72 + 75 + 78 + 78 = 370.

Number of test marks: 5

Mean: $\frac{370}{5} = 74$

Be sure to include all definitions and formulas from this lesson on your resource sheet.

Median

The **median** of a data set is the middle number when the numbers are written in numerical order. If a data set has an even number of numbers, the median is the mean of the two middle numbers.

Example 2

Find the median of the following set of test marks:

78, 72, 75, 67, and 78

Solution

First, you need to write these numbers in numerical order (i.e., in order of size): 67, 72, 75, 78, 78.

The middle number from this set is 75. Therefore, the median is 75.

Mode

The **mode** of a set of numbers is the number that occurs most frequently. A data set can have no mode, one mode, or more than one mode.

Example 3

Find the mode of the following set of test marks:

78, 72, 75, 67, and 78

Solution

Mode: 78

The number 78 occurs most frequently, and is therefore the mode.

Notice how writing the numbers in numerical order can be helpful for calculating the mean and the mode. Since it has to be done to calculate the median, it is a good practice to start every question by arranging the data in numerical order.

Example 4

Consider the following set of numbers:

107, 118, 96, 102, 96, 118.

Find the following. Round your answer to the nearest tenth.

a) Mean

b) Median

c) Mode

Solution

Before beginning, arrange the numbers in order: 96, 96, 102, 107, 118, 118.

a) To find the **mean**, first calculate the sum of the numbers.

96 + 96 + 102 + 107 + 118 + 118 = 637

Since there are six numbers in the set, divide the sum of the numbers in the set by six.

$$\frac{637}{6} = 106.2 \text{ (rounded to one decimal place)}$$

The mean of this set of numbers is 106.2.

b) To find the **median**, look at the arrangement of the numbers in order from smallest to largest.

96, 96, 102, 107, 118, 118

Since there is an even number of numbers, find the mean of the two middle numbers.

$$\text{The mean of 102 and 107} = \frac{(102 + 107)}{2} = 104.5$$

The median of this set of numbers is 104.5.

c) To find the **mode**, look for the number that appears most frequently. In this case, the numbers 96 and 118 both appear twice. Therefore, the numbers 96 and 118 are both modes.

Example 5

A Grade 12 class with 15 students was polled to determine the number of television sets they had in their homes. These are the results the students provided:

3, 4, 1, 3, 2, 2, 1, 1, 4, 5, 8, 3, 2, 7, 4

After the results were in, one of the students stated the median of the set of data was 1.

a) What error did the student make?

b) What is the actual median of this set of data?

c) What is the mean of this set of data?

d) What is the mode of this set of data?

Solution

a) This student did not put these numbers in numerical order before they calculated the median.

b) To find the median, put the numbers in numerical order.

1, 1, 1, 2, 2, 2, 3, **3**, 3, 4, 4, 4, 5, 7, 8

The median of this set of data is 3.

c) The mean $= \dfrac{1+1+1+2+2+2+3+3+3+4+4+4+5+7+8}{15}$

$= \dfrac{50}{15} = 3.3$

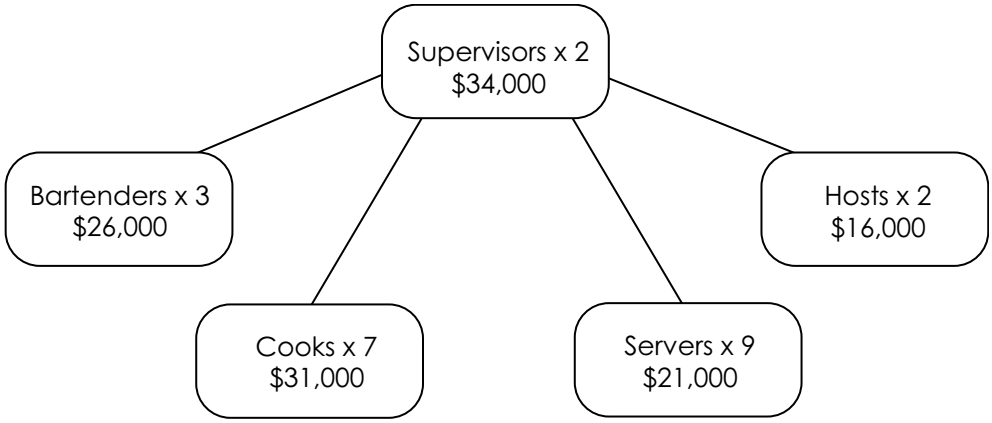
d) 1, 2, 3, and 4 both appear three times. Therefore, the modes of this set of data are 1, 2, 3, and 4.

The mean, median, and mode are all measures of central tendency for this data, but they measure different patterns in the data, and the answers are not the same. It is therefore important for you to remember the definitions of these terms so that you interpret the information correctly. Consider the following example.

Example 6

In a small restaurant, the employees are trying to convince their manager that they need a raise.

The following diagram displays the salaries for each position.



One employee states that the mean salary of all employees is $21,000. Another employee believes that the mean salary of all employees is $26,000. A further employee disagrees and states that the mean salary of all employees is $25,391.30.

a) Which employee is correct?

b) What mistakes did the other two employees make?

c) Which measure of central tendency should the employees use to signify that they need a raise? Explain.

Solution

a) The third employee is correct.

The mean salary of all employees

$$= \frac{(2 \times 34,000) + (3 \times 26,000) + (7 \times 31,000) + (9 \times 21,000) + (2 \times 16,000)}{2 + 3 + 7 + 9 + 2}$$

$$= \frac{584,000}{23} = \$25,391.30$$

b) The first employee found the mode instead of the mean. $21,000 is the salary that appears most often and is therefore the mode.

The second employee found the median instead of the mean.

To find the median, you need to put all the instances of each salary in numerical order. $16,000 appears twice. $21,000 appears nine times. $26,000 appears three times. $31,000 appears seven times. $34,000 appears twice.

$16,000, $16,000, $21,000, $21,000, $21,000, $21,000, $21,000, $21,000, $21,000, $21,000, $21,000, $26,000, $26,000, $26,000, $31,000, $31,000, $31,000, $31,000, $31,000, $31,000, $31,000, $34,000, $34,000.

Therefore, the middle number in this set of numbers, or the median, is $26,000.

c) In order to make their point, the employees may decide to use the mode. The mode is a lower value, which portrays the fact that the employees' salaries are extremely low and therefore they need a raise. The mode might not be the best measure of the centre of the data in this case; however, it does suit the needs of the employees.

As you can see, you need to be careful when you calculate the mean, median, and mode of a set of data. Be sure to practise what you have learned in the following learning activity before continuing on to the next lesson.

Learning Activity 7.1

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. What is the median of the following list of numbers? 4, 5, 7, 9, 10, 12
2. Evaluate: $12 + 3 - 5 + 3 + 53$
3. Which two terms are the same? $6, 4, \frac{18}{6}, \frac{18}{3}, \frac{18}{2}, \frac{8}{3}$
4. Beth spends 60% of her monthly income on household expenses including groceries. Of her remaining income, she puts 50% into savings. If Beth's monthly income is $3400, how much money does she have left after groceries and savings?
5. What is one-half of $\frac{1}{7}$?

continued

Learning Activity 7.1 (continued)

Part B: Mean, Median, Mode, and Mistakes

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Find the mean, median, and mode for each set of data. Round your answer to the nearest tenth where necessary.

   a) 8, 10, 23, 10, 14, 16, 19

   b) 6, 3, 8, 6, 17, 8

   c) 9, 13, 7, 2, 18

   d) 3, 4, 6, 6, 10, 16

2. Mark Goode receives the following marks on four mathematics tests:

   78, 75, 82, 74

   What is the lowest mark that Mark can receive on his fifth test in order for the mean of his test marks to be at least 80?

3. Which of the three measures of central tendency is most suitable to describe the following sets of data?

   a) The typical annual rainfall in Brandon

   b) The most common size of T-shirt sold at a fundraiser

   c) The usual number of pages in a particular magazine

   d) The average mark of a student in a course

4. Ava Redge has a mean mark of 50% on her first three math tests. She receives a mark of 70% on her fourth test. Since the mean of 50 and 70 is 60, Ava states that her new mean mark in math is 60. Is her reasoning correct? Explain.

5. If a random sample of 50 people produces a mean income of $36,000, would a random sample of 100 people produce a mean income of $72,000? Explain.

6. In one month, Ian Mead buys two lunches at $10.95 each, five lunches at $11.75 each, and one lunch at $12.25. Find the mean, median, and mode for the amount that Ian spends per lunch during the month.

continued

Learning Activity 7.1 (continued)

7. A sales department is made up of three divisions. The annual salary for each employee of a division is the same and is indicated in the following table.

Division	Number of Employees	Annual Salary of Each Employee
A	3	$52,000
B	25	$34,000
C	5	$28,000

a) Explain why the mean annual income of all the employees cannot be found by adding the numbers in the third column and dividing by three.

b) Find the mean annual income of all the employees.

Lesson Summary

In this lesson, you reviewed three measures of central tendency. These measures of central tendency include the mean, median, and mode. You also recognized errors in calculations involving the mean, median, and mode. Recognizing others' mistakes helps you not to make those same mistakes.

In the next lesson, you will be introduced to outliers. Outliers are specific values in a data set that may present misleading answers when you calculate measures of central tendency.

Lesson 2: Outliers in Data

Lesson Focus

In this lesson, you will

- ❑ identify outliers and justify their removal from a data set
- ❑ discover the effect of outliers on the mean, median, and mode
- ❑ calculate a trimmed mean

Lesson Introduction

Imagine that there are 11 people in a room. One person earns a salary of one million dollars each year, and the other 10 earn teachers' salaries. If you were asked to find the mean salary of the people in this room, what do you think this value would be? Would this value be greater than or less than the salaries of the teachers?

The mean salary would be significantly greater than what each teacher earns. This is because the millionaire earns significantly more money than each teacher. Because of this, the mean salary is extremely high and does not accurately represent the typical salary of all the people in the room.

In the previous lesson, you reviewed three measures of central tendency, including the mean, median, and mode. One factor that can influence these measures of central tendency is an outlier. In the example above, the million-dollar salary is the outlier. In this lesson, you will identify outliers and discover how they can affect calculations of central tendency, as in the example above.

Outliers

Outliers are numbers that are widely separated from the other numbers in the set.

Include this definition on your resource sheet.

5, 6, 9, 4, 7, (52) → 52 is the outlier in this data set

In the image above, 52 is identified as the outlier. The number 52 is significantly different than the other numbers in the set.

The Effect of Outliers on the Mean, Median, and Mode

As outliers are widely separated from the rest of the data, they may affect the mean, median, and the mode. Consider the following example.

Example 1

Suppose that you want to determine the price of a house in the Charleswood area of Winnipeg. You randomly select the prices of 10 houses. The prices are as follows:

$255,900, $1,799,900, $278,900, $399,900, $284,900, $389,900, $429,900, $364,600, $209,500, $331,700

a) Find the mean.

b) Find the median.

c) Find the mode.

d) Identify the outlier.

e) Which measure of central tendency would best describe the typical house price in Charleswood if you include the outlier in your calculations?

f) Suppose you delete the outlier from this set of data. Calculate the new mean, median, and mode.

Solution

a) The mean:

$$= \frac{255,900 + 1,799,900 + 278,900 + 399,900 + 284,900 + 389,900 + 429,900 + 364,600 + 209,500 + 331,700}{10}$$

$$= \frac{4,745,100}{10} = \$474,510$$

b) To find the median, first put the values in the set of data in order.

$209,500, $255,900, $278,900, $284,900, $331,700, $364,600, $389,900, $399,900, $429,900, $1,799,900

As there is an even number of values in this set (10), find the mean of the two middle values. The median: $\frac{331,700 + 364,600}{2} = \$348,150$

c) No value appears more than once. Therefore, there is no mode.

d) $1,799,900 is the outlier. This value is significantly greater than the other house prices in the Charleswood area.

e) The median would best describe the typical home price in Charleswood. The mean house price is too high, as it is greater than the majority (9 out of 10) of the home prices.

f) The new data set without the outlier is:

$209,500, $255,900, $278,900, $284,900, $331,700, $364,600, $389,900, $399,900, $429,900

The mean:

$$= \frac{255,900 + 278,900 + 399,900 + 284,900 + 389,900 + 429,900 + 364,600 + 209,500 + 331,700}{9}$$

$$= \frac{2,945,200}{9} = \$327,244.44$$

The median = $331,700

There is no mode.

From this example, you can see how outliers affect measures of central tendency. In this example, the house priced at $1,799,900 affects these three measures of central tendency differently. The mean calculated with the outlier ($474,510) is significantly greater than the mean calculated without the outlier ($327,244.44). However, the median calculated with the outlier ($348,150) is very similar to the median calculated without the outlier ($331,700). The mode stays exactly the same in both situations.

Effect of outliers on the mean: If there are one or more outliers in a set of data, then the mean will be strongly affected by these outliers. If the outliers are significantly greater than the rest of the data, then the mean will be higher. If the outliers are significantly smaller than the rest of the data, the mean will be lower.

Effect of outliers on the median: Outliers can affect the median. However, the median will still remain relatively unchanged even if there are a few outliers.

Effect of outliers on the mode: Unless two or more of the outliers are the exact same value, the outliers will have no effect at all on the mode. However, if two or more outliers are the exact same value, these outlier values may be the mode, depending on the other data values.

Include these descriptions on your resource sheet.

Outliers affect the mean, median, and mode differently. This is because these three measures of central tendency are calculated differently. Consider the following example.

Example 2

Juanita received the following pledge amounts when she participated in a Cure Cancer Walk: $10, $20, $5, $12, $5, $8, $5, $70, $5.

Which measure of central tendency best represents the pledge amounts that Juanita received?

Solution

Mean: $\frac{10 + 20 + 5 + 12 + 5 + 8 + 5 + 70 + 5}{9} = \$15.56$

Median: 5, 5, 5, 5, 8, 10, 12, 20, 70

The median is 8.

Mode: $5

The median best represents the pledge amounts. The mean, $15.56, is too high, as it is affected by the outlier of $70. The mode, $5, is too low and therefore suggests the pledges are lower than they actually are.

Justifying the Removal of Outliers

As you can see, outliers can affect the mean, median, and mode. To lessen the effect that outliers have on these measures of central tendency, two things can be done. First, you can simply remove the outliers and then calculate the mean, median, and mode. Secondly, you can calculate the trimmed mean.

Removing Outliers

Example 1 dealt with house prices. Most of the house prices were between $200,000 and $400,000. However, there was one outlier house price of over $1,700,000. This outlier house price caused the mean house price of the houses in Charleswood to be around $470,000. However, if someone were to say that the mean house price in Charleswood was around $470,000, this would be misleading. The majority of houses in Charleswood are under this price. Therefore, the outlier value can be removed in this case.

This is not the same as saying that the $1,799,000 home does not exist. However, removing this outlier implies that this value should not be considered when describing the typical house price.

Another instance where outliers can be removed is in Olympic scores. In some Olympic sports, the highest and lowest scores for a particular sport are deleted. Consider the following example.

Example 3

Jennifer, a Canadian Olympic athlete, participates in the women's mogul competition, which is a form of freestyle skiing. The mogul competition is judged based on turns, air, and speed. In this example, you will focus on calculating Jennifer's marks for the "turns" component. In the Olympic mogul event, five judges score Jennifer's turns. Each judge gives Jennifer a score out of five. The highest score and the lowest score are omitted. The three middle scores are then added for a score out of 15.

a) Jennifer's five scores are 4.2, 5.0, 4.9, 3.0, and 4.6. Find Jennifer's score out of 15.

b) Why do you believe the highest and lowest scores are deleted in this calculation?

Solution

a) Deleting Jennifer's highest and lowest scores leaves the middle three scores: 4.2, 4.9, 4.6.

Adding these scores together gives a score of 13.7 out of a possible 15.

b) The highest and lowest scores are deleted, as they may be outliers. Some judge may have given Jennifer a low score in order to give an athlete from the judge's own country an advantage. Another judge may be Canadian and thus give Jennifer a high score in order to help her win.

All of Jennifer's scores seem to be fairly high. However, one judge only gave her a 3.0. This value is clearly not representative of Jennifer's abilities, as all the other judges gave her significantly higher scores. Therefore, in an Olympic competition, where scores can be extremely close, eliminating biases and outliers is very important in order to get the best possible score of each competitor.

As you can see, justifying the removal of outliers can be a complicated process. However, another method of removing outliers, called the trimmed mean, is usually less complicated and easier to calculate.

The Trimmed Mean

From the first two examples in this lesson, you may have noticed that the mean is the measure of central tendency that is most affected by outliers. To help lessen the effect of outliers on the mean, the trimmed mean is used. The **trimmed mean** is a measure of central tendency that ignores outliers in the calculation of the mean.

The trimmed mean is calculated the same way you calculate an ordinary mean. However, a certain percentage of the extreme values are omitted. If you continue on in your study of statistics, different percentages may be used, such as the 20% or even the 25% trimmed mean. In this course, you are going to be calculating a 10% trimmed mean.

To calculate the 10% trimmed mean, the lowest 5% and the highest 5% of the data values are excluded from this calculation. Overall, 10% of the most extreme data—5% on either side—is excluded from the calculation of the trimmed mean.

Include the definition of the trimmed mean and the explanation of how to calculate the trimmed mean on your resource sheet.

Example 4

The manager of the Manitoba Ski Hill rental shop collects data on how many snowboards were rented during the 20 Saturdays of winter. The numbers of snowboards rented each Saturday were as follows:

100, 99, 32, 87, 89, 74, 76, 95, 53, 69, 80, 91, 105, 156, 109, 93, 83, 92, 82, 94.

Calculate the 10% trimmed mean.

Solution

10% of 20 = 20 × 0.1 = 2

5% of 20 = 20 × 0.5 = 1

Therefore, you need to omit two numbers. You need to omit the highest number and the lowest number. Before you omit these numbers, you need to put the numbers in order.

32, 53, 69, 74, 76, 80, 82, 83, 87, 89, 91, 92, 93, 94, 95, 99, 100, 105, 109, 156

The lowest number is 32 and the highest number is 156. Omitting both of these numbers gives a new data set of 18 numbers.

53, 69, 74, 76, 80, 82, 83, 87, 89, 91, 92, 93, 94, 95, 99, 100, 105, 109

Trimmed mean:

$$= \frac{53 + 69 + 74 + 76 + 80 + 82 + 83 + 87 + 89 + 91 + 92 + 93 + 94 + 95 + 99 + 100 + 105 + 109}{18}$$

$$= \frac{1571}{18} = 87.3$$

The trimmed mean has the advantage of being resistant to outliers. However, if there is a significant number of outliers, such as more than 5% in a given direction, these outliers can still skew the trimmed mean. If there are a small number of outliers, such as less than 5% in a given direction, then outliers will be omitted in the calculation of the trimmed mean.

You have now learned all about outliers! Use the following learning activity to practise doing calculations that involve outliers. Check your answers in the Module 7 Answer Key before you complete the following assignment.

Learning Activity 7.2

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Estimate the product: 39.2 × 78.9
2. Complete the pattern: 7, 5, 3, 1, −1, _____ , _____
3. What is the total cost of a lunch if the sandwich costs $4.95, a salad costs $5.65, and a drink costs $2.50?
4. A manager at a community centre wants to supply hot dogs as a treat for the members. The manager estimates that 120 people will attend and eat three hotdogs each. How many hotdogs does the community centre need to prepare?
5. You are buying a new fall wardrobe. You want to purchase five pairs of $50 jeans, two $30 sweaters, and seven $25 shirts. How much will you spend on your fall wardrobe (excluding tax)?

continued

Part B: Outliers and Their Effect on Data

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Maddox wants to run the 100 m race at his school's track event. To find his typical race time, his physical education teacher is deciding whether or not to use the mean or the trimmed mean. Over the course of a month, Maddox has run 20 races to determine if he will qualify for the track team. Maddox's race times are all measured in seconds and are as follows:

   12.37, 12.46, 12.45, 13.64, 13.25, 11.99, 12.00, 13.75, 12.75, 12.73, 12.27, 12.61, 13.51, 12.63, 12.84, 11.67, 11.95, 12.52, 12.63, 13.52

   a) Find the mean of Maddox's race times.

   b) Find the 10% trimmed mean of Maddox's race times.

   c) Which value should the physical education teacher use to determine whether Maddox makes the track team? Explain.

2. Find the outliers for the following data sets. State the new data sets after removing these outliers.

   a) 5, 8, 10, 13, 7, 9, 66

   b) 12, 14, 16, 15, 14, 43, 12, 18, 9, 13, 11, 23

3. State a sample set of data where outliers affect the following measures of central tendency.

   a) The mean

   b) The mode

4. A billionaire is in a room with 10 farm workers. Assume the billionaire's yearly income is $40,000,000. Assume that the 10 farm workers each earn a yearly income of approximately $30,000.

   a) What is the mean income of all the people in the room?

   b) Is the billionaire's income classified as an outlier?

   c) How does the outlier affect the mean income? Is the mean income an accurate representation of the typical income in the room?

   d) Which measure of central tendency would be the best representative of the typical income in the room?

continued

Learning Activity 7.2 (continued)

5. Sheila was trying to find the 10% trimmed mean of the following data set:

   4, 7, 3, 8, 12, 34, 23, 41, 73, 46, 14, 94, 25, 73, 25, 63, 24, 46, 52, 48.

   She thought the 10% trimmed mean was $\frac{618}{20}$.

   a) What was Sheila's mistake?

   b) What is the actual 10% trimmed mean?

Lesson Summary

You have now studied and completed practice questions involving outliers. You have learned what outliers are, how to find them, when to remove them from data, and how to calculate means, including trimmed means, that are not affected by outliers. In the next lesson, you will study another type of mean: the weighted mean.

It is now time to complete Assignment 7.1. If any material seems challenging to you, be sure to ask your tutor/marker or learning partner for help. Also, make sure your resource sheet is up to date with all definitions and sample solutions for some of the more difficult questions.

Notes

Assignment 7.1

Mean, Median, Mode, and Outliers

Total: 34 marks

1. Consider the following set of numbers:

   12, 34, 30, 16, 23, 18, 23, 28.

   a) Alia is trying to determine the median. She believes the median is 19.5. What mistake did Alia make when calculating the median? *(1 mark)*

   b) Calculate the mean, median, and mode. *(3 marks)*

   c) What is true about the mean, median, and mode for this set of numbers? Why is this the case? *(1 mark)*

continued

Assignment 7.1: Mean, Median, Mode, and Outliers (continued)

2. A Grade 12 class with 20 students did a survey on how many doughnuts each student usually ate each week. These were their results:

   0, 1, 4, 5, 0, 3, 2, 5, 1, 5, 2, 0, 4, 2, 4, 1, 4, 5, 8, 2

   a) Calculate the mean. *(1 mark)*

   b) Calculate the 10% trimmed mean. *(2 marks)*

   c) If these values are different, explain why. If these values are similar, explain why. *(1 mark)*

continued

Assignment 7.1: Mean, Median, Mode, and Outliers (continued)

3. Consider the following statistics for an NHL hockey team. The mean salary for 37 players on a NHL hockey team is $1,990,000. However, 65% of players have a smaller salary than the mean salary. The mode salary is $500,000 and the median salary is $950,000. The lowest salary is $420,000 and the highest salary is $7,000,000.

   a) If the mean, median, and mode are all measures of central tendency, why are they significantly different values? *(1 mark)*

   b) As the $7,000,000 salary is an outlier, what effect does this have on the mean? *(1 mark)*

   c) What statistic should this hockey team provide to the media to represent its typical salary value? Explain. *(1 mark)*

continued

Assignment 7.1: Mean, Median, Mode, and Outliers (continued)

4. Your monthly cell phone bill was $42 for 11 months. After these 11 months, you decide to add unlimited texting to your contract. Therefore, your monthly phone bill increased to $53 for the next nine months. What are the mean, median, and mode prices of your cell phone bill? *(3 marks)*

5. Find the mean, median, and mode of the following data sets. *(6 marks)*
   a) 12, 20, 18, 15, 10, 12

   b) 48, 32, 67, 47, 95, 89, 888, 1

continued

Assignment 7.1: Mean, Median, Mode, and Outliers (continued)

6. A production company has 50 employees that work on the shop floor. Overseeing these 50 employees is one manager. Each of the 50 employees earns an annual salary of $43,250. The manager earns an annual salary of $356,900.

   a) In this situation, is the manager's salary an outlier value? *(1 mark)*

   b) Calculate the mean salary of the employees at this production company including the manager's salary. *(1 mark)*

   c) Calculate the mean salary of the employees at this production company, not including the manager's salary. *(1 mark)*

   d) Would you include the manager's salary in a calculation of the mean salary of the people at this production company? Why or why not? *(2 marks)*

continued

Assignment 7.1: Mean, Median, Mode, and Outliers (continued)

7. The heights of six members of a basketball team are as follows:

   174 cm, 183 cm, 185 cm, 190 cm, 170 cm, 183 cm

   a) Calculate the mean, median, and mode of the heights. *(3 marks)*

   b) If a player who is 204 cm tall joins the team, calculate the new mean, median, and mode. *(3 marks)*

   c) Which measure of central tendency is most affected by the new data? Explain. Use the concept of outliers in your explanation. *(2 marks)*

Lesson 3: Weighted Mean

Lesson Focus

In this lesson, you will

- ❑ calculate the weighted mean of a data set
- ❑ earn why some data in a set are given different weightings

Lesson Introduction

Have you ever wondered how your course marks are calculated and why each examination, assignment, or test is worth a different percentage? Have you ever wondered how students calculate their grade point averages (GPAs) in university or college? These are all examples of another measure of central tendency that you will explore in this lesson.

You have already studied the mean and the trimmed mean. There is another type of mean called the weighted mean. Weighted means are the fifth and final measure of central tendency that you will study in this course.

Weighted means have many applications, such as those mentioned above. Weighted means also have applications in statistics, such as population studies. In this lesson, you will be looking at some of these population studies, such as the census done by Statistics Canada. This will demonstrate how weighted means are used in real-life situations.

The Weighted Mean

The weighted mean is similar to the mean. However, instead of each of the data points contributing equally to the final value, some data contributes more and some data contributes less. Each data value has a weight assigned to it. Data values with larger weights contribute more to the weighted mean. Data values with smaller weights contribute less to the weighted mean. If the weights are all equal, then the weighted mean is the same as the regular mean. Overall, the weighted mean allows for a more accurate description of certain types of statistics.

Why Do You Need the Weighted Mean?

Suppose you have the option of taking one of the following two science classes.

a) In one science class, the teacher tells you that the final examination is worth 75%, assignments are worth 5%, and one test is worth 20%.

b) In the second science class, the teacher tells you that the final examination is worth 33.4%, assignments are worth 33.3%, and three tests are worth a total of 33.3%.

Which science class would you take?

Why would you take that science class?

You probably chose your science class based on how much each graded item (such as the examination, assignments, or tests) was worth, as you had no other information on which to base your decision.

In this example, the weighted mean would be the final mark you receive in either science class. If you chose the first science class, your mark would be mostly based on how well you did on your final examination. If you chose the second science class, your mark would be based equally on how well you did on the assignments, unit tests, and the final examination.

In each science class, the teachers have their own reasons for assigning the percentages the way they do. The first teacher may believe that examinations are the most important part of the evaluation because students need to know how to work under pressure, or because students need time to learn everything and an examination at the end of the course allows them to put together the topics from throughout the year. The second teacher may believe that everything should be weighted equally so that you do not feel so pressured to do very well on one item.

The weighted mean is useful in situations like these where not every part of a data set (such as the assignment, examination, or test marks) contributes equally to the mean.

Calculating the Weighted Mean

To calculate the weighted mean, you need to use the **weighted mean formula**. This formula is a lot easier to use than it looks; the procedure is outlined in the following steps. Include the weighted mean formula and the steps to find the weighted mean on your resource sheet.

Weighted Mean Formula: $\frac{\sum(x \times w)}{\sum w}$

Where: w = the weight of each type of item

x = the individual data value (or mark)

$\sum$ is the symbol for *sum*.

Steps to find the weighted mean:

1. Multiply each individual data value by its weight.
2. Add the answers you found in Step 1. This answer is the numerator of the weighted mean formula.
3. Add the weights of each type of item. This answer is the denominator of the weighted mean formula.
4. Divide the answer you found in Step 2 (the numerator) by the answer you found in Step 3 (the denominator). This is the weighted mean.

These steps may be confusing. The following example shows the procedure for each step.

Example 1

You want to determine your final mark in Grade 12 Essential Mathematics. Assignments are worth 75%, the midterm examination is worth 12.5%, and the final examination is worth 12.5%. You have received a mean mark of 76 on all of your assignments. You have also received a mark of 68 on your midterm examination. You estimate that you will receive a mark of 80 on your final examination. What will be your final mark?

Solution

If the mean were not weighted, you could simply add up the three marks you received (76, 68, and 80), and then divide by three. However, since the mean is weighted and each mark is worth a different percentage of your final mark, you may find it useful to set up the following chart in order to find the weighted mean.

Item	Value (x)	Weight (w)

First, fill in each item that determines what your final mark will be.

Item	Value (x)	Weight (w)
Assignments		
Midterm Examination		
Final Examination		

Second, fill in the value (or mark) that you received for each item.

Item	Value (x)	Weight (w)
Assignments	76	
Midterm Examination	68	
Final Examination	80	

Third, fill in the weight of each item, or how much each item is worth. The weights are written in decimal form.

Item	Value (x)	Weight (w)
Assignments	76	0.75
Midterm Examination	68	0.125
Final Examination	80	0.125

Now, you can use the weighted mean formula.

1. Multiply each individual value by its weight.

   $76 \times 0.75 = 57$

   $68 \times 0.125 = 8.5$

   $80 \times 0.125 = 10$

2. Add each of the values you found in Step 1. This is the numerator of the weighted mean formula.

   $57 + 8.5 + 10 = 75.5$

3. Add the weight of each individual value. This is the denominator of the weighted mean formula.

   $0.75 + 0.125 + 0.125 = 1$

4. Divide the value you found for the numerator by the value you found for the denominator.

   $$\frac{75.5}{1} = 75.5$$

Therefore, in this example, your final mark will be 75.5%.

Example 2

The teachers of two Grade 12 English classes at Vincent Massey High School want to find the mean final examination score for both classes. The first class has 24 students and its mean final examination score was 62%. The second class has 30 students and its mean final examination score was 78%. What is the mean final examination score of both classes?

Solution

You may be tempted to just add 78 and 62 together, and then divide by two to find the mean final examination score. However, these classes do not have equal weights, as there is not the same number of students in each class. Therefore, you can use the weighted mean to solve this question.

This solution could be done just like problems in the previous lesson by writing a list with 62 twenty-five times and 78 thirty times, and finding the mean by dividing by the total number of students.

The following solution shows the same thing using the weighted mean formula.

Setting up the tables gives you the following:

Item	Value (x)	Weight (w)
Class 1	62	24
Class 2	78	30

In this table, the weight refers to the number of students in each class. The value refers to the mean final examination score each class received.

To calculate the weighted mean, first multiply each value by its weight.

$62 \times 24 = 1488$

$78 \times 30 = 2340$

Add these two values:

$1488 + 2340 = 3828$

Add the weights:

$24 + 30 = 54$

Divide the numerator by the denominator:

$$\text{Mean: } \frac{3828}{54} = 70.89$$

Therefore, the weighted mean of the final examination score for both classes is 70.89%.

Where Do You Use the Weighted Mean?

In the lesson introduction, you read that the weighted mean is used in school (to calculate marks) and in population studies. The weighted mean is also used in the following situations:

- When each individual data value represents multiple people. This is demonstrated in Example 2.
- When a sample over-represents or under-represents certain parts of the population. To restore balance, the weighted mean is used. For example, you may have conducted a survey of Winnipeggers but accidently surveyed more males than females. The weighted mean can help you to correct this by giving different weights to the male and female populations you surveyed.
- When some values in your data are less accurate. These less accurate values are given lower weightings. For example, if experts are rating a new vehicle model, one expert might have less experience. Therefore, you would give that expert's rating less weight in the overall rating of the new vehicle model.
- If you have values that appear multiple times. In this situation, calculating the weighted mean is sometimes a faster way of calculating the mean. Example 3 deals with this situation.

Example 3

Fifty students taking Grade 12 Essential Mathematics were asked how many hours they spend studying for an examination. Twenty students said they spend six hours studying; 13 students said they spend four hours studying; 9 students said they spend two hours studying; and 8 students said they spend no time studying at all. Calculate the mean time that these students spend studying.

Solution

To find the mean, you could make a list of the number of hours each student spent studying and then divide that answer by 50, the total number of students.

To use the weighted mean, set up the following chart.

Item	Value (x)	Weight (w)
0 Hours Studying	0	8
2 Hours Studying	2	9
4 Hours Studying	4	13
6 Hours Studying	6	20

The value refers to the number of hours each student usually spends studying. The weight refers to the number of students that spend the specified amount of time studying.

To calculate the weighted mean, first multiply each value by its weight.

$0 \times 8 = 0$

$2 \times 9 = 18$

$4 \times 13 = 52$

$6 \times 20 = 120$

Add these four numbers to find the numerator:

$0 + 18 + 52 + 120 = 190$

Add the weights to find the denominator:

$8 + 9 + 13 + 20 = 50$

Divide the numerator by the denominator to find the weighted mean:

$$\text{Mean: } \frac{190}{50} = 3.8$$

Therefore, most students spend around 3.8 hours studying for an examination.

Analyzing the Weighted Mean

The weighted mean is helpful to avoid misrepresentation of data. Consider the following example.

Example 4

The following chart displays the percentage of people from Manitoba and Quebec who speak the English or French language most often at home as of 2006.

This information is also available online at www40.statcan.ca/l01/cst01/demo61b-eng.htm.

	Manitoba	Quebec
English	87.27%	10.01%
French	1.72%	81.06%

a) One statistician claims that 48.64% of people from Manitoba and Quebec speak the English language most at home. Note that 48.64% is the mean of 87.27% and 10.01%. Is this necessarily true?

b) In 2006, Manitoba had a population of 1,133,515 people, and Quebec had a population of 7,435,905. Calculate the weighted mean of people who speak the English language most at home in Manitoba and Quebec.

c) How might the media use statistics such as the mean instead of the weighted mean to misrepresent this data?

Solution

a) No, this is not necessarily true. If Manitoba and Quebec had the same population, then this would be true. However, Manitoba and Quebec have significantly different populations.

b)

	Value	Weight
Manitoba	87.27%	1,133,515
Quebec	10.01%	7,435,905

Multiple each value by its weight:

$87.27 \times 1{,}133{,}515 = 98{,}921{,}854.1$

$10.01 \times 7{,}435{,}905 = 74{,}433{,}409.1$

Add these two answers to get the numerator:

$98{,}921{,}854.1 + 74{,}433{,}409.1 = 173{,}355{,}263.2$

In this example, the weight refers to the population of either province. Therefore, to find the denominator, you add the populations from each province together:

$1{,}133{,}515 + 7{,}435{,}905 = 8{,}569{,}420$

Divide the numerator by the denominator:

$$\frac{173{,}355{,}263.2}{8{,}569{,}420} = 20.2\%$$

Therefore, 20.2% of the people who live in Manitoba and Quebec speak mostly the English language while at home.

c) If the media wanted to portray that many people from Manitoba and Quebec speak mostly English at home, they would use the mean instead of the weighted mean. The answer then is 48.64% instead of the actual value, being the weighted mean, which is 20.2%. The media could also use the weighted mean to portray that few people speak mainly English at home in Manitoba and Quebec. If people are unaware of the population difference between the two, then they might be influenced to believe that many people do not speak mostly English at home, which isn't necessarily true for Manitoba.

You have now learned when and how to use a weighted mean. Use the following learning activity to practise doing problems involving weighted means, as this may be a difficult concept for some students.

Learning Activity 7.3

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. What is the lowest common multiple of 6 and 8?
2. Evaluate: 3^4
3. How many millimetres are in 14.1 m?
4. In a standard deck of 52 cards, what is the probability that you will draw a red card?
5. Evaluate: $\frac{1}{2} - \frac{9}{32}$

continued

Learning Activity 7.3 (continued)

Part B: Finding the Weighted Mean

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. In one high school psychology class, the marks are weighted as follows:

   Test 1 = 15%

   Test 2 = 25%

   Test 3 = 10%

   Assignments = 20%

   Participation = 5%

   Final Examination = 25%

   Janie received marks of 80, 73, 69, 83, 100, and 65 respectively.

   Scotty received marks of 79, 84, 73, 52, 97, and 87 respectively.

   a) What is Janie's final mark?

   b) What is Scotty's final mark?

   c) Scotty received lower marks in every item except for two. Why is Scotty's final mark higher than Janie's final mark if Janie did better in more items?

2. Residents from two towns in Manitoba were asked for their IQ scores. Two hundred and fifty people from A-Town reported their IQ scores and the mean IQ score was 120. One hundred people from B-Town reported their IQ scores and the mean IQ score was 90.

   a) What is the mean IQ of all the residents of both towns?

   b) Is the weighted mean IQ closer to the IQ of A-Town or B-Town? Why do you think this is?

continued

Learning Activity 7.3 (continued)

3. One retail company wants to determine how long its employees have been working for it. It found the following statistics:

   8 people had worked at the company for 1 year.

   5 people had worked at the company for 2 years.

   4 people had worked at the company for 3 years.

   7 people had worked at the company for 4 years.

   5 people had worked at the company for 5 years.

   a) Calculate the mean number of years that employees have worked for this company without using the weighted mean.

   b) Calculate the mean number of years that employees have worked for this company by using the weighted mean.

4. In a Brandon high school, chemistry is taught during the fall semester, the spring semester, and summer school. The following chart displays the percentage of students who passed the chemistry course.

Term	Percentage Who Passed
Fall	74%
Winter	80%
Summer	68%

   a) Someone calculated the mean of the three percentages and stated that 74% of the students who took this course passed. Is this statement necessarily accurate? Why or why not?

   b) If 700 people took this course in the fall, 500 people took this course in the winter, and 100 people took this course in the summer, what percent of the students who took this course passed?

continued

Learning Activity 7.3 (continued)

5. Celine just received her marks for her first year in university. Celine now wants to know what her grade-point average (GPA), or weighted mean, is. Celine received the following marks in each course:

   History: C

   Calculus: B

   Intro to English: A

   Chemistry: B

   Physics: C

   Spanish: A

   Celine knows that the value of each letter grade is as follows:

   A = 4 points per year-long course

   B = 3 points per year-long course

   C = 2 points per year-long course

   D = 1 point per year-long course

   All courses are full-credit courses, except for Spanish. In Celine's school, Spanish is only a half-credit course.

   a) Calculate Celine's weighted mean (GPA). Justify the weightings you used for the course length.

   b) What letter grade is Celine's GPA close to?

   c) Why should a half course receive a smaller weight than a full course in GPA calculations?

6. Consider the following table that displays the average earnings of Manitobans as related to their highest level of schooling. Note that the word *average* is used instead of the word *mean*.

	Manitoba (2005) ($)
Average—Highest certificate, diploma, or degree	**$31,320**
Certificate or diploma below bachelor level	$27,509
University certificate or degree	$51,977
Bachelor's degree	$45,804
University certificate, diploma, or degree above bachelor level	$64,403

Source: Statistics Canada.

continued

Learning Activity 7.3 (continued)

a) If there were the same number of people in the following three categories, what would be the mean earnings of this group?
   - Certificate or diploma below bachelor level
   - Bachelor's degree
   - University certificate, diploma, or degree above bachelor level

b) Why is the total average earnings in Manitoba not the same as the value you found in (a)? What can you determine about the number of people holding each level of education?

c) Why do you think Statistics Canada used the word *average* instead of the word *mean* in this study?

Be sure to check your answers in the Module 7 Answer Key. If you still have trouble calculating the weighted mean, you may find it useful to copy a difficult example onto your resource sheet. You can expect similar problems to appear on the final examination. You may contact your tutor/marker for additional help as well.

Lesson Summary

You have now studied the weighted mean and discovered where it is used in everyday situations, including the way your grade will be calculated in this course. In the previous lesson, you worked with mean, median, mode, and trimmed mean. All of these measures of central tendency are useful, but they do have some disadvantages. In the next lesson, you will explore the advantages and disadvantages of each measure of central tendency.

Notes

Lesson 4: Advantages and Disadvantages of Using Different Measures of Central Tendency

Lesson Focus

In this lesson, you will

- ❑ look at situations where it is appropriate to use each of the five measures of central tendency
- ❑ look at situations where it is not appropriate to use each of the five measures of central tendency

Lesson Introduction

The golf scores for the first nine holes for Tom and Sam are shown below:

Tom: 3, 4, 4, 3, 5, 15, 4, 3, 4 Total = 45

Sam: 5, 4, 5, 6, 5, 4, 5, 6, 5 Total = 45

Each golfer has a score of 45. Which golfer will likely have a better (lower) score for the next nine holes?

Different measures of central tendency studied in previous lessons can be used to find each golfer's average score per hole, and the answers will sometimes be quite different. Therefore, some of the measures of central tendency are more appropriate to use in certain situations. In other cases, using certain measures of central tendency can be quite misleading.

This lesson will explore when it is best to use each type of central tendency.

Five Measures of Central Tendency

The five measures of central tendency presented in this course include the mean, mode, median, trimmed mean, and the weighted mean.

As you go through this lesson, add the advantages and disadvantages of each measure of central tendency to your resource sheet. You can either copy them directly or write them in your own words.

The Mean

Recall that the mean is the sum of all values in a data set divided by the total number of items in the data set.

Advantages of the Mean

Advantages of the mean include the following:

- The mean is useful for describing data if the data has no outliers. In other words, the data set has no extremely high or extremely low data points compared to the rest of the data.

Disadvantages of the Mean

Disadvantages of the mean include the following:

- The mean often does not represent a typical outcome, as it can be affected by outliers.

The Mode

Recall that the mode of a data set is the number in a data set that occurs most frequently.

Advantages of the Mode

Advantages of the mode include the following:

- Extremely high or extremely low values usually do not affect the mode unless these values are the mode.
- The mode is the item that appears most frequently, which is useful in **nominal data**. Nominal data is data that does not consist of numerical values. Examples of nominal data include the most popular baby names or video games, or the votes during an election.
- The mode is usually quick and easy to find.

Disadvantages of the Mode

Disadvantages of the mode include the following:

- The mode could be very far from the middle of the data and therefore give an inaccurate representation of the data.
- The mode does not exist if no value appears more than once.

The Median

Recall that the median is the middle value of the data set when the values are written in numerical order.

Advantages of the Median

Advantages of the median include the following:

- The median is useful when describing typical or the usual values, such as house prices.
- Outliers have little to no effect on the median.

Disadvantages of the Median

Disadvantages of the median include the following:

- It can be time consuming to arrange all the numbers in a large data set in numerical order before finding the median.
- If the gap between values is either very large or very small, the median can be an inaccurate representation of the data.

Example 1

One hospital did a study to determine the typical age of patients hospitalized by two different viruses. For Virus #1, the median age of patients hospitalized was 30 years. For Virus #2, the median age of patients hospitalized was 70 years.

a) For Virus #1, does the median age of 30 necessarily mean that many adults around the age of 30 had this virus? What other situations could allow for a median age of 30?

b) For Virus #2, what does the median age of 70 imply?

c) What other data should be presented so that a reader of this study will get a more accurate picture of this data?

Solution

a) Even though Virus #1 has a median age of 30, this doesn't necessarily mean that many adults around the age of 30 had this virus. Instead, many young children and many elderly people could have this virus. This situation could also provide a median age of 30.

b) For Virus #2, the median age of 70 implies that many elderly people had this virus. There could still be young children or younger adults with this virus as well; however, most people with this virus were around the age of 70.

c) The mean and mode ages could be presented so that the reader gets a more accurate picture of this data. As there could be large gaps between the ages of people with Virus #1, the median is not necessarily a good indicator of the age of people with this virus.

Example 2

Consider the following list of annual incomes of automotive technicians:

$20,000, $23,000, $42,000, $20,000, $58,000, $35,000, $20,000, $30,000.

a) Calculate the median of these incomes.

b) How many salaries are less than the median? How many salaries are greater than the median? Explain.

c) Calculate the mode of these incomes.

d) How many incomes are less than the mode? How many incomes are greater than the mode? Explain.

e) Calculate the mean of these incomes.

f) How many of the incomes are less than the mean? How many incomes are greater than the mean? Explain.

g) Which of these measures of central tendency best represents the typical income of an automotive technician? Explain.

Solution

a) Order the incomes:

$20,000, $20,000, $20,000, $23,000, $30,000, $35,000, $42,000, $58,000

The mean of the two middle values is: $\frac{23,000 + 30,000}{2} = \$26,500$

b) There are four incomes less than the median and four incomes greater than the median. This occurs because the median lies between the two middle values.

c) The mode is $20,000.

d) No incomes are less than the mode. Five incomes are greater than the mode. This implies that the most people earn the lowest income.

e) The mean:

$$= \frac{20,000 + 20,000 + 20,000 + 23,000 + 30,000 + 35,000 + 42,000 + 58,000}{8}$$

$$= \$31,000$$

f) Five incomes are less than the mean and three incomes are greater than the mean. This is because the 58,000 outlier sways the mean to a larger value.

g) In this situation, the median best represents the typical income of an automotive technician because an equal number of technicians earn either less or more than the median. The mode is too low, as no incomes are less than the mode. Also, the mean is too high because of the outlier value of $58,000.

The 10% Trimmed Mean

Recall that the 10% trimmed mean is the value you get by calculating the mean after removing the lowest 5% and the highest 5% of your data values, which would be the outliers.

Advantages of the Trimmed Mean

Advantages of the trimmed mean include the following:

- The trimmed mean is usually resistant to outliers.
- It is useful for data with skewed values.
- The trimmed mean gives a reasonable estimate of the centre of the data.

Disadvantages of the Trimmed Mean

Disadvantages of the trimmed mean include the following:

- If there are a significant number of outliers, such as more than 5% in a given direction, the calculation of the trimmed mean may still include outliers.

The Weighted Mean

Recall that the weighted mean is similar to the mean, except each item has a different weight. Therefore, each value contributes in different amounts to the weighted mean.

Advantages of the Weighted Mean

Advantages of the weighted mean include the following:

- It is useful when each individual data value represents multiple people.
- It is useful when a sample over-represents or under-represents certain parts of the population.
- It is useful when some values in your data are less accurate.

Disadvantages of the Weighted Mean

Disadvantages of the weighted mean include the following:

- The weighted mean can be biased if arbitrary weights are given to the data.

As you can see, there are advantages and disadvantages with using each of the five measures of central tendency. Because of this, using one measure of central tendency to analyze a particular set of data may be more appropriate than another.

Example 3

Words in the English language vary in length. The shortest words consist of one letter, like the words "a" and "I". The longest word in the Oxford English Dictionary consists of 45 letters and is "pneumonoultramicroscopicsilicovolcanokoniosis."

This information can also be found online at http://www.oxforddictionaries.com/words/what-is-the-longest-english-word.

Consider the following paragraph.

> Statistics is one of the most useful branches of mathematics for daily life. It helps us understand the world around us and organize information in ways that make it easier to comprehend.

a) Calculate the mean, median, and mode of the number of letters in each word.

b) Which measure of central tendency is least appropriate to indicate the length of a typical word in this paragraph? Which measure of central tendency is most appropriate to indicate the length of a typical word in this paragraph?

c) What do all three measures of central tendency tell about the data?

Solution

a) Since there are 154 letters in 32 words, the mean = $\frac{154}{32} = 4.8$

(rounded to the nearest tenth).

Since there are 32 words, the median is the mean of the 16th and 17th values.

Putting the number of letters from each word in order, you get:

2, 2, 2, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 4, 4, 4, 4, 4, 5, 5, 5, 6, 6, 6, 8, 8, 10, 10, 10, 11, 11

Mean of the 16th and 17th value: $\frac{(4 + 4)}{2} = 4$

The mode is the value that occurs most frequently. The mode = 2.

b) The mode is the measure of central tendency least appropriate to represent the typical number of letters in each word in the above paragraph. Either the mean or median would be more appropriate to represent the typical number of letters in each word. You may be of the opinion that the mean is most appropriate, while another student may be of the opinion that the median is most appropriate. It is possible to have differences in opinion when analyzing data. As long as you are able to justify your opinion, it is valid.

c) The mean indicates that the "typical" number of letters in each word is 4.8. The median indicates that half the words have four or fewer letters and the other half have four or more letters. Since the mean is higher than the median, we conclude that there must be some high outliers (some words must have a lot more than four letters). The mode indicates that a word of two letters occurs most frequently. Together, the three measures of central tendency give more insight into the distribution of the data.

Example 4

The following table represents the number of marriages and divorces in Canada by province and territory during 2004, according to Statistics Canada.

Marriages and Divorces by Province and Territory in 2004			
	Marriages	**Divorces**	**Percentage of Divorces to Marriages**
Canada	**146,242**	**69,644**	**47.62%**
Newfoundland and Labrador	2,848	837	29.39%
Prince Edward Island	851	293	34.43%
Nova Scotia	4,609	2,000	43.39%
New Brunswick	3,589	1,415	39.43%
Quebec	21,281	15,999	75.12%
Ontario	62,425	26,374	42.25%
Manitoba	5,706	2,333	40.89%
Saskatchewan	5,050	1,875	37.13%
Alberta	17,457	8,317	47.64%
British Columbia	22,076	10,049	45.52%
Yukon	150	66	44.00%
Northwest Territories	131	71	54.20%
Nunavut	69	15	21.74%

a) Calculate the mean and median of the percentage of divorces to marriages.

b) Identify the outlier. Remove this value from the data set. Calculate the new mean of the percentage of divorces to marriages.

c) Is the mean you found in (a) or the mean you found in (b) the same value as the Canadian percentage of divorces to marriages? Why or why not?

Solution

a) Mean:

$$= \frac{29.39 + 34.43 + 43.39 + 39.43 + 75.12 + 42.25 + 40.89 + 37.13 + 47.64 + 45.52 + 44.00 + 54.20 + 21.74}{13}$$

$$= 42.7\%$$

Ordered Percentages: 21.74, 29.39, 34.43, 37.13, 39.43, 40.89, 42.25, 43.39, 44.00, 45.52, 47.64, 54.20, 75.12

Therefore, the median is the seventh value: 42.25%

b) The only outlier is 75.12. This value is significantly far away from other percentages of divorces to marriages.

If this value is removed, the new data set is: 21.74, 29.39, 34.43, 37.13, 39.43, 40.89, 42.25, 43.39, 44.00, 45.52, 47.64, 54.20.

The new mean:

$$= \frac{29.39 + 34.43 + 43.39 + 39.43 + 42.25 + 40.89 + 37.13 + 47.64 + 45.52 + 44.00 + 54.20 + 21.74}{12}$$

$$= 40.0\%$$

c) The mean is not the same as the Canadian percentage of divorces to marriages. The Canadian percentage of divorces to marriages is 47.62% while the mean is 42.7%. The mean you found in (b), 40%, is not the same as the Canadian percentage of divorces to marriages.

The Canadian percentage of divorces to marriages is calculated by dividing the total number of divorces in Canada by the total number of marriages in Canada. The answer of 47.62% is a weighted average. This is different than the mean, as different provinces and territories have different numbers of marriages and divorces. Therefore, the mean you found in (a) and the mean you found in (b) aren't accurate, as each province and territory contributes differently to the overall Canadian percentage of divorces to marriages.

Learning Activity 7.4

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Evaluate: $5 \times 17 \times 20$
2. You went to the grocery store to pick up a few items. The total came to $21.37. You gave the cashier $40. What should your change be?
3. How many days are in 15 weeks?
4. In the months of November, December, and January, it snowed 14 mm, 60 mm, and 76 mm respectively. What is the mean amount of snow that fell each month?
5. Complete the pattern: 7, 14, 21, 28, _____ , _____

Part B: Finding the Weighted Mean

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Mark Fehr received the following marks on nine mathematics tests:

   80, 74, 72, 71, 25, 68, 71, 50, 80.

   a) Calculate the median of these marks.

   b) How many marks are less than the median? How many marks are greater than the median?

   c) Calculate the mean of these marks.

   d) How many marks are less than the mean? How many marks are greater than the mean?

   e) Calculate the mode(s) of these marks.

continued

f) How many marks are less than the mode(s)? How many marks are greater than the mode(s)?

g) Which measure of central tendency best represents Mark Fehr's typical mark on a mathematics test?

2. Consider the golf scores of two players who play nine holes of golf. Note that Ethan was stuck in a sand trap on the ninth hole.

Hole	1	2	3	4	5	6	7	8	9
Ethan	3	4	5	3	4	4	3	4	15
Caden	5	5	6	4	6	4	4	5	4

a) Calculate the mean, median, and mode of the scores for Ethan.

b) Calculate the mean, median, and mode of the scores for Caden.

c) In your opinion, which player usually has the better score per hole? Explain.

d) In your opinion, which measure of central tendency is the most appropriate to use in this situation?

3. Consider the mean, median, and the mode.

a) Is it possible for the mean, median, and mode of a data set to be the same value? If so, state an example.

b) For some data regarding annual precipitation, the mean, median, and mode are the same. A statistician presents the mode as the measure of central tendency to represent this data, but does not say that the mean, median, and mode are all the same. Would you accept the mode as a usual amount of annual precipitation, or would you question the statistician?

4. The median wait time for a specific surgery in Winnipeg is 13 weeks.

a) What does this wait time of 13 weeks imply?

b) What are some possible interpretations of the median wait time being 13 weeks?

continued

Learning Activity 7.4 (continued)

5. Travis lives in northern Manitoba. His science teacher asks him to conduct an experiment on snow depth. Each day, Travis measures the snow depth in his front yard. At the end of the three-month experiment, his science teacher asks him to report back with one piece of data that displays the typical snow depth in his front yard during these three months.

   Travis found the following data about the snow depth in his front yard:

   Mean = 19.6 cm

   Median = 22.5 cm

   Mode = 5 cm

   10% Trimmed Mean = 19.3 cm

   a) If Travis uses the mean to represent his data, what possible misinterpretations could there be?

   b) If Travis uses the median to represent his data, what possible misinterpretations could there be?

   c) If Travis uses the mode to represent his data, what possible misinterpretations could there be?

   d) If Travis uses the 10% trimmed mean to represent his data, what possible misinterpretations could there be?

Lesson Summary

In this lesson, you studied the advantages and disadvantages of using five different measures of central tendency to represent data in a variety of situations. The measures of central tendency are mean, median, mode, trimmed mean, and weighted mean.

In the next lesson, you will explore how percentiles can be used to compare different sets of data.

It is now time to complete Assignment 7.2. If any material seems challenging to you, be sure to ask your tutor/marker or learning partner for help. Also, make sure your resource sheet is up to date with all definitions and sample solutions for some of the more difficult questions.

Notes

Assignment 7.2

Five Measures of Central Tendency

Total: 46 marks

1. A class has 25 students. On a test, three students received 90%, six students received 80%, 12 students received 70%, three students received 60%, and you received 75%.

   a) Calculate the mean, median, and mode of the student marks. *(4 marks)*

   b) How many students scored lower than the mean? How many students scored higher than the mean? *(1 mark)*

   c) How many students scored lower than the mode? How many students scored higher than the mode? *(1 mark)*

   d) How does your score relate to the mean, median, and mode of the class? *(1 mark)*

   e) Which measure of central tendency best describes the typical mark on this test? *(1 mark)*

continued

Assignment 7.2: Five Measures of Central Tendency (continued)

2. Samita is taking a Grade 12 Law class. The marks are distributed according to the following categories:

   20% Assignments

   10% Class Participation

   15% Test 1

   15% Test 2

   15% Test 3

   25% Examination

   Samita receives the following marks for each category listed respectively:

   76, 68, 78, 84, 58, 83

   a) Calculate Samita's final mark. *(3 marks)*

   b) The teacher is annoyed at the low level of student participation, because discussion and argument are a very important part of this class, and so the weight of the categories is changed as follows:

      5% Assignments

      40% Class Participation

      10% Test 1

      10% Test 2

      10% Test 3

      25% Examination

      Calculate Samita's final mark using this distribution. *(3 marks)*

   c) Does Samita have reason to complain about the change in weighting? Explain. *(2 marks)*

continued

Assignment 7.2: Five Measures of Central Tendency (continued)

3. In the Olympics, gymnastics is scored by judges, and the gymnast with the highest score wins the competition. The following marks were given by 10 judges for each of three gymnasts.

Vanessa	9.4	9.2	9.0	8.7	9.2	9.1	9.4	8.8	9.1	9.2
Hana	8.9	8.8	9.1	9.8	8.2	9.1	9.0	8.7	9.2	9.3
Kaori	9.0	9.2	9.4	8.1	9.0	9.4	9.1	9.2	8.9	9.3

   a) Find the median and mode of each gymnast's scores. *(9 marks)*

   b) The first and last scores for each gymnast are for the balance beam event, which is weighted more heavily in this competition. Calculate the weighted mean for each gymnast when the balance beam event is double the weight of every other event. *(6 marks)*

continued

Assignment 7.2: Five Measures of Central Tendency (continued)

c) Which gymnast would win if the winner was determined by

i) the weighted mean? *(1 mark)*

ii) the median? *(1 mark)*

iii) the mode? *(1 mark)*

d) Consider possible arguments the losing gymnasts (in (c)) could make to argue that they should have won. Be sure to use the disadvantages of the measures of central tendency in your answer. State the arguments if

i) the winner is determined by the weighted mean *(1 mark)*

ii) the winner is determined by the mode *(1 mark)*

continued

Assignment 7.2: Five Measures of Central Tendency (continued)

4. State one disadvantage of each of the following measures of central tendency. Include an example that represents the disadvantage. *(10 marks)*

   a) The Mode

   b) The Median

   c) The Mean

continued

Assignment 7.2: Five Measures of Central Tendency (continued)

d) The Trimmed Mean

e) The Weighted Mean

Lesson 5: Percentiles

Lesson Focus

In this lesson, you will

- ❑ learn the meaning of percentile
- ❑ calculate percentile ranks
- ❑ discover how the median relates to percentiles
- ❑ learn how percentile ranks can be used to make decisions

Lesson Introduction

Suppose you got 88% on an examination. Your first impression might be that you did extremely well on that examination. However, once you start talking to other people in the class, you realize that most of the other students have a higher mark than you. Receiving a high mark on an examination shows that you knew most of the material that was tested. However, this high mark does not tell you how well you did in relation to other people who wrote that examination. Percentiles are used to compare one score with the rest of the scores.

Examination marks are just one situation where percentiles are used. Percentiles are also used in analyzing children's growth, including their height and weight. Physicians will often use the child's height and weight percentiles to compare the child's growth to other children in the same age group. Overall, percentiles are a very useful statistic when you are interested in comparing data values.

Percentiles

As the word *percentiles* sounds similar to the word *percent*, you may be thinking that percentiles are similar to percentages. However, this isn't always true.

Percent is a number expressed in relation to 100. For example, 88 out of 100 is 88%.

A **percentile** rank is the percentage of values in a data set that are the same or lower than a certain data value. Suppose you receive a mark of 88% on an examination. Also, suppose that this score is greater than or equal to the marks of 92% of people writing this examination. In other words, 92% of people scored the same as you or lower than you on this examination. In this situation you would have a percentile ranking of 92. You would also be in the 92nd percentile.

Include these definitions on your resource sheet.

Note: In some contexts, percentile rank is defined as the percentage of values in a data set that are strictly lower than a certain data value. However, for the purposes of this course, percentile rank is the percentage of values in a data set that are the same or lower than a certain data value.

Calculating Percentile Ranks

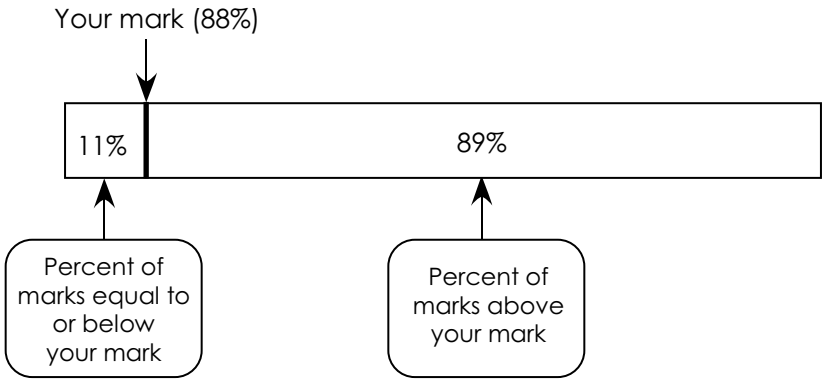
The following examples will help you to understand the differences between percentages and percentile ranks.

Example 1

You have received a mark of 88% on an examination. Suppose 100 students have written the same examination and only 10 of these students have scored less than 88%. Also, no other students have scored exactly 88% (besides you). How does your mark compare with the marks of the other students who have written the same examination?

Solution

You can compare your mark with those of the other students who have written the same examination by using the following percent bar.



Ten out of 100 students scored less than you. Therefore, 11 students (including you) have scores that are equal to or less than 88%. This implies that 89 other students had a higher mark than you.

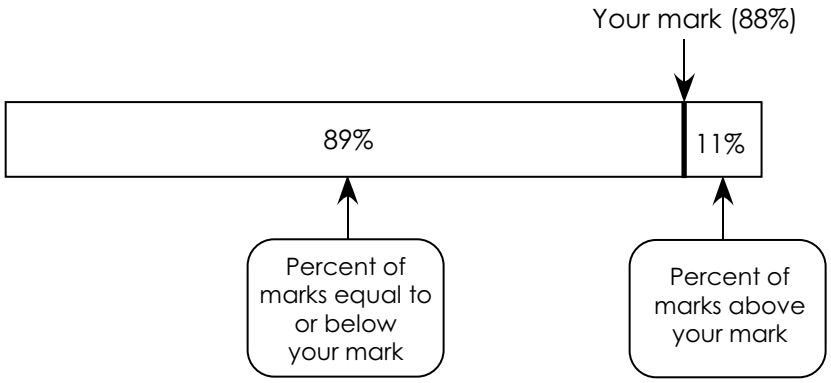
Since the majority of students have scored higher than 88%, your mark of 88% is not one of the top marks in the class. Eighty-eight percent is still a good mark, but when that mark is compared to the other marks, it is not one of the highest marks.

Example 2

Suppose, however, that of the 100 students who have written the same examination as you, 88 of them score lower than 88%. How does your mark now compare with the marks of the other students? Assume no other student scores 88% (besides you).

Solution

You can again use a percent bar to compare your mark with the other students' marks.



Relative to the other test scores, your mark of 88% is very high.

In Example 1, where 11% of the students scored at or below a mark of 88%, your percentile rank would be 11. It is correct to say that you are at the 11th percentile in your class. A mark in the 11th percentile indicates that you have scored the same as or better than only 11% of all the students who have written the examination.

In Example 2, where 89% of students scored at or below a mark of 88%, your percentile rank would be 89. In this case, you are at the 89th percentile. A mark in the 89th percentile indicates that you have scored the same as or better than 89% of the students who have written the examination.

As you can see, a score can become more meaningful when it is compared with other scores. Percentile ranks are one way to indicate how one score compares to other scores.

The following statements are true for percentile ranks:

- The *higher* the percentile rank, the *better* the score when compared with the other scores.
- The *lower* the percentile rank, the *poorer* the score when compared with the other scores.

The Percentile Rank Formula

The previous examples involved 100 test scores. You can use the following formula to calculate the percentile rank of any score in *any number* of test scores. Include this formula on your resource sheet.

$$\text{Percentile Rank} = \frac{(B + 0.5E)}{n} \times 100$$

where B = the number of scores *below* a given score

E = the number of scores *equal* to the given score, including the given score

n = the total number of scores

Note that the percentile rank is usually rounded up to the next whole number.

When using the percentile formula to determine your percentile ranking, you add the number of scores lower than your score (B) and half the number of scores equal to your score including your score (E). The formula uses $0.5E$ to get to the median of the equal scores. Then divide this sum by the total number of scores (n). You then multiply this answer by 100 to change it into percent form.

Note: Percentile Rank is interpreted differently by different authorities. Another common interpretation uses a slightly different formula to find the percentage of scores that are strictly below the score in question (rather than considering the values equal to and below the score in question). This formula is shown below:

$$\text{Percentile Rank} = \frac{B}{n} \times 100$$

For large sets of data with a wide variety of numbers, these two formulas yield very similar percentile rank values. For small sets of data or for large sets of data using a small range of numbers, the two formulas produce significantly different values. While either formula can be interpreted as being correct, for the remainder of this course, answers will use the first formula that includes half of the number of values equal to the score in question.

Example 3

The following is a set of 32 marks achieved by students on an examination worth 100 marks. Notice they are arranged in order as you go down each column.

18	42	52	59	68	73	83	89
27	45	53	61	70	75	83	90
38	45	56	67	72	82	85	90
40	48	58	67	72	83	85	97

Determine the percentile ranking for each of the following marks.

a) 40

b) 83

Solution

a) Percentile rank $= \dfrac{(B + 0.5E)}{n} \times 100$

where $B = 3$ (there are three scores lower than 40)

$E = 1$ (there is one instance of the mark of 40)

$n = 32$

$$\text{Percentile rank} = \frac{(3 + (0.5 \times 1))}{32} \times 100$$

$$= 10.9375$$

Percentile rank = 11 (rounded to the next whole number)

Note the difference between the actual mark expressed as a percent and its percentile rank. The actual mark expressed as a percent is 40%. The percentile rank of 11 indicates that only 11% of the scores on the examination were equal to or lower than a score of 40. It indicates that a mark of 40 is one of the lower marks on the examination.

b) Percentile rank $= \dfrac{(B + 0.5E)}{n} \times 100$

where $B = 23$ (there are 23 scores lower than 83)

$E = 3$ (there are three instances of the mark of 83)

$n = 32$

$$\text{Percentile rank} = \frac{(23 + (0.5 \times 3))}{32} \times 100$$

$$= 76.5625$$

Percentile rank = 77 (rounded to the next whole number)

Note again that the percent mark and the percentile rank are not the same. Although the mark is 83, the percentile rank is only 77. The percentile rank of 77 indicates that this student scored the same as or better than 77% of all students.

Properties of Percentile Ranks

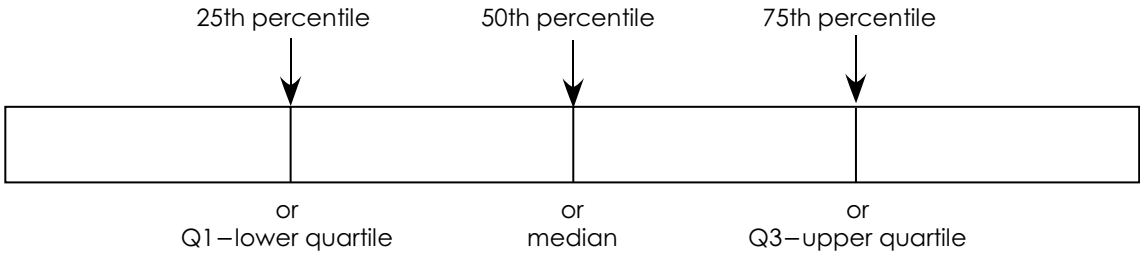
Now that you know how to calculate a percentile rank, it will be easier for you to understand the properties of percentile ranks. These properties include the following:

- A percentile rank is a number between 0 and 100. This number indicates the percent of data values equal to or below that specific data value.
- There is no 0 percentile rank. The lowest score is at the first percentile.
- There is no 100th percentile. The highest score is at the 99th percentile.
- The *higher* the percentile rank, the *better* the score compares with the other scores.
- The *lower* the percentile rank, the *worse* the score compares with the other scores.
- Percentile ranks are written as whole numbers. 32.5 becomes 33, which is the 33rd percentile.
- You cannot calculate measures of central tendency based on percentiles, as the results may be misleading.

Add these properties to your resource sheet.

Percentiles and the Median

In addition to the properties mentioned above, some percentile values are given special names. These values include the 25th, 50th, and 75th percentiles. The following percent bar displays these percentiles and their special names. Note that the 50th percentile is the middle value, which is the median. This is consistent with what you know about median: 50% of the scores are above the median and 50% are below the median.



It may be helpful for you to include this image on your resource sheet.

You can also use the letter P and a subscript to denote a particular percentile. For example, P_{20} denotes the 20th percentile and P_{85} denotes the 85th percentile.

Example 4

A survey is conducted in a community of 2000 families. The survey yields the following percentiles on family income:

P_{25} = \$23,500 P_{50} = \$32,000

P_{75} = \$48,000 P_{90} = \$100,000

a) Approximately what percentage of families in the community earn more than \$100,000 a year?

b) Approximately what percentage of families in the community have a yearly income of \$48,000 or less?

c) Approximately how many families in the community have a yearly income of \$23,500 or less?

Solution

a) Approximately 10% of families in the community earn more than \$100,000 a year.

b) Approximately 75% of families in the community have a yearly income of \$48,000 or less.

c) Approximately 25% of families in the community have a yearly income of \$23,500 or less.

0.25 × 2000 = 500 families in the community have a yearly income of \$23,500 or less.

Making Decisions Based on Percentile Ranks

Now that you know how and where percentile ranks are used, you may have concluded that you can make decisions based on percentile ranks.

Percentiles, rather than marks, are often used to describe the results of achievement tests by calculating the ranks of the individuals taking these tests. Universities and colleges, as well as some government agencies, often choose applicants based on their percentile ranking on tests. Some universities and colleges only accept applicants who have high percentile rankings on certain tests (such as the ACT test) or applicants who have high percentile rankings in their academic results in school.

Example 5

Justin writes a college entrance examination and scores 1440 out of a possible 1800. Of the 875 students writing the college entrance examination, 25 other students have the same score as Justin and 680 students have lower scores than his.

a) Find Justin's percentile rank.

b) In order to be considered for a particular college program, Justin needs a percentile ranking of 75 or better. Is Justin's score high enough for him to be considered for the program?

Solution

a) $B = 680$

$E = 26$ (including Justin)

$n = 875$

$$\text{Percentile rank} = \frac{(680 + (0.5 \times 26))}{875} \times 100$$

$$= 79.2$$

$$= 80 \text{ (rounded to the next whole number)}$$

b) Because Justin's percentile rank is higher than required, he will be considered for the program.

Example 6

Some of the more prestigious universities and colleges only accept students with a percentile ranking of 80 or higher. Therefore, these students have marks that are equal to or better than 80% of the students in their classes.

a) Why do you think these schools chose a percentile ranking of 80?

b) Which disciplines or careers might require a high percentile ranking for admission?

Solution

a) These schools probably chose a percentile ranking of 80 to attract students who were at the top of their classes. Also, these schools may have a strong academic focus and expect high marks from their students. Students with high percentile rankings may have a high probability of succeeding in these schools and have a low probability of dropping out of school due to difficult classes.

b) Engineers, doctors, and teachers may require a high percentile ranking in order to be accepted into these programs. Engineers need to be capable of designing and developing new products, as well as having vast knowledge of the sciences and mathematics. Doctors need to know their medical material so that they are capable of performing surgeries and diagnosing patients. Teachers are informing students and helping them build their knowledge. These students are going to be the doctors, engineers, mechanics, and teachers of tomorrow.

Example 7

IQ stands for *intelligence quotient*. An IQ is a score from a test designed to test your intelligence. The mean score of all people writing the test is set to be 100. Approximately 95% of the population will have an IQ from 70 to 130. IQ tests are sometimes used to predict success in education or job performance. Certain organizations only accept people with a specific percentile ranking on these IQ tests. Mensa International is a society that was created for people with a high IQ. The requirement to get into Mensa International is to have a score in the 98th percentile on any of a variety of recognized intelligence tests. No other requirements are needed in order to get into this society. One of Mensa International's goals is to identify and promote the growth of human intelligence for the benefit of humanity.

a) Why do you think Mensa chose having an IQ score in the 98th percentile as the requirement to be accepted into the society?

b) If Mensa chose a higher percentile as a requirement, what might happen?

c) If Mensa chose a lower percentile as a requirement, what might happen?

Solution

a) People who have an IQ score in the 98th percentile have an extremely high IQ. Mensa is an organization focused on intelligence for the benefit of the human race, and an IQ score is one way to quantify an individual's intelligence.

b) If Mensa chose a higher percentile, fewer people would be accepted into the organization. The organization may want to include as many people as possible while still ensuring that the people included have high IQ scores.

c) If Mensa chose a lower percentile as a requirement, more people would be accepted into the organization. This way, they can limit the size of the organization.

The questions in the following learning activity deal with percentile ranking. Be sure to check your answers before doing Assignment 7.3.

Learning Activity 7.5

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Calculate the mortgage if Carmen bought a house for $210,000 and had a down payment of $32,000.

2. Solve for x: $\frac{(x+5)}{6} = 7$

3. Calculate 75% of 2300.

4. What is the sum of the digits from 1 to 10?

5. Marcel is getting ready for school in September. He has bought a binder for $11.46, pens for $6.26, and pencils for $3.67. Estimate how much Marcel has spent on school supplies.

continued

Learning Activity 7.5 (continued)

Part B: Percentiles

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Karl receives his first mark of the year in his law course. His teacher tells him that he scored at the 94th percentile. Should Karl be happy with this mark?

2. Bandwidth is the amount of data being transferred through an Internet connection at any given time. In order to determine how much bandwidth a consumer uses, Internet providers usually use the 95th percentile of bandwidth use as a reference point. Therefore, 95% of the time, a consumer's usage is below this reference point. In other words, the top five percent of bandwidth peaks are ignored when Internet providers calculate a consumer's Internet bill.

   Why do you think Internet providers use the 95th percentile as a reference point?

3. Are the following statements true or false?
   a) The higher the percentile rank of a score, the greater the percent of scores above that score.
   b) A mark of 75% always has a percentile rank of 75.
   c) A mark of 75% sometimes has a percentile rank of 75.
   d) A mark of 75% never has a percentile rank of 75.
   e) A percentile rank of 0 is possible.
   f) It is not possible to have a mark of 80% and a percentile rank of 50.
   g) The higher the percentile score, the better that score is compared to the other scores.
   h) A percentile rank of 70 indicates that 70% of the scores are above that score.
   i) P_{50} is the median.
   j) Two equal scores have the same percentile rank.

continued

Learning Activity 7.5 (continued)

4. The following is a set of 48 scores arranged in order by columns achieved by students on an examination.

28	49	61	69	82	89
34	50	62	73	82	90
38	52	62	73	84	91
40	53	64	73	85	92
42	53	64	74	85	92
45	53	66	77	86	92
45	56	68	77	87	93
48	59	68	79	88	96

   Determine the percentile rank for each of the following scores. Remember to round all percentiles to the next whole number.

   a) 73

   b) 48

   c) 82

5. A total of 620 individuals take a government employment examination. Lina scores 586 out of 800 marks. There are 498 individuals who score less than 586 out of 800, and no one else has a score of 586.

   a) Find Lina's percentile rank.

   b) Find the percent mark Lina receives.

6. Shira's final mark in her Grade 12 Essential Math class is 92. Of the 30 students in her class, three other students received the same mark and 26 students have lower marks.

   a) Find Shira's percentile rank.

   b) How many students have a final mark higher than Shira?

continued

Learning Activity 7.5 (continued)

7. A group of Grade 9 students participates in a Differential Aptitude Test (DAT) in order to assess their strengths and weaknesses in English and mathematics. The test consists of eight subtests. Percentiles are determined for each student in each subtest. Use the percentiles for Student A and Student B in the chart to answer the following questions.

	Student A Percentile Rank	**Student B Percentile Rank**
Problem Solving	70	52
Computation	93	60
Math Skills	84	62
Abstract Reasoning	73	45
Reading Comprehension	68	68
Mechanical Reasoning	40	92
Space Relations	32	84
Spelling	58	70

   a) Which aptitude appears to be strongest for Student A?

   b) Which aptitude appears to be weakest for Student B?

   c) What percentage of students who have written this test have scored equal to or lower than Student A in problem solving?

   d) How do Student A and Student B compare with the rest of the students who have written the space relations subtest?

   e) With reference to this particular aptitude test, predict the area of study in which Student A would most likely be successful.

   f) With reference to this particular aptitude test, predict the area of study in which Student B would most likely be successful.

8. Ricardo scores 85% on a recent test. However, his percentile rank on the test is 40.

   a) What can you conclude about the success rate of most of the other students who have written the test?

   b) What reasons could cause test results like this?

Lesson Summary

Percentiles are helpful in comparative statistics, such as test or examination scores, incomes, and even IQ scores. In this lesson, you learned how to calculate percentiles and how decisions are sometimes made based on percentiles.

It is now time to complete Assignment 7.3. If any material seems challenging to you, be sure to ask your tutor/marker or learning partner for help. Also, make sure your resource sheet is up to date with all definitions and sample solutions for some of the more difficult questions.

You have now completed the last lesson and learning activity in Module 7! Be sure to complete Assignment 7.3 before you submit your assignments and move on to Module 8.

Assignment 7.3

Analyzing Percentiles

Total: 20 marks

1. A total of 4720 students write a university entrance examination. Lee achieves a score of 892 out of 1200. There are 3488 students who score lower than 892. There are 50 students, including Lee, who score 892.

   a) Find Lee's percentile rank. *(2 marks)*

   b) In order to be considered for the university, Lee needs a percentile rank of 70 or better. Is Lee's score high enough for him to be considered for acceptance to the university? *(1 mark)*

continued

Assignment 7.3: Analyzing Percentiles (continued)

2. Examination results for 3000 students are analyzed and the following percentiles are calculated.

   $P_{25} = 48$ $P_{50} = 62$

   $P_{75} = 78$ $P_{90} = 89$

   a) Approximately what percentage of students have scored less than or equal to 62? *(1 mark)*

   b) Approximately how many students have scored less than or equal to 62? *(1 mark)*

   c) Approximately how many students have scored more than 48? *(2 marks)*

   d) What is the median mark of this examination? *(1 mark)*

3. Todd has a final Grade 12 average of 89%. The college he wishes to attend will not consider any applicant if his or her percentile rank is below 82. Can Todd be sure the college will consider his application? Explain your answer. *(2 marks)*

continued

Assignment 7.3: Analyzing Percentiles (continued)

4. Sonya scores 38% on a recent test. However, her percentile rank on the test was 82.
   a) What can you conclude about the success rate of most of the other students who have written the test? *(1 mark)*

   b) What could cause test results like this? *(1 mark)*

5. Georgia is 1.6 m tall. She is taller than 56 of the students in her grade and no one is exactly the same height as she is. There are 152 students in her grade.
   a) What is Georgia's percentile rank? *(2 marks)*

   b) What percentage of students is taller than Georgia? *(1 mark)*

continued

Assignment 7.3: Analyzing Percentiles (continued)

6. State whether the following statements are true or false. *(3 marks)*
   a) Earning 54% on a test is the same as scoring in the 54th percentile.

   b) The 73.2 percentile is the same as the 73rd percentile.

   c) P_{50} is the median.

7. A mother takes her child, Bryn, to the doctor for a checkup. The doctor says Bryn's weight is in the 65th percentile and Bryn's height is in the 45th percentile.
   a) How does Bryn's weight compare to other children in her age range? *(1 mark)*

   b) How does Bryn's height compare to other children in her age range? *(1 mark)*

Module 7 Summary

You have now completed Module 7, and you have only one more module to complete in this course!

In this module, you were introduced to statistics. You reviewed mean, median, and mode, and then looked at two other measures of central tendency: the trimmed mean and the weighted mean. The trimmed mean is used to deal with outliers. You learned what outliers were and how they affected three measures of central tendency. You also learned why and how the weighted mean is frequently used to calculate, for example, your marks for a course, including this one. You also studied the advantages and disadvantages of using all five measures of central tendency in a variety of situations. Then, your focus was switched to percentiles. You learned all about percentiles including how to calculate them, and how decisions can be based on percentiles.

Throughout the lessons in this module, you saw how studying statistics has many real-life applications. When you are in a situation where you are presented with statistics or data, you should now be able to analyze this data more accurately. After analyzing the data, you should be capable of making more informed decisions based on your knowledge.

The final module is Precision Measurement. In this module, you will study the meanings of precision, accuracy, uncertainty, and tolerance, and how they are related. After learning these concepts, you should understand why they are needed in calculations based on measurement.

Submitting Your Assignments

It is now time for you to submit the Module 7 Cover Assignment and Assignments 7.1 to 7.3 to the Distance Learning Unit so that you can receive some feedback on how you are doing in this course. Remember that you must submit all the assignments in this course before you can receive your credit.

Make sure you have completed all parts of your Module 7 assignments and organize your material in the following order:

- ❑ Module 7 Cover Sheet (found at the end of the course Introduction)
- ❑ Module 7 Cover Assignment: Problem Analysis
- ❑ Assignment 7.1: Mean, Median, Mode, and Outliers
- ❑ Assignment 7.2: Five Measures of Central Tendency
- ❑ Assignment 7.3: Analyzing Percentiles

For instructions on submitting your assignments, refer to How to Submit Assignments in the course Introduction.

Grade 12 Essential Mathematics (40S)

Module 7
Statistics

Learning Activity Answer Keys

Module 7: Statistics

Learning Activity 7.1

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. What is the median of the following list of numbers? 4, 5, 7, 9, 10, 12
2. Evaluate: $12 + 3 - 5 + 3 + 53$
3. Which two terms are the same? $6, 4, \frac{18}{6}, \frac{18}{3}, \frac{18}{2}, \frac{8}{3}$
4. Beth spends 60% of her monthly income on household expenses including groceries. Of her remaining income, she puts 50% into savings. If Beth's monthly income is $3400, how much money does she have left after groceries and savings?
5. What is one-half of $\frac{1}{7}$?

Answers:

1. Median is 8 $\left(\frac{(7+9)}{2} = 8\right)$
2. 66 $(15 - 5 + 56 = 10 + 56 = 66)$
3. 6 and $\frac{18}{3}$ $\left(\frac{18}{3} = 6\right)$
4. $680 (50% of $3400 = $1700; 10% of $3400 = $340; 60% of $3400 = $1700 + $340 = $2040; $3400 – $2040 = $1360; 50% of $1360 = $680)
5. $\frac{1}{14}$ $\left(\frac{1}{7} = \frac{2}{14}\text{; half of } \frac{1}{7} = \text{half of } \frac{2}{14} = \frac{1}{14}\right)$

Part B: Mean, Median, Mode and Mistakes

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Find the mean, median, and mode for each set of data. Round your answer to the nearest tenth where necessary.

   a) 8, 10, 23, 10, 14, 16, 19

   b) 6, 3, 8, 6, 17, 8

   c) 9, 13, 7, 2, 18

   d) 3, 4, 6, 6, 10, 16

   Answer:

   a) Mean: $\frac{8+10+23+10+14+16+19}{7} = \frac{100}{7} = 14.3$

   Median: 8, 10, 10, 14, 16, 19, 23. (The middle number (median) is 14.)

   Mode: 10

   b) Mean: $\frac{6+3+8+6+17+8}{6} = \frac{48}{6} = 8$

   (The sum of the six data items is 48; divide this by the number of data items to get the mean.)

   Median: 3, 6, 6, 8, 8, 17 (The two middle numbers are 6 and 8.)

   $\frac{6+8}{2} = \frac{14}{2} = 7$

   Modes: 6, 8

   c) Mean: $\frac{9+13+7+2+18}{5} = \frac{49}{5} = 9.8$

   Median: 2, 7, 9, 13, 18. (The median is 9.)

   Mode: None

   d) Mean: $\frac{3+4+6+6+10+16}{6} = \frac{45}{6} = 7.5$

   Median: 3, 4, 6, 6, 10, 16. (The median is 6.)

   Mode: 6

2. Mark Goode receives the following marks on four mathematics tests:

   78, 75, 82, 74

   What is the lowest mark that Mark can receive on his fifth test in order for the mean of his test marks to be at least 80?

   Answer:

   In order for the five marks to have a mean of 80, they must total $5 \times 80 = 400$. (Note that when calculating the mean, $\frac{400}{5} = 80.$)

   The total of the first four marks = $78 + 75 + 82 + 74 = 309$.

   The mark required on the fifth test = $400 - 309 = 91$.

   Checking the answer:

   Total: $78 + 75 + 82 + 74 + 91 = 400$

   Mean: $\frac{400}{5} = 80$

3. Which of the three measures of central tendency is most suitable to describe the following sets of data?

   a) The typical annual rainfall in Brandon

   b) The most common size of T-shirt sold at a fundraiser

   c) The usual number of pages in a particular magazine

   d) The average mark of a student in a course

   Answers:

   a) Mean

   b) Mode

   c) Mean

   d) Mean or median

4. Ava Redge has a mean mark of 50% on her first three math tests. She receives a mark of 70% on her fourth test. Since the mean of 50 and 70 is 60, Ava states that her new mean mark in math is 60. Is her reasoning correct? Explain.

   Answer:

   No. Ava's reasoning is not correct because she is giving the same weight to her fourth test as she did to the combination of her first three tests. Her new mark should be:

   $$\frac{50 + 50 + 50 + 70}{4} = 55\%$$

5. If a random sample of 50 people produces a mean income of $36,000, would a random sample of 100 people produce a mean income of $72,000? Explain.

   Answer:

   No, because the sum of the incomes would increase, but so would the number of incomes that this sum would be divided by. Assuming that both random samples are similar, the mean income would also be similar to $36,000.

6. In one month, Ian Mead buys two lunches at $10.95 each, five lunches at $11.75 each, and one lunch at $12.25. Find the mean, median, and mode for the amount that Ian spends per lunch during the month.

   Answer:

   Mean: $\frac{10.95 + 10.95 + 11.75 + 11.75 + 11.75 + 11.75 + 11.75 + 12.25}{8}$

   $= \$11.61$

   Mode: $11.75

   Ordered values: 10.95, 10.95, 11.75, 11.75, 11.75, 11.75, 11.75, 12.25

   Median: $11.75

7. A sales department is made up of three divisions. The annual salary for each employee of a division is the same and is indicated in the following table.

Division	Number of Employees	Annual Salary of Each Employee
A	3	$52,000
B	25	$34,000
C	5	$28,000

a) Explain why the mean annual income of all the employees cannot be found by adding the numbers in the third column and dividing by three.

Answer:

The mean cannot be calculated by adding up the figures in column 3 and dividing by 3 because the number of employees who earn each of the salaries is different.

b) Find the mean annual income of all the employees.

Answer:

$$\frac{3(52\,000) + 25(34\,000) + 5(28\,000)}{33}$$

$$= \frac{1\,146\,000}{33}$$

$$= \$34,727.27$$

Learning Activity 7.2

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Estimate the product: 39.2×78.9
2. Complete the pattern: 7, 5, 3, 1, −1, _____ , _____
3. What is the total cost of a lunch if the sandwich costs $4.95, a salad costs $5.65, and a drink costs $2.50?
4. A manager at a community centre wants to supply hot dogs as a treat for the members. The manager estimates that 120 people will attend and eat three hotdogs each. How many hotdogs does the community centre need to prepare?
5. You are buying a new fall wardrobe. You want to purchase five pairs of $50 jeans, two $30 sweaters, and seven $25 shirts. How much will you spend on your fall wardrobe (excluding tax)?

Answers:

1. 3200 (The product is approximately $40 \times 80 = 3200$.)
2. −3, −5 (Each term is two less than the term before.)
3. $13.10 ($4.95 + $5.65 + $2.50 = $10.60 + $2.50)
4. 360 ($120 \times 3 = 360$)
5. $485.00 ($5 \times 50 + 2 \times 30 + 7 \times 25 = 250 + 60 + 175 = 485$)

Part B: Outliers and Their Effect on Data

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Maddox wants to run the 100 m race at his school's track event. To find his typical race time, his physical education teacher is deciding whether or not to use the mean or the trimmed mean. Over the course of a month, Maddox has run 20 races to determine if he will qualify for the track team. Maddox's race times are all measured in seconds and are as follows:

   12.37, 12.46, 12.45, 13.64, 13.25, 11.99, 12.00, 13.75, 12.75, 12.73, 12.27, 12.61, 13.51, 12.63, 12.84, 11.67, 11.95, 12.52, 12.63, 13.52

   a) Find the mean of Maddox's race times.

      Answer:

      $$\frac{12.37 + 12.46 + 12.45 + 13.64 + 13.25 + 11.99 + 12.00 + 13.75 + 12.75 + 12.73 + 12.27 + 12.61 + 13.51 + 12.63 + 12.84 + 11.67 + 11.95 + 12.52 + 12.63 + 13.52}{20}$$

      $= 12.677$

   b) Find the 10% trimmed mean of Maddox's race times.

      Answer:

      Maddox's fastest time is 11.67 seconds.

      Maddox's slowest time is 13.75 seconds.

      If you delete these two values, you will be deleting 10% of all values, including the lowest 5% and the highest 5%.

      Deleting these values gives a new score:

      $$\frac{12.37 + 12.46 + 12.45 + 13.64 + 13.25 + 11.99 + 12.00 + 12.75 + 12.73 + 12.27 + 12.61 + 13.51 + 12.63 + 12.84 + 11.95 + 12.52 + 12.63 + 13.52}{18}$$

      $= 12.673$

c) Which value should the physical education teacher use to determine whether Maddox makes the track team? Explain.

Answer:

It does not matter which value the physical education teacher uses to determine whether Maddox makes the track team, as Maddox's race times are very similar. However, the trimmed mean may be a more accurate description, as the slowest and fastest times are not necessarily reflective of Maddox's typical race times.

2. Find the outliers for the following data sets. State the new data sets after removing these outliers.

a) 5, 8, 10, 13, 7, 9, 66

Answer:

The outlier in this data set is 66, as it is a significant distance away from the other data values.

The new data set is: 5, 8, 10, 13, 7, 9.

b) 12, 14, 16, 15, 14, 43, 12, 18, 9, 13, 11, 23

Answer:

The outlier in this data set is 43, as it is significantly higher than the other numbers.

The new data set is: 12, 14, 16, 15, 14, 12, 18, 9, 13, 11, 23.

3. State a sample set of data where outliers affect the following measures of central tendency.

a) The mean

Answer:

Your answer may be different, but it should be similar to the sample answer.

1, 2, 3, 4, 66

The mean is 15.2. However, this value doesn't represent the average well because of the outlier of 66. This value skews the mean towards a higher value when most values in the data are 4 or less.

b) The mode

Answer:

Your answer may be different, but it should be similar to the sample answer.

1, 1, 52, 53, 54, 55, 56

The mode is 1. However, 1 is an outlier, as most data points are significantly greater than 1. Therefore, the mode is altered by the outlying value of 1.

4. A billionaire is in a room with 10 farm workers. Assume the billionaire's yearly income is $40,000,000. Assume that the 10 farm workers each earn a yearly income of approximately $30,000.

   a) What is the mean income of all the people in the room?

   Answer:

   Mean: $\frac{(10 \times 30\ 000) + (40\ 000\ 000)}{11} = \$3,663,636.36$

   b) Is the billionaire's income classified as an outlier?

   Answer:

   Yes. This income is very much higher than the 10 farm workers' incomes.

   c) How does the outlier affect the mean income? Is the mean income an accurate representation of the typical income in the room?

   Answer:

   The billionaire's income, which is the outlier, increases the mean income a lot. Therefore, the mean income of the people in the room is significantly different than the income of most of the people in the room. Therefore, the mean income is not an accurate representation of the typical income in the room.

   d) Which measure of central tendency would be the best representative of the typical income in the room?

   Answer:

   Either the mode or the median would be a better representative of the typical income in the room, as they are both $30,000. They are not affected by the outlier.

5. Sheila was trying to find the 10% trimmed mean of the following data set:

   4, 7, 3, 8, 12, 34, 23, 41, 73, 46, 14, 94, 25, 73, 25, 63, 24, 46, 52, 48.

   She thought the 10% trimmed mean was $\frac{618}{20}$.

   a) What was Sheila's mistake?

      Answer:

      Ordered data values:

      3, 4, 7, 8, 12, 14, 23, 24, 25, 25, 34, 41, 46, 46, 48, 52, 63, 73, 73, 94.

      Sheila omitted 5% of the highest and 5% of the lowest values, which lead to her calculation of the 10% trimmed mean. However, after omitting these two values, she forgot to divide by 18 instead of 20.

   b) What is the actual 10% trimmed mean?

      Answer:

      The 10% trimmed mean: $\frac{618}{18} = 34.33$.

Learning Activity 7.3

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. What is the lowest common multiple of 6 and 8?
2. Evaluate: 3^4
3. How many millimetres are in 14.1 m?
4. In a standard deck of 52 cards, what is the probability that you will draw a red card?
5. Evaluate: $\frac{1}{2} - \frac{9}{32}$

Answers:

1. LCM = 24
2. 81 ($3 \times 3 \times 3 \times 3 = 9 \times 9 = 81$)
3. 14 100 mm (There are 10 mm/cm, and 100 cm/metre. So, $14.1 \times 10 \times 100 =$ 14,100 mm.)
4. $\frac{1}{2}\left(\text{P(red)} = \frac{(13+13)}{52} = \frac{26}{52} = \frac{1}{2}\right)$

   (There are two suits that are red: hearts and diamonds. There are 13 cards in a suit.)
5. $\frac{7}{32}\left(\frac{16}{32} - \frac{9}{32} = \frac{7}{32}\right)$

Part B: Finding the Weighted Mean

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. In one high school psychology class, the marks are weighted as follows:

   Test 1 = 15%

   Test 2 = 25%

   Test 3 = 10%

   Assignments = 20%

   Participation = 5%

   Final Examination = 25%

   Janie received marks of 80, 73, 69, 83, 100, and 65 respectively.

   Scotty received marks of 79, 84, 73, 52, 97, and 87 respectively.

   a) What is Janie's final mark?

   Answer:

Item	Janie's Value	Scotty's Value	Weight
Test 1	80	79	0.15
Test 2	73	84	0.25
Test 3	69	73	0.1
Assignments	83	52	0.2
Participation	100	97	0.05
Final Examination	65	87	0.25

   Janie's weighted average = Janie's mean mark =

$$\frac{(80 \times 0.15) + (73 \times 0.25) + (69 \times 0.1) + (83 \times 0.2) + (100 \times 0.05) + (65 \times 0.25)}{0.15 + 0.25 + 0.1 + 0.2 + 0.05 + 0.25}$$

$$= \frac{75}{1} = 75\%$$

b) What is Scotty's final mark?

Answer:

Scotty's weighted average = Scotty's mean mark =

$$\frac{(79 \times 0.15) + (84 \times 0.25) + (73 \times 0.1) + (52 \times 0.2) + (97 \times 0.05) + (87 \times 0.25)}{0.15 + 0.25 + 0.1 + 0.2 + 0.05 + 0.25}$$

$$= \frac{77.15}{1} = 77.2\%$$

c) Scotty received lower marks in every item except for two. Why is Scotty's final mark higher than Janie's final mark if Janie did better in more items?

Answer:

Even though Janie did better than Scotty in more areas, Scotty received higher marks in the two items that had the highest weights (Test 2 and the final examination). Therefore, these two items contributed more to the final mark because of their greater weights. Thus, Scotty received a higher mark than Janie.

2. Residents from two towns in Manitoba were asked for their IQ scores. Two hundred and fifty people from A-Town reported their IQ scores and the mean IQ score was 120. One hundred people from B-Town reported their IQ scores and the mean IQ score was 90.

a) What is the mean IQ of all the residents of both towns?

Answer:

Item	Value	Weight
A-Town	120	250
B-Town	90	100

Mean IQ of both towns = $\frac{(120 \times 250) + (90 \times 100)}{250 + 100} = \frac{39\ 000}{350} = 111.43$

b) Is the weighted mean IQ closer to the IQ of A-Town or B-Town? Why do you think this is?

Answer:

The mean IQ is closer to that of A-Town because it had more residents who reported their IQ score. Therefore, A-Town contributed more to the weighted mean.

3. One retail company wants to determine how long its employees have been working for it. It found the following statistics:

   8 people had worked at the company for 1 year.

   5 people had worked at the company for 2 years.

   4 people had worked at the company for 3 years.

   7 people had worked at the company for 4 years.

   5 people had worked at the company for 5 years.

   a) Calculate the mean number of years that employees have worked for this company without using the weighted mean.

   Answer:

   Mean number of years worked at company:

$$\frac{\begin{array}{c}1+1+1+1+1+1+1+1+2+2+2+2+2+3+3+3+3+\\ 4+4+4+4+4+4+4+4+5+5+5+5+5\end{array}}{8+5+4+7+5}$$

$$= \frac{83}{29} = 2.86 \text{ years}$$

   b) Calculate the mean number of years that employees have worked for this company by using the weighted mean.

   Answer:

   Mean number of years worked at company:

$$\frac{(8\times 1)+(5\times 2)+(4\times 3)+(7\times 4)+(5\times 5)}{8+5+4+7+5} = \frac{83}{29} = 2.86 \text{ years}$$

4. In a Brandon high school, chemistry is taught during the fall semester, the spring semester, and summer school. The following chart displays the percentage of students who passed the chemistry course.

Term	Percentage Who Passed
Fall	74%
Winter	80%
Summer	68%

   a) Someone calculated the mean of the three percentages and stated that 74% of the students who took this course passed. Is this statement necessarily accurate? Why or why not?

   Answer:

   No, this statement wouldn't necessarily be valid. This statement would only be valid if the same number of students took the course in each term. As it is very likely that different numbers of students took the course in each term, this would alter the mean and you would need to calculate the weighted mean instead.

   b) If 700 people took this course in the fall, 500 people took this course in the winter, and 100 people took this course in the summer, what percent of the students who took this course passed?

   Answer:

   Weighted mean =

$$\frac{(700 \times 0.74) + (500 \times 0.80) + (100 \times 0.68)}{700 + 500 + 100} = \frac{986}{1300} = 0.758 = 75.8\%$$

5. Celine just received her marks for her first year in university. Celine now wants to know what her grade-point average (GPA), or weighted mean, is. Celine received the following marks in each course:

   History: C

   Calculus: B

   Intro to English: A

   Chemistry: B

   Physics: C

   Spanish: A

Celine knows that the value of each letter grade is as follows:

A = 4 points per year-long course

B = 3 points per year-long course

C = 2 points per year-long course

D = 1 point per year-long course

All courses are full-credit courses, except for Spanish. In Celine's school, Spanish is only a half-credit course.

a) Calculate Celine's weighted mean (GPA). Justify the weightings you used for the course length.

Answer:

GPA: $\dfrac{(2 \times 1) + (3 \times 1) + (4 \times 1) + (3 \times 1) + (2 \times 1) + (4 \times 0.5)}{1 + 1 + 1 + 1 + 1 + 0.5} = \dfrac{16}{5.5} = 2.9$

In this calculation of the weighted mean, each full-credit course has been given a weight of one. The half-credit course has been given a weight of 0.5.

It does not matter which value you pick for the weight of the full-credit course. However, the weight you pick for the half-credit course must be *half* the value of the weight you picked for the full-credit course.

b) What letter grade is Celine's GPA close to?

Answer:

Celine's GPA is really close to a B.

c) Why should a half course receive a smaller weight than a full course in GPA calculations?

Answer:

Since students spend half as much time in half-course classes, these courses should have less influence on the grade-point average.

6. Consider the following table that displays the average earnings of Manitobans as related to their highest level of schooling. Note that the word *average* is used instead of the word *mean*.

	Manitoba (2005) ($)
Average—Highest certificate, diploma, or degree	**$31,320**
Certificate or diploma below bachelor level	$27,509
University certificate or degree	$51,977
Bachelor's degree	$45,804
University certificate, diploma, or degree above bachelor level	$64,403

Source: Statistics Canada.

a) If there were the same number of people in the following three categories, what would be the mean earnings of this group?

- Certificate or diploma below bachelor level
- Bachelor's degree
- University certificate, diploma, or degree above bachelor level

Answer:

Main earnings: $\frac{27\ 509 + 45\ 804 + 64\ 403}{3} = \$45,905.33$

b) Why is the total average earnings in Manitoba not the same as the value you found in (a)? What can you determine about the number of people holding each level of education?

Answer:

The total average earnings in Manitoba, $31,320, is not the same as the mean earnings, because the number of people in each category is not the same. Since the total average earnings is lower than the mean earnings (#a), there must be more people in the lower income brackets than in the higher ones. Therefore, there are more people in the certificate or "diploma below bachelor level" category than in the other categories.

c) Why do you think Statistics Canada used the word *average* instead of the word *mean* in this study?

Answer:

Answers may vary. Statistics Canada may have used the word *average* because more people understand the meaning of *average* than *mean*. Average includes a variety of measures of central tendency.

Learning Activity 7.4

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Evaluate: $5 \times 17 \times 20$
2. You went to the grocery store to pick up a few items. The total came to $21.37. You gave the cashier $40. What should your change be?
3. How many days are in 15 weeks?
4. In the months of November, December, and January, it snowed 14 mm, 60 mm, and 76 mm respectively. What is the mean amount of snow that fell each month?
5. Complete the pattern: 7, 14, 21, 28, _____ , _____

Answers:

1. 1700 ($5 \times 20 = 100 \times 17 = 1700$)
2. $18.63 ($40.00 − $21.37 = $18.63 or counting up: 21.37 + 0.63 = 22.00; 22.00 + 8.00 = 30.00; 30.00 + 10.00 = 40.00; ∴ 0.63 + 8 + 10 = $18.63 in change)
3. 105 ($7 \times 15 = 7 \times 10 + 7 \times 5 = 70 + 35 = 105$)
4. 50 mm ($14 + 60 + 76 = 150$; $\frac{150}{3} = 50$ mm.)
5. 35, 42 (Add 7 to each term.)

Part B: Finding the Weighted Mean

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Mark Fehr received the following marks on nine mathematics tests:

   80, 74, 72, 71, 25, 68, 71, 50, 80.

   a) Calculate the median of these marks.

   b) How many marks are less than the median? How many marks are greater than the median?

   c) Calculate the mean of these marks.

   d) How many marks are less than the mean? How many marks are greater than the mean?

   e) Calculate the mode(s) of these marks.

   f) How many marks are less than the mode(s)? How many marks are greater than the mode(s)?

   g) Which measure of central tendency best represents Mark Fehr's typical mark on a mathematics test?

   Answers:

   a) To calculate the median, first place the marks in order of size.

   25, 50, 68, 71, 71, 72, 74, 80, 80

   The median = 71

   b) There are three marks less than the median and four marks greater than the median.

   c) The mean $= \dfrac{80 + 74 + 72 + 71 + 25 + 68 + 71 + 50 + 80}{9} = \dfrac{591}{9} = 65.7$

   d) There are only two marks less than the mean and seven marks greater than the mean.

   e) The modes are 71 and 80.

   f) For the mode of 71, three marks are less than the mode and four marks are greater than the mode.

   For the mode of 80, seven marks are less than the mode and no marks are greater than the mode.

g) The median is the best representative of this data. The median allows for higher and lower values. However, knowing all the measures of central tendency is better than knowing just one.

2. Consider the golf scores of two players who play nine holes of golf. Note that Ethan was stuck in a sand trap on the ninth hole.

Hole	1	2	3	4	5	6	7	8	9
Ethan	3	4	5	3	4	4	3	4	15
Caden	5	5	6	4	6	4	4	5	4

a) Calculate the mean, median, and mode of the scores for Ethan.

Answer:

Mean: $\dfrac{3+4+5+3+4+4+3+4+15}{9} = 5$

Median: 3, 3, 3, 4, 4, 4, 4, 5, 15 = 4

Mode: 4

b) Calculate the mean, median, and mode of the scores for Caden.

Answer:

Mean: $\dfrac{5+5+6+4+6+4+4+5+4}{9} = 4.8$

Median: 4, 4, 4, 4, 5, 5, 5, 6, 6 = 5

Mode: 4

c) In your opinion, which player usually has the better score per hole? Explain.

Answer:

Ethan did usually have a better score per hole until he reached hole #9. Ethan's score for hole #9 shouldn't count against his usual score per hole just because he got stuck in a sand trap.

d) In your opinion, which measure of central tendency is the most appropriate to use in this situation?

Answer:

The median or the mode is most appropriate to use in this situation. The median is representative of the middle score for each player. The mode could also be used, as it is the score that appears most often in both of these players' games.

3. Consider the mean, median, and the mode.

   a) Is it possible for the mean, median, and mode of a data set to be the same value? If so, state an example.

      Answer:

      Yes.

      For example, 3, 4, 4, 4, 5

      Mean = Median = Mode = 4

      (**Note:** Your example may be different, but it should give a mean, median, and mode that are all equal.)

   b) For some data regarding annual precipitation, the mean, median, and mode are the same. A statistician presents the mode as the measure of central tendency to represent this data, but does not say that the mean, median, and mode are all the same. Would you accept the mode as a usual amount of annual precipitation, or would you question the statistician?

      Answer:

      Answers may vary. Generally, unless the data is nominal, modes are not accepted as the typical value. Therefore, it is probable that the statistician would be questioned. The mean or the median are generally more accurate representations of data.

4. The median wait time for a specific surgery in Winnipeg is 13 weeks.

   a) What does this wait time of 13 weeks imply?

      Answer:

      The median wait time of 13 weeks implies that half of all the people who needed this surgery waited longer than 13 weeks, and the other half waited less than 13 weeks.

   b) What are some possible interpretations of the median wait time being 13 weeks?

      Answer:

      Some of these surgeries may have been lower priority and therefore would have a longer wait time. Also, people needing immediate surgeries could have been pushed to the front of the waiting list, thus making other people wait longer. Either way, there needs to be more information given about this specific surgery so that Winnipeggers can better understand the reasons for the wait times.

5. Travis lives in northern Manitoba. His science teacher asks him to conduct an experiment on snow depth. Each day, Travis measures the snow depth in his front yard. At the end of the three-month experiment, his science teacher asks him to report back with one piece of data that displays the typical snow depth in his front yard during these three months.

   Travis found the following data about the snow depth in his front yard:

   Mean = 19.6 cm

   Median = 22.5 cm

   Mode = 5 cm

   10% Trimmed Mean = 19.3 cm

   a) If Travis uses the mean to represent his data, what possible misinterpretations could there be?

      Answer:

      In this case, the mean is below the median. Therefore, one possible misinterpretation is that less snow fell than actually did.

   b) If Travis uses the median to represent his data, what possible misinterpretations could there be?

      Answer:

      One possible misinterpretation could be that the snow was very deep, even though there were more days that the snow was only 5 cm deep.

   c) If Travis uses the mode to represent his data, what possible misinterpretations could there be?

      Answer:

      One possible misinterpretation is that not a lot of snow fell during this period. However, the other measures of central tendency suggest that a lot of snow fell during this period.

   d) If Travis uses the 10% trimmed mean to represent his data, what possible misinterpretations could there be?

      Answer:

      As the trimmed mean is very similar to the mean, there probably wasn't a large number of outliers in this data set. Therefore, using the trimmed mean could lead to a possible misinterpretation that there were outliers in the data that needed to be removed. These outliers could include days where there was a lot of snow, or no snow at all.

Learning Activity 7.5

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Calculate the mortgage if Carmen bought a house for $210,000 and had a down payment of $32,000.
2. Solve for x: $\frac{(x + 5)}{6} = 7$
3. Calculate 75% of 2300.
4. What is the sum of the digits from 1 to 10?
5. Marcel is getting ready for school in September. He has bought a binder for $11.46, pens for $6.26, and pencils for $3.67. Estimate how much Marcel has spent on school supplies.

Answers:

1. $178,000 ($210,000 − $32,000 = $178,000)
2. 37

   (x + 5 = 42

   x = 42 − 5 = 37)
3. 1725 (50% of 2300 = 1150

   25% of 2300 = 575

   75% of 2300 = 1150 + 575 = 1725)
4. 55 (1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10)

   (Combine digits that add to 10 (1 and 9, 2 and 8, etc.).
   The result is: 10 + 10 + 10 + 10 + 10 + 5 = 55.)
5. ~$21.25 (~$11.50 + ~$6.25 + ~$3.50 = ~$21.25)

   Note: If your answer is between $20 and $23, that is a good estimate.

Part B: Percentiles

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Karl receives his first mark of the year in his law course. His teacher tells him that he scored at the 94th percentile. Should Karl be happy with this mark?

   Answer:

   Yes. Karl scored as well as or better than 94% of the people who are in his law course.

2. Bandwidth is the amount of data being transferred through an Internet connection at any given time. In order to determine how much bandwidth a consumer uses, Internet providers usually use the 95th percentile of bandwidth use as a reference point. Therefore, 95% of the time, a consumer's usage is below this reference point. In other words, the top five percent of bandwidth peaks are ignored when Internet providers calculate a consumer's Internet bill.

   Why do you think Internet providers use the 95th percentile as a reference point?

   Answer:

   The 95th percentile gives an accurate description of how much bandwidth a consumer uses. This means that 95% of the time, consumers use equal to or less than this amount. Therefore, periods of time where more bandwidth is used, such as a lot of downloading, aren't included in this calculation. This 95th percentile is a good number to judge how much bandwidth a consumer actually uses without including usage spikes. By using the 95th percentile, Internet providers won't overcharge consumers. However, these Internet providers are still earning a profit.

3. Are the following statements true or false?
   a) The higher the percentile rank of a score, the greater the percent of scores above that score.
   b) A mark of 75% always has a percentile rank of 75.
   c) A mark of 75% sometimes has a percentile rank of 75.
   d) A mark of 75% never has a percentile rank of 75.
   e) A percentile rank of 0 is possible.
   f) It is not possible to have a mark of 80% and a percentile rank of 50.
   g) The higher the percentile score, the better that score is compared to the other scores.
   h) A percentile rank of 70 indicates that 70% of the scores are above that score.
   i) P_{50} is the median.
   j) Two equal scores have the same percentile rank.

   Answers:

   a) False
   b) False
   c) True
   d) False
   e) False
   f) False
   g) True
   h) False
   i) True
   j) True

4. The following is a set of 48 scores arranged in order by columns achieved by students on an examination.

28	49	61	69	82	89
34	50	62	73	82	90
38	52	62	73	84	91
40	53	64	73	85	92
42	53	64	74	85	92
45	53	66	77	86	92
45	56	68	77	87	93
48	59	68	79	88	96

Determine the percentile rank for each of the following scores. Remember to round all percentiles to the next whole number.

a) 73

Answer:

$$\text{Percentile rank} = \frac{(B + 0.5E)}{n} \times 100$$

where $B = 25$

$E = 3$

$n = 48$

$$\text{Percentile rank} = \frac{(25 + 0.5(3))}{48} \times 100$$

$$= \frac{(25 + 1.5)}{48} \times 100$$

$$= \frac{(26.5)}{48} \times 100$$

$$= 55.208$$

$$= 56 \text{ (rounded to the next percentile)}$$

b) 48

Answer:

$$\text{Percentile rank} = \frac{(B + 0.5E)}{n} \times 100$$

where $B = 7$

$E = 1$

$n = 48$

$$\text{Percentile rank} = \frac{(7 + 0.5(1))}{48} \times 100$$

$$= \frac{(7 + 0.5)}{48} \times 100$$

$$= \frac{(7.5)}{48} \times 100$$

$$= 15.625$$

$$= 16 \text{ (rounded to the next percentile)}$$

c) 82

Answer:

$$\text{Percentile rank} = \frac{(B + 0.5E)}{n} \times 100$$

where $B = 32$

$E = 2$

$n = 48$

$$\text{Percentile rank} = \frac{(32 + 0.5(2))}{48} \times 100$$

$$= \frac{(32 + 1)}{48} \times 100$$

$$= \frac{(33)}{48} \times 100$$

$$= 69$$

5. A total of 620 individuals take a government employment examination. Lina scores 586 out of 800 marks. There are 498 individuals who score less than 586 out of 800, and no one else has a score of 586.

   a) Find Lina's percentile rank.

   Answer:

$$\text{Percentile rank} = \frac{(498 + (0.5 \times 1))}{620} \times 100$$

$$= 80.4032$$

$$= 81 \left(\text{rounded to the next whole number}\right)$$

   b) Find the percent mark Lina receives.

   Answer:

$$\text{The percent mark} = \frac{586}{800} \times 100$$

$$= 73.25$$

Lina's percent mark = 73.25%.

6. Shira's final mark in her Grade 12 Essential Math class is 92. Of the 30 students in her class, three other students received the same mark and 26 students have lower marks.

   a) Find Shira's percentile rank.

   Answer:

   $$\text{Percentile rank} = \frac{(B + 0.5E)}{n} \times 100$$

   where $B = 25$

   $E = 4$ (including Shira)

   $n = 48$

   $$\text{Percentile rank} = \frac{(26 + 0.5(4))}{30} \times 100$$

   $$= \frac{(26 + 2)}{30} \times 100$$

   $$= \frac{28}{30} \times 100$$

   $$= 93.33\overline{3}$$

   $$= 94 \left(\text{rounded to the next percentile}\right)$$

   b) How many students have a final mark higher than Shira?

   Answer:

   Although no students have a final mark higher than Shira, three other students have the same mark. This is indicated by a percentile rank of 94 rather than a percentile rank of 99.

7. A group of Grade 9 students participates in a Differential Aptitude Test (DAT) in order to assess their strengths and weaknesses in English and mathematics. The test consists of eight subtests. Percentiles are determined for each student in each subtest. Use the percentiles for Student A and Student B in the chart to answer the following questions.

	Student A Percentile Rank	Student B Percentile Rank
Problem Solving	70	52
Computation	93	60
Math Skills	84	62
Abstract Reasoning	73	45
Reading Comprehension	68	68
Mechanical Reasoning	40	92
Space Relations	32	84
Spelling	58	70

a) Which aptitude appears to be strongest for Student A?

Answer:

Computation appears to be strongest for Student A.

b) Which aptitude appears to be weakest for Student B?

Answer:

Abstract reasoning appears to be weakest for Student B.

c) What percentage of students who have written this test have scored equal to or lower than Student A in problem solving?

Answer:

Of the students that have written this test, 70% have scored equal to or lower than Student A in problem solving.

d) How do Student A and Student B compare with the rest of the students who have written the space relations subtest?

Answer:

Student A has scored equal to or better than only 32% of the students that have written the space relations subtest, while Student B has scored equal to or better than 84% of these students.

e) With reference to this particular aptitude test, predict the area of study in which Student A would most likely be successful.

Answer:

With reference to this particular aptitude test, Student A would most likely be successful in a math-related discipline involving computation and math skills, such as the field of accounting.

f) With reference to this particular aptitude test, predict the area of study in which Student B would most likely be successful.

Answer:

With reference to this particular aptitude test, Student B would most likely be successful in a mechanical field of study, such as engineering.

8. Ricardo scores 85% on a recent test. However, his percentile rank on the test is 40.

a) What can you conclude about the success rate of most of the other students who have written the test?

Answer:

40% of the students who wrote this test scored less than or equal to Ricardo. 60% of the students who wrote the test scored above 85%.

b) What reasons could cause test results like this?

Answer:

One reason could be that the test was easy. A second reason could be that the students were all well prepared for the test and the students are very bright.

Grade 12 Essential Mathematics (40S)

Module 8
Precision Measurement

Module 8:
Precision Measurement

Introduction

It is important for you to be able to measure distances. In previous courses, you have measured distances using many different types of measuring devices, including rulers and tape measures. You probably have rulers and tape measures in your home or tool box. Some people also use laser or electronic means to calculate length. In this module, you will be introduced to two instruments that are used for measuring small distances with great precision and accuracy: the Vernier caliper and the micrometer. It would be helpful if you have both a Vernier caliper and a micrometer, but you do not require them in order to complete this module.

Once you take a measurement, it is important for you to know how exact this measurement is. Take a look around you. You probably see a pencil, pen, table, calculator, ruler, electrical outlet, a light, and maybe even a computer. These were all manufactured with varying degrees of precision and accuracy. Have you ever wondered how mechanical parts can be made in any country in the world, and yet still fit the object you are trying to fix right at home? Precision and accuracy are two concepts that make this possible.

In this module, you will be learning about precision, accuracy, uncertainty, and tolerance. These four concepts are all related to the limitations of any measuring instrument. If you are planning on having a career in engineering, machining, carpentry, or even if you plan on just fixing up your own home one day, what you learn in this module will be very useful for you.

Assignments in Module 8

When you have completed the assignments for Module 8, submit your completed assignments to the Distance Learning Unit either by mail or electronically through the learning management system (LMS). The staff will forward your work to your tutor/marker.

Lesson	Assignment Number	Assignment Title
	Cover Assignment	Puzzles in Design
2	Assignment 8.1	Accuracy, Precision, and Uncertainty
4	Assignment 8.2	Measurements and Tolerances

Resource Sheet

When you write your final examination, you are encouraged to take a Final Examination Resource Sheet with you into the examination. This sheet will be one letter-sized page, 8½ " by 11", with both sides in your handwriting or typewritten. You will submit it with your examination, but you do not receive any marks for it.

Many students have found that preparing a resource sheet is an excellent way to review. It provides you with a summary of the important facts of each module. You should complete a resource sheet for each module to help with your studying and reviewing. Lesson summaries and module summaries are included for you to use as a guide.

You may use the following list of instructions to help you with preparing your resource sheet for the material in Module 8. On this sheet, you should record mathematics terms and definitions, formulas, sample questions, or a list of places where you often make mistakes. You should also identify special areas that require extra attention or review by writing the page numbers.

After you have completed each module's resource sheet, you may summarize the sheets from Modules 5, 6, 7, and 8 to prepare your Final Examination Resource Sheet. The final examination for this course is based on Modules 5 to 8.

Resource Sheet for Module 8

As you go through the lessons of this module, you may want to consider the following suggestions regarding the creation of a resource sheet.

1. List all the important mathematics terms, and define them if necessary.
2. List all the formulas and perhaps a sample problem that shows how each formula is used.
3. If necessary, write the solutions to some problems, showing in detail how you did the calculations.
4. Copy any questions that represent the key points of the lesson, and perhaps include the solutions as well.
5. Identify the problems you found most difficult, and copy the page numbers onto the resource sheet so that you can review them before writing the examination. You may also copy the problems and the solutions onto your resource sheet, and later write them onto your Final Examination Resource Sheet.
6. Write any comments, ideas, shortcuts, or other reminders that may be helpful during an examination.

Writing Your Final Examination

You will write the final examination when you have completed Module 8 of this course. The final examination is based on Modules 5 to 8, and is worth 12.5 percent of your final mark in the course. To do well on the final examination, you should review all the work you complete in Modules 5 to 8, including all the learning activities and assignments. You will write the final examination under supervision.

Notes

Module 8 Cover Assignment: Puzzles in Design

Drawing a diagram can sometimes be a useful strategy when solving a problem. It is usually necessary to draw a large object like a new home or office building much smaller than its actual size so that the drawing of the object fits onto a page. On the other hand, sometimes enlargements are necessary. Commercial artists often make scale diagrams of logos and crests much larger than the actual objects so that they can better illustrate fine details. These drawings (reductions and enlargements) are called scale diagrams.

The scale of a diagram is usually determined before the diagram is drawn. The scale is always written as a ratio:

diagram size : object size

Therefore, if the scale of a drawing is 2:1, then the diagram is twice as large as the actual object.

This can also be written as

$$\frac{\text{diagram size}}{\text{object size}} = \frac{2}{1}$$

If the scale of a drawing 1:5, then the object is 5 times as large as the diagram.

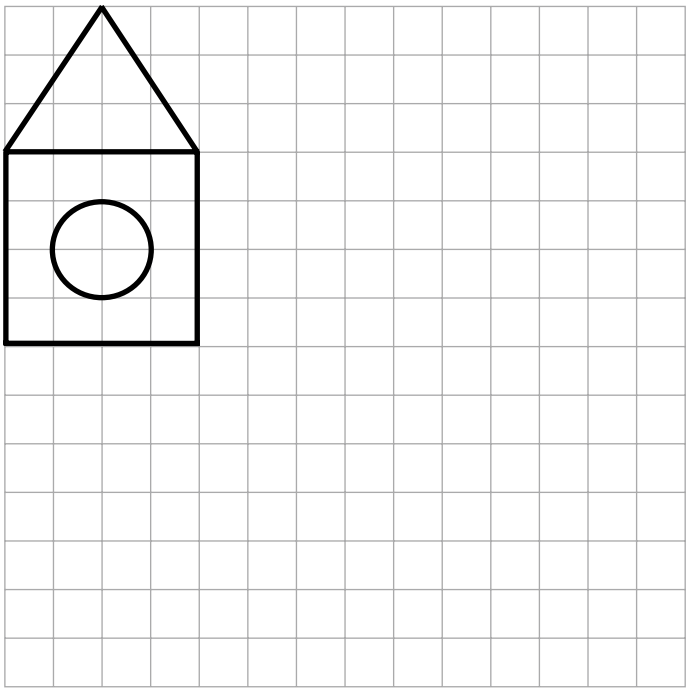
This can also be written as

$$\frac{\text{diagram size}}{\text{object size}} = \frac{1}{5}$$

In this cover assignment, you will draw scale diagrams and solve two-dimensional geometry problems represented with toothpicks.

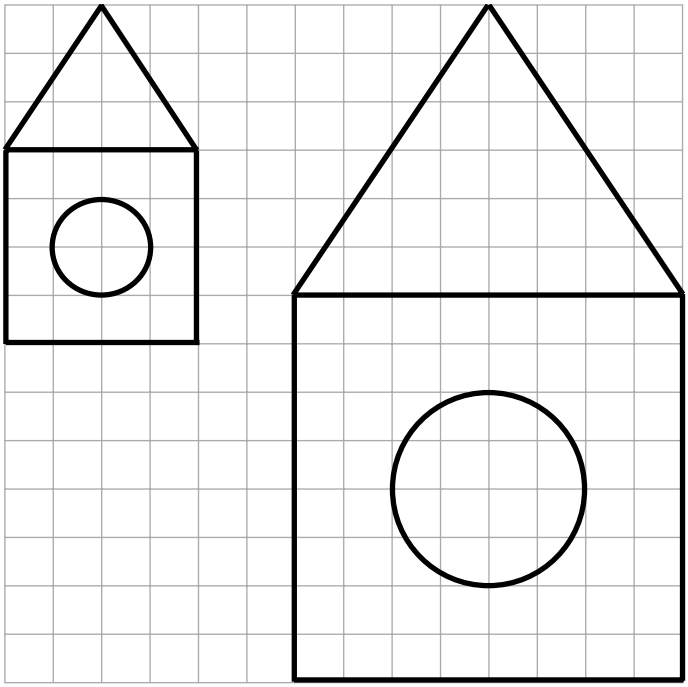
Example 1

Given the following object, enlarge it according to the scale 2:1.

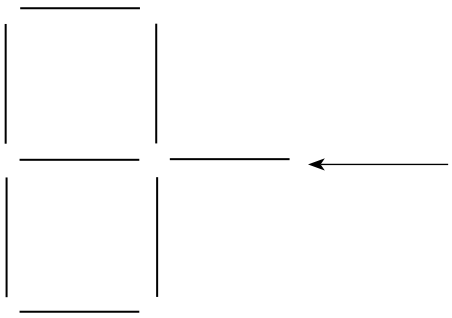


Solution

The enlargement would be as follows. Note that all dimensions are double the original.



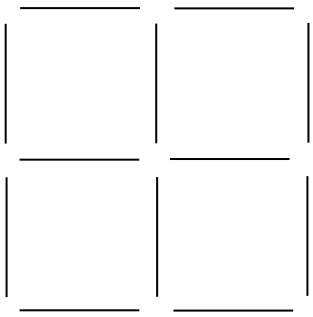
Part A of the following cover assignment involves drawing scale diagrams and solving puzzles involving scale diagrams. Part B of the cover assignment involves solving toothpick puzzles. The only rule for solving toothpick puzzles is that each toothpick must be part of a square or triangle.



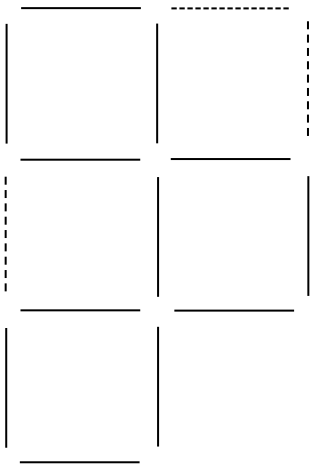
This toothpick is not part of a square. Therefore, this solution is incorrect.

Example 1

These 12 toothpicks form four small squares and one large square. Move three toothpicks to create only three squares that are all the same size.



Solution



Note: The dotted lines represent toothpicks that have been moved to create the desired solution.

Notes

Module 8 Cover Assignment

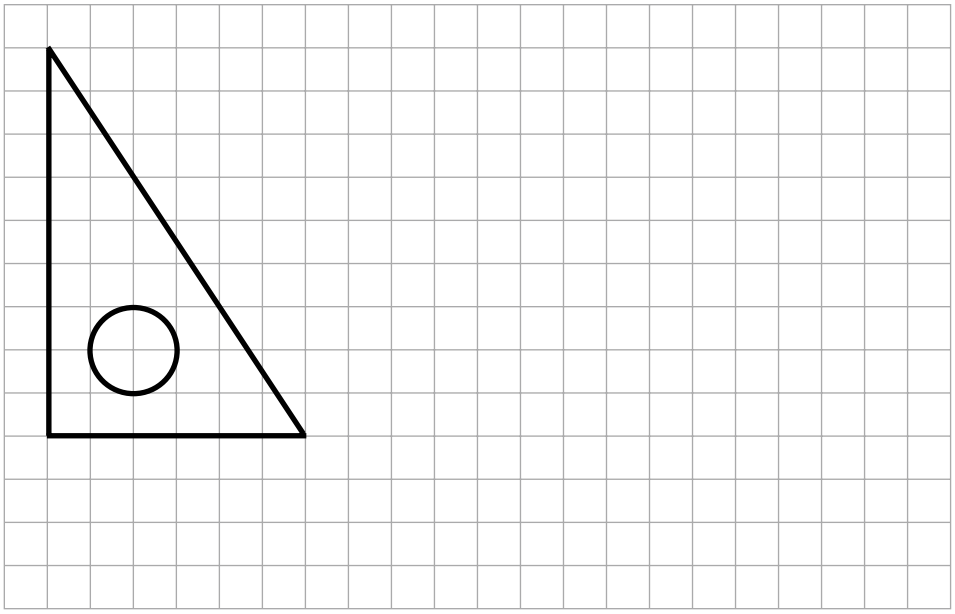
Problem Analysis

Total: 10 marks

You must complete both Part A and Part B in this cover assignment.

Part A: Scale Diagrams ***(5 marks)***

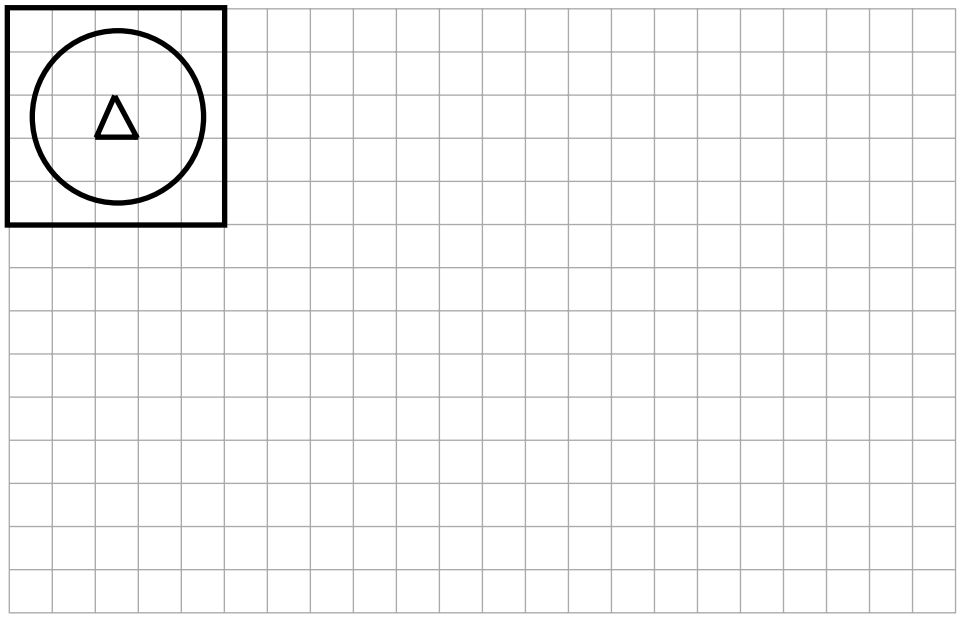
1. Draw a diagram of each object according to the given scale. *(2 marks)*
   a) Scale 1 : 3



continued

Module 8 Cover Assignment: Puzzles in Design (continued)

b) Scale 2.5 : 1



2. Draw a floor plan for a bathroom with measurements of 6′ × 9′ and the following requirements. Grid paper is supplied on the following page. *(3 marks)*

   a) a 2′ × 6′ bathtub/shower combination

   b) a 2′ × 3′ sink in cabinet

   c) a 2′ × 2′ toilet

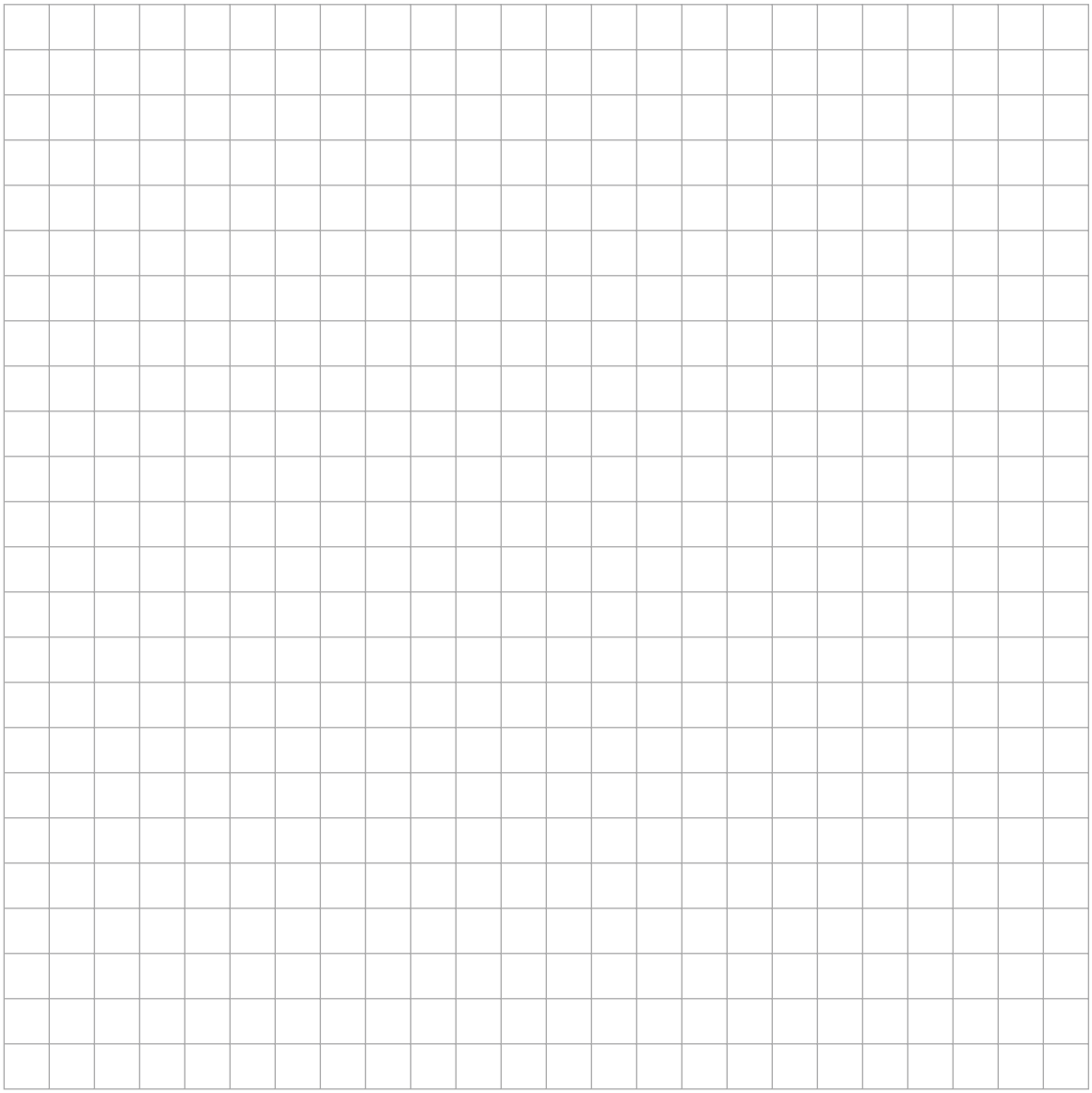
   d) a 3′ door opening

   Be sure to allow enough clearance for the doorway and walkways around the fixtures. Also, state the scale you used.

   Note: 6′ × 9′ denotes a 6 foot by 9 foot room.

continued

Module 8 Cover Assignment: Puzzles in Design (continued)

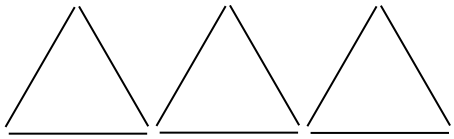


continued

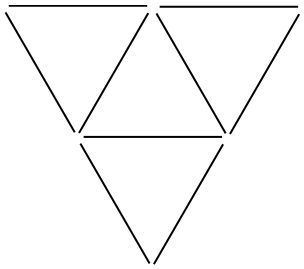
Module 8 Cover Assignment: Puzzles in Design (continued)

Part B: Toothpick Puzzles *(5 marks)*

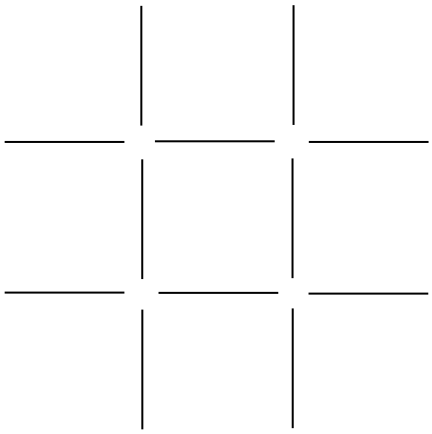
1. These 9 toothpicks form 3 triangles. Move 3 of these toothpicks to create 5 triangles. *(1 mark)*



2. These 9 toothpicks form 4 small triangles and one large triangle. Remove 2 toothpicks to leave 2 triangles. *(2 marks)*



3. This figure contains 12 toothpicks. Move 4 toothpicks to create 5 squares. *(2 marks)*



Be sure to complete Part A and Part B of this cover assignment.

Lesson 1: Accuracy vs. Precision

Lesson Focus

In this lesson, you will

- ❑ study the difference between the "accuracy" and "precision" of a measurement
- ❑ study the difference between the "accuracy" and "precision" of a measuring device such as a ruler
- ❑ perform calculations involving precision
- ❑ observe that all measurements are approximations, which means that there is a degree of uncertainty in all measurements

Lesson Introduction

In previous courses, you measured various figures using both the metric and imperial systems of measurement. In this lesson, you will examine the confidence you have in the measurements you take. You can examine a measurement in terms of either its accuracy or its precision. In everyday language, the terms *accuracy* and *precision* are often used interchangeably. However, a distinction is made between these terms in science and industry.

Accuracy and Precision

Accuracy and precision are two different concepts in measurement. Include the following two definitions on your resource sheet to help you distinguish between the two.

Accuracy is defined as how close a measurement is to the true value or quantity of an object. In other words, the accuracy of a measurement describes how close the measurement is to the "real" value. The closer a measurement is to the true measurement of an object, the greater the accuracy of the measurement.

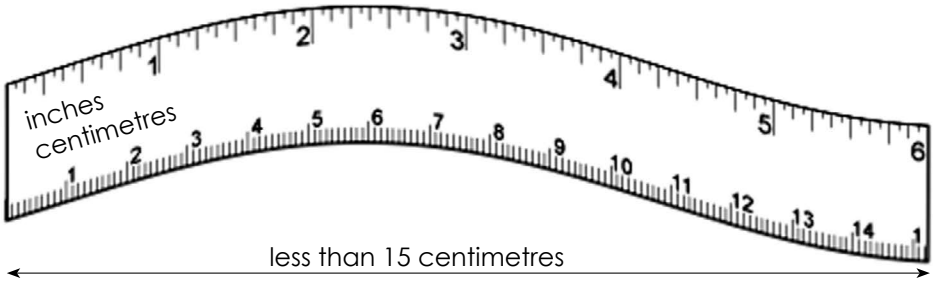
Precision is the degree of exactness of a measurement. The degree of precision is the degree to which there is agreement between several measurements of the same object. Therefore, if you measure an object numerous times and get similar results, the tool used to make the measurements is said to have a high degree of precision.

The **precision of a measuring instrument** is usually stated as the smallest scale division of measurement. The greater the number of divisions on a measuring device, the greater its precision. A common metric ruler divided into millimetres is said to have a precision of 1 millimetre. A common imperial ruler divided into $\frac{1}{16}$ inch intervals is said to have a precision of $\frac{1}{16}$ of an inch. In Lesson 3, you will use a Vernier caliper. The metric Vernier caliper has a precision of one-tenth of a millimetre, while an imperial Vernier caliper has a precision of $\frac{1}{32}$ of an inch. In Lesson 3, you will also learn to use an even more precise instrument, the micrometer. The metric micrometer has a precision of one-hundredth of a millimetre, while an imperial micrometer has a precision of one-thousandth of an inch.

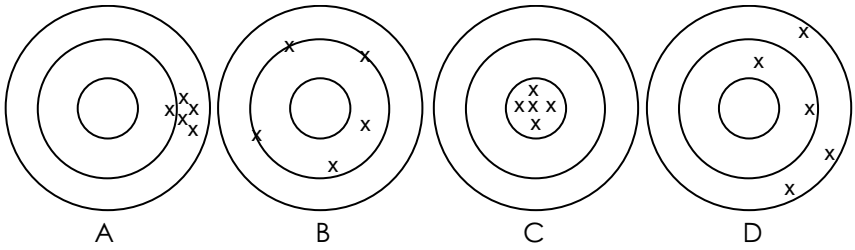
Accuracy versus Precision

Now that you have looked at the difference between accuracy and precision, consider the following questions. Is it possible to have a measurement that is precise but not accurate? Also, is it possible to have a measurement that is accurate but not precise?

Consider the example of a ruler bowed out of shape. Since this ruler gives you the same measurement every time, according to the definition of precision, it is a precise measuring device. Since it does not give you a measure close to the true value of an object, it is not an accurate measuring device. Therefore, this ruler is precise but not accurate.



The difference between the terms *accuracy* and *precision* can be further illustrated by the following target practices where five shots are fired at each target.



In this analogy, accuracy describes the closeness of arrows to the centre of the target. Arrows that are near the centre are considered more accurate. When a number of arrows are shot, precision refers to the size of the cluster of the arrows. If all the arrows are close together, the precision is good. If the arrows are scattered around the target, the precision is poor.

In A, all the shots are to the right of the centre, and so the accuracy is poor. As all five shots are quite close together, the precision is good.

In B, the shots are scattered all over the target with no shot hitting the centre of the target, and so the accuracy is not good. As all five shots are quite far apart, the precision is poor. Note that it is not possible to have good accuracy when the precision is not good.

In C, all the shots are very near to the centre, which means that the accuracy is good. As all the shots are close together, the precision is good as well.

In D, all the shots are to the right of the centre, and so the accuracy is poor. As all five shots are quite far apart, the precision is also poor.

Solving Precision Problems

Consider the following examples involving the precision of measurements of strings.

Example 1

A radius of a circle is measured to be 28 millimetres. State the precision of the measuring device.

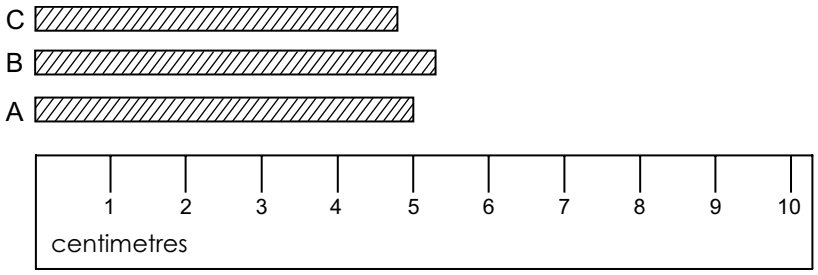
Solution

The measuring device is precise to the nearest millimetre.

A measuring device cannot be more precise than its smallest scale division. As the smallest scale division reported in this measurement is 1 millimetre, this measuring device is precise to the nearest millimetre.

Example 2

Measure the following three strings, using the given ruler. How precise are each of the measurements?



Solution

String A measures 5 centimetres. As the smallest scale division of the ruler is in centimetres, the measurement is precise to the nearest centimetre.

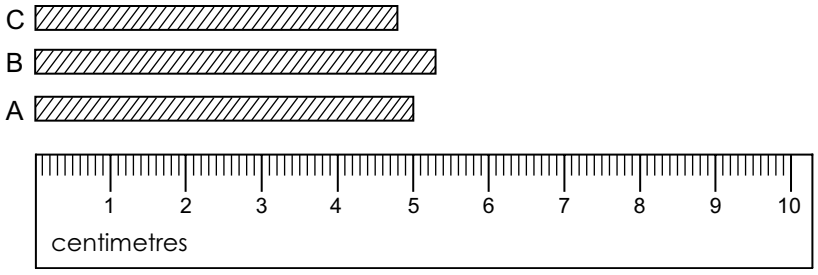
Using the given ruler, strings B and C also measure 5 centimetres. The smallest scale division of the ruler is in centimetres. Therefore, the measurements can be precise only to the nearest centimetre.

The above example illustrates only the concept of precision and not accuracy. The accuracy depends on how close the measurement is to the actual length of the string.

Example 3

a) Measure the following strings, using the given ruler.

b) How precise are your measurements?



Solution

a) String A measures 5.0 centimetres or 50 millimetres.
String B measures 5.3 centimetres or 53 millimetres.
String C measures 4.8 centimentres or 48 millimetres.

b) The measurements are precise to the nearest millimetre.

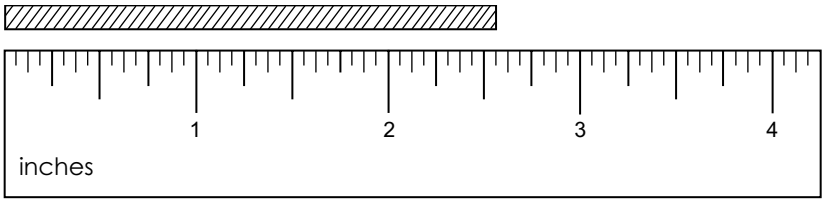
Example 3 measures the same strings as Example 2. However, the strings in Example 3 are measured to a greater degree of precision. Tools such as Vernier calipers and micrometers can measure objects even more precisely.

Sometimes you may be interested in a level of precision less than that indicated by your measuring device. Consider the following example where a string is measured to various levels of precision, using an imperial ruler calibrated to $\frac{1}{16}$ of an inch.

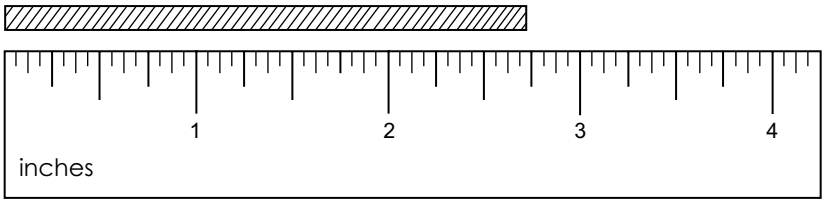
Example 4

Measure the length of the following string precise to the nearest indicated unit, using the given imperial ruler.

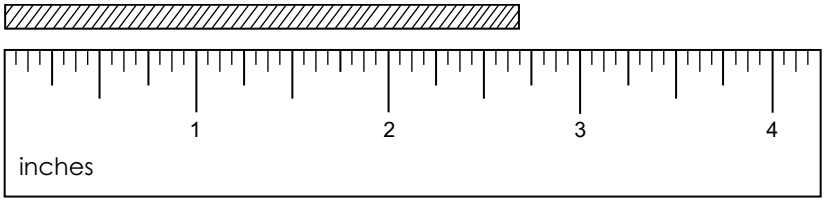
a) $\frac{1}{2}''$



b) $\frac{1}{4}''$

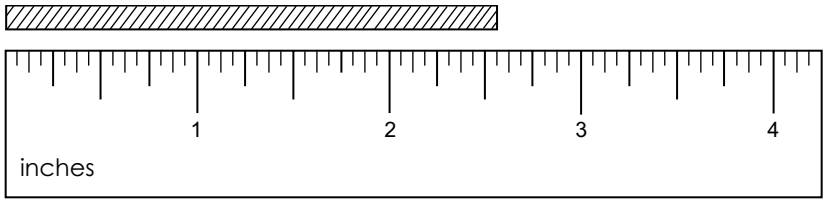


c) $\frac{1}{8}''$



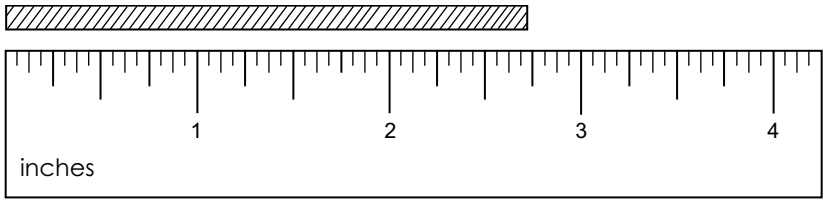
Solution

a)



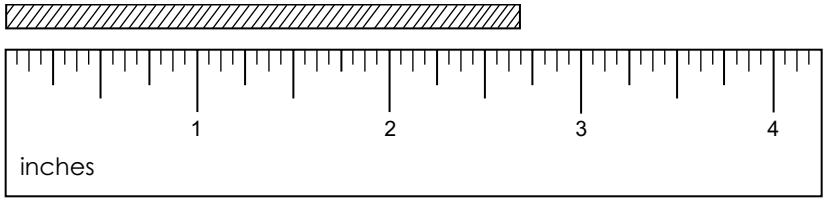
The length of the string is between $2\frac{1}{2}''$ and 3″. Since the string is closer in length to $2\frac{1}{2}''$, the length of the string precise to the nearest $\frac{1}{2}''$ is $2\frac{1}{2}''$.

b)



There are four quarters between 2″ and 3″; $2\frac{1}{4}''$, $2\frac{2}{4}'' = 2\frac{1}{2}''$, $2\frac{3}{4}''$, and $2\frac{4}{4}'' = 3''$. The length of the string is between $2\frac{1}{2}''$ and $2\frac{3}{4}''$. Since the length of the string is closer in length to $2\frac{3}{4}''$, the length of the string, precise to the nearest $\frac{1}{4}''$, is $2\frac{3}{4}''$.

c)



There are eight-eighths between 2″ and 3″. The length of the string is between $2\frac{5}{8}''$ and $2\frac{6}{8}'' = 2\frac{3}{4}''$. Since the length of the string is closer in length to $2\frac{5}{8}''$, the length of the string, precise to the nearest $\frac{1}{8}''$, is $2\frac{5}{8}''$.

Example 5

A homeowner wishes to build a fence around her property. The shape of her property is a rectangle, and the dimensions are 65 m by 32 m.

a) How precise are the dimensions?

b) What is the perimeter of her property?

Solution

a) The dimensions are precise to the nearest metre.

b) The perimeter (or the distance around the property) =
65 + 32 + 65 + 32 = 194 m.

Example 6

A rectangular painting has dimensions 7.8 cm by 9.4 cm.

a) Calculate the area using the given dimensions.

b) State the precision of each dimension.

Solution

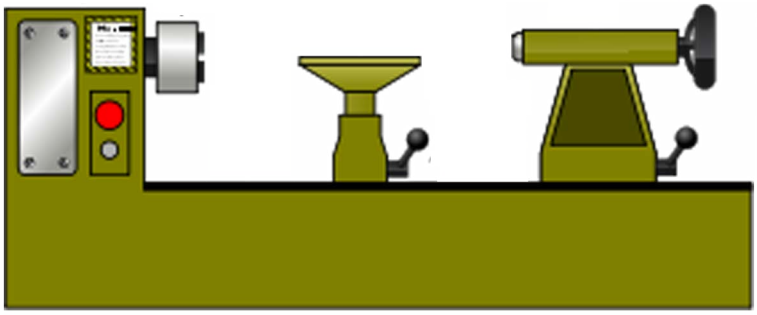
a) Using the given dimensions, the area is $7.8 \times 9.4 = 73.32$ cm^2.

b) Each dimension is precise to the nearest tenth of a centimetre.

Precision and Accuracy in Real Life

Precision and accuracy in measurement are important to all of us in many ways. Some examples are listed below:

- Machining tools (such as lathes and mills) must be very precise to create engine parts with correct (accurate) measurements for today's vehicles. An engine that is built with greater precision produces more power, uses less fuel, creates less pollution, is less noisy, and lasts longer.



- The production of miniature electronic circuits, such as those found in computers, cell phones, and digital appliances, requires a high degree of accuracy and precision.
- For people who require corrective lenses, accuracy is important when their eyes are tested, and precision is essential when lenses for glasses are prepared.
- Accuracy and precision are very important in the preparation of medications we buy at a pharmacy. Pharmaceutical companies must be sure that each pill has the same amount of medication (precision) and that this amount is the correct amount (accuracy).

Learning Activity 8.1

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

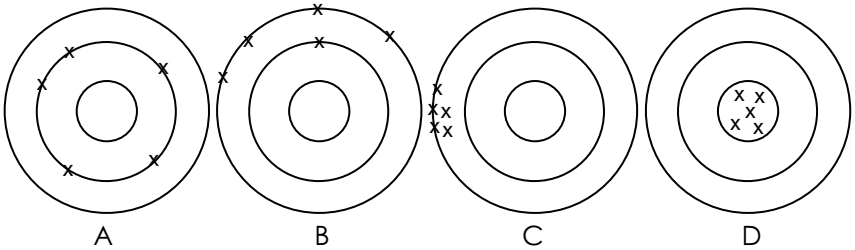
You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Suzanna scores $\frac{26}{75}$ on her world issues test. Estimate the percent score Suzanna receives on this test.
2. What percentile rank is also called the median?
3. 7′2″ = _____ inches
4. How many mm^2 are there in 26 cm^2?
5. There are 15 students missing from a class of 50 students. Write this as a fraction in lowest terms.

Part B: Accuracy and Precision

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

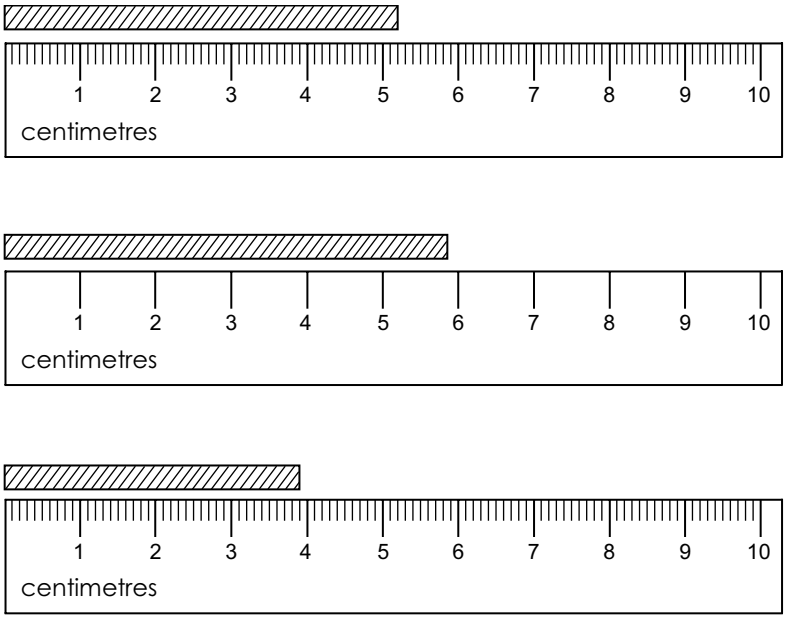
1. Determine whether each of the following target practices demonstrates accuracy, precision, or both accuracy and precision.



continued

Learning Activity 8.1 (continued)

2. a) Measure each of the following strings using the given ruler.
   b) How precise is each measurement?



3. Calculate the precision for each of the following measurements.
   a) 49.8 mm
   b) 36 m
   c) 22.47 cm
   d) 0.0216 mm
   e) 479.203 cm

continued

Learning Activity 8.1 (continued)

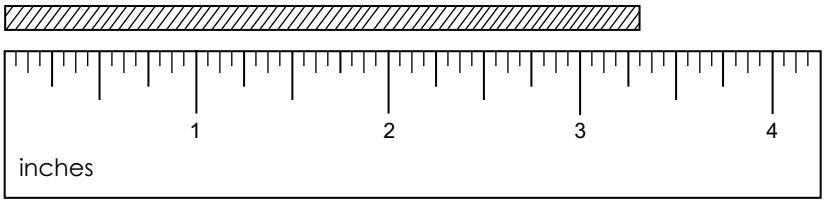
4. Measure the length of the following string, precise to the nearest indicated unit, using the given imperial ruler.

   a) $\frac{1}{2}''$

   b) $\frac{1}{16}''$

   c) $\frac{1}{4}''$

   d) $\frac{1}{8}''$



5. A farmer wishes to rope off a rectangular field. He measures the dimensions of the field to be 203 m by 83 m.
   a) How precise is each of his measurements?
   b) What is the perimeter of his property?

Lesson Summary

In this lesson, you studied accuracy and precision in measurement, and the difference between the two. You also learned where accuracy and precision are important in industry, manufacturing, and the production of various goods.

You may have noticed that all measurements are approximations, and therefore not completely accurate. Therefore, all measurements have a certain degree of uncertainty. In the next lesson, you will study the concept of uncertainty and how it relates to accuracy and precision.

Notes

LESSON 2: UNCERTAINTY

Lesson Focus

In this lesson, you will

- ❑ find the uncertainty of a measurement
- ❑ learn how uncertainty relates to precision
- ❑ learn how uncertainty relates to accuracy

Lesson Introduction

In the previous lesson, you studied the importance of precision and accuracy in measurement. The accuracy of a measurement is always limited by the accuracy and precision of the measuring device. In many disciplines, including physics and engineering, the measurement includes a range of values that is likely to include the true value.

Uncertainty

As stated previously, it is not possible to obtain an exact measurement from any measuring device. The accuracy of a measurement may be limited by the correctness or the precision of the instrument, or by human error. Therefore, when reporting a measurement, the uncertainty in the measurement is sometimes included. This uncertainty is written as:

measured value ± uncertainty

There are many ways to find the uncertainty of a measurement. Consider the following example.

Example 1

Consider the following two figures that represent the measure of the same object. In Figure A, the scale is harder to read as it is smaller. Figure B has a larger scale that is easier to read.

Figure A

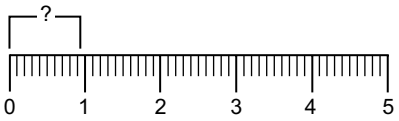


Figure B

A possible reading of the length based on this expanded view would be 0.95 ± 0.05 cm. The uncertainty identifies how confident you are with your reading. The maximum length according to an uncertainty of 0.05 cm and a measurement of 0.95 cm would be 1.00 cm. The minimum length would be 0.90 cm.

Usually, the **uncertainty** of a measurement is determined by the smallest scale division on a measuring device. Therefore, the true value of an object should be within one scale division of the measurement, or half of a scale division in either direction. There are more complex ways of addressing uncertainty, but this is the one you will be using in this course.

Include this definition of uncertainty on your resource sheet.

Uncertainty and Precision

The uncertainty of a measurement is related to precision of the measuring device. For example, a ruler that is precise to $\frac{1}{10}$ cm, or 1 mm, will have an uncertainty of ± 0.5 mm. The ruler is precise to the nearest millimetre because this is the smallest scale division on the ruler. As uncertainty is half of a scale division greater or less than the measurement, half a millimetre must be added to or subtracted from the measurement. The uncertainty is written as ±0.5 mm.

Example 2

Leila measures the radius of a circle and finds the radius to be 28 millimetres.

a) State the precision of the measuring device used.

b) State the uncertainty of the measurement.

c) State the measurement Leila should report (including the uncertainty).

Solution

a) The measuring device is precise to the nearest millimetre.

b) The uncertainty of the measurement is 0.5 mm in either direction: ±0.5 mm.

c) Leila should report that she found a measurement of 28 mm ± 0.5 mm.

Example 3

Brendon measures his height and finds it to be 72.0 cm.

a) State the precision of the measuring device used.

b) State the uncertainty of the measurement.

c) State the measurement Brendon should report (including the uncertainty).

Solution

a) Brendon found his height to be 72.0 cm and not 72 cm. This means that the measuring device Brendon used is precise to the nearest millimetre. (If Brendon had reported his height as 72 cm, the measuring device would have been precise to the nearest centimetre.)

b) The uncertainty of the measurement is ±0.05 cm.

c) Brendon should report his height as 72.0 cm ± 0.05 cm.

Uncertainty and Accuracy

The true measurement of an object cannot be absolutely determined because of the uncertainty of measuring devices. Devices with greater precision may provide increasingly precise answers; however, these answers aren't necessarily accurate. In some situations, a reference value is accepted as the true value. For example, you may use 3.14 as the value of π. This value isn't truly accurate, but it is the accepted value when the required degree of accuracy is two decimal places.

For an instrument to provide accurate readings, it must be **calibrated**. To calibrate means to adjust or make corrections. Therefore, instruments may need to be adjusted in order for them to provide accurate readings. Consider the following example.

Example 4

A 100 g baseball is weighed three times on a very precise scale. The three weights are 84.523 g, 84.528 g, and 84.531 g.

a) Comment on the degree of precision of the scale.

b) Comment on the degree of accuracy of the measurements.

c) What may cause the measures to be inaccurate?

Solution

a) The degree of precision is good since these three measures of weight are very similar. The precision of the scale is to the nearest 0.001 g.

b) The degree of accuracy of the scale is not good since these three measures of weight are not close to the known weight of the baseball (100 g).

c) The measurements may be inaccurate because the calibration of the scale is faulty. Instruments may provide precise readings; however, these instruments need to be calibrated in order to provide accurate readings. Therefore, this scale may not have been calibrated properly. It is also possible that a human error occurred, such as putting the wrong baseball on the scale or reading the scale incorrectly.

When measuring devices such as scales and thermometers are calibrated properly, the instruments will likely provide accurate measurements. These accurate measurements usually include the accepted (true) measurement within the range of uncertainty. Consider the following example.

Example 5

The accepted measurement for acceleration due to gravity on Earth is 9.8 m/s^2. Abigail completed an experiment designed to measure the acceleration due to gravity by dropping various objects and measuring the distance the objects fell and the time it took for the objects to fall. After completing all the calculations, Abigail found a measurement that was $9.5 m/s^2 \pm 0.5 m/s^2$.

a) Is the accepted value for acceleration due to gravity within the range of uncertainty that Abigail calculated? Explain why Abigail may have received this result.

b) If Abigail found the measurement for acceleration due to gravity to be $9.5 m/s^2 \pm 0.2 m/s^2$, would the accepted value fall within the range of uncertainty? Explain why Abigail may have received this result.

Solution

a) Abigail measured gravity to be 9.5 m/s^2 ± 0.5 m/s^2. The lowest possible value is 9 m/s^2 and the highest possible value is 10 m/s^2. Therefore, the accepted value, 9.8 m/s^2, is in this range. This may have occurred because Abigail took precise and accurate measurements using properly calibrated measuring devices.

b) If Abigail measured acceleration due to gravity to be 9.5 m/s^2 ± 0.2 m/s^2, the lowest possible value would be 9.3 m/s^2, while the highest possible value would be 9.7 m/s^2. Therefore, the accepted value does not fall in this range. This may have occurred because Abigail did not get accurate measurements due to using a measuring device that wasn't calibrated properly. Abigail could also have committed a human error by not reading the measuring devices properly, or by making a calculation error.

Complete the following learning activity. Similar questions will appear on the assignment following this lesson, as well as on the final examination.

Learning Activity 8.2

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. If the volume of a 2 × 2 × 2 cube is 8 units, approximately how many times larger would the volume be if the dimensions of the cube were 5 × 5 × 5?

2. 135 cm = _____ m

3. Simplify this fraction: $\frac{40}{300}$

4. 3 feet and 1212 inches = _____ feet

5. Consider the expression $y = 3x$. What is the value of x when $y = 54$?

continued

Learning Activity 8.2 (continued)

Part B: Uncertainty

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Describe the precision of the measuring device used and the uncertainty of the following measurements.
   a) 54.3 mm
   b) 48 m
   c) 46.4 cm
   d) 0.35733 mm
   e) 2362.24 cm
2. Fredrick measures the radius of a circle and finds the radius to be 35.75 mm.
   a) State the precision of the measuring device.
   b) State the uncertainty of the measuring device.
   c) State the measurement Fredrick should report (including the uncertainty).
3. Consider the connection between accuracy and uncertainty. Explain why some measurements may be inaccurate; include the concept of uncertainty in your explanation.
4. The accepted value for π is 3.14. Arianna measured the circumference and diameter of a circle, and then divided the circumference by the diameter to determine a value for π. Arianna calculated that π was equal to 3.1 ± 0.1. Is the accepted value for π within the range of uncertainty that Arianna calculated? Explain why Arianna may have received this result.

Lesson Summary

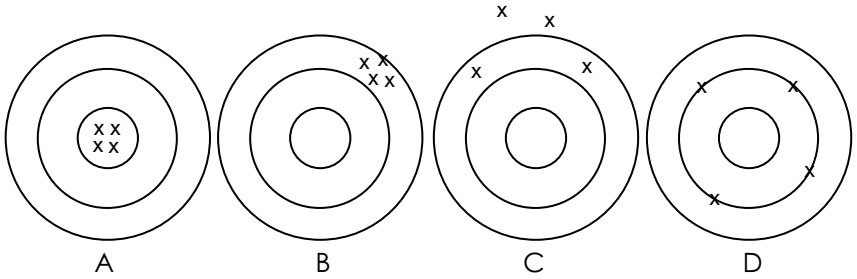
In this lesson, you studied the concept of uncertainty and how it is related to the accuracy and precision of measurements. In the next lesson, you will study two measuring devices you can use to measure objects with increased precision: the Vernier caliper and the micrometer.

Assignment 8.1

Accuracy, Precision, and Uncertainty

Total: 29 marks

1. State whether each of the following target patterns displays a high degree of accuracy, a high degree of precision, both precision and accuracy, or neither. *(4 marks)*



continued

Assignment 8.1: Accuracy, Precision, and Uncertainty (continued)

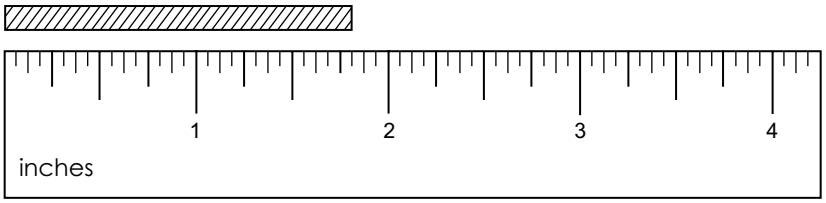
2. Measure the length of the following string, precise to the nearest indicated unit, using the given imperial unit. *(4 marks)*

   a) $\frac{1}{8}''$

   b) one inch

   c) $\frac{1}{2}''$

   d) $\frac{1}{4}''$



continued

Assignment 8.1: Accuracy, Precision, and Uncertainty (continued)

3. Tatiana measures the dimensions of a painting as 8.6 cm by 7.4 cm.
   a) How precise are each of these measurements? *(1 mark)*

   b) Calculate the perimeter of the painting. *(1 mark)*

   c) Calculate the area of the painting. *(1 mark)*

4. Explain how accuracy is related to uncertainty. *(2 marks)*

continued

Assignment 8.1: Accuracy, Precision, and Uncertainty (continued)

5. Describe the precision of the measuring device used and the uncertainty of the following measurements. *(8 marks)*

   a) 3.0 cm

   b) 5.6 mm

   c) 3 m

   d) 0.004 cm

6. Kerry measures the diameter of her pencil eraser and finds it to be 0.9 cm. *(3 marks)*

   a) State the precision of the measuring device used.

   b) State the uncertainty of the measurement.

   c) State the measurement Kerry should report (including the uncertainty).

continued

Assignment 8.1: Accuracy, Precision, and Uncertainty (continued)

7. A 1 kg object is weighed four times. The four readings are 1.005 kg, 0.998 kg, 0.995 kg, and 1.002 kg. *(3 marks)*

   a) Comment on the degree of precision of the measuring device used.

   b) Comment on the degree of accuracy of the measurements.

   c) What may cause the measurements to be inaccurate?

8. The accepted measurement for the density of aluminum is 2.70 g/cm^3. After completing an experiment, Heath found the density of aluminum to be 2.76 g/cm^3 $\pm$ 0.06 g/cm^3. Is the accepted value for the density of aluminum within the range of uncertainty that Heath found? Explain why Heath may have received this result. *(2 marks)*

Notes

Lesson 3: Calipers and Micrometers

Lesson Focus

In this lesson, you will

- ❑ read a metric Vernier caliper and a metric micrometer
- ❑ compare the precision and accuracy of a ruler, a Vernier caliper, and a micrometer
- ❑ explore the limitations of using each of the above measuring devices

Lesson Introduction

In Lesson 1, you used imperial and metric rulers to measure the lengths of strings. The precision of each of these instruments is adequate to measure string. There are times, however, when you need measurements that are more precise.

People in different professions use various instruments to measure lengths to different degrees of precision. In North America, carpenters usually measure lengths rounded to the nearest $\frac{1}{16}$ of an inch, while automotive mechanics measure lengths of engine parts rounded to the nearest $\frac{1}{1000}$ of an inch or $\frac{1}{100}\left(\text{and sometimes } \frac{1}{1000}\right)$ of a millimetre.

In this lesson, you will review two of these specialized instruments: Vernier calipers and micrometers. It would be useful to have a metric Vernier caliper and a metric micrometer for this lesson so that you can practise reading measurements from these devices. However, if you do not have access to these instruments, you can still do this lesson.

Precision Measurements

Note: On the final examination, you will not be required to read measurements using Vernier calipers or micrometers. However, there is an assignment at the end of the next lesson that will include this material. For your examination, you *do* need to know the limits of precision of certain measuring devices and how to compare the accuracy of two measuring devices.

Metric rulers can be used to make measurements precise to the nearest tenth of a centimetre, and imperial rulers can be used to make measurements precise to the nearest $\frac{1}{16}$ of an inch.

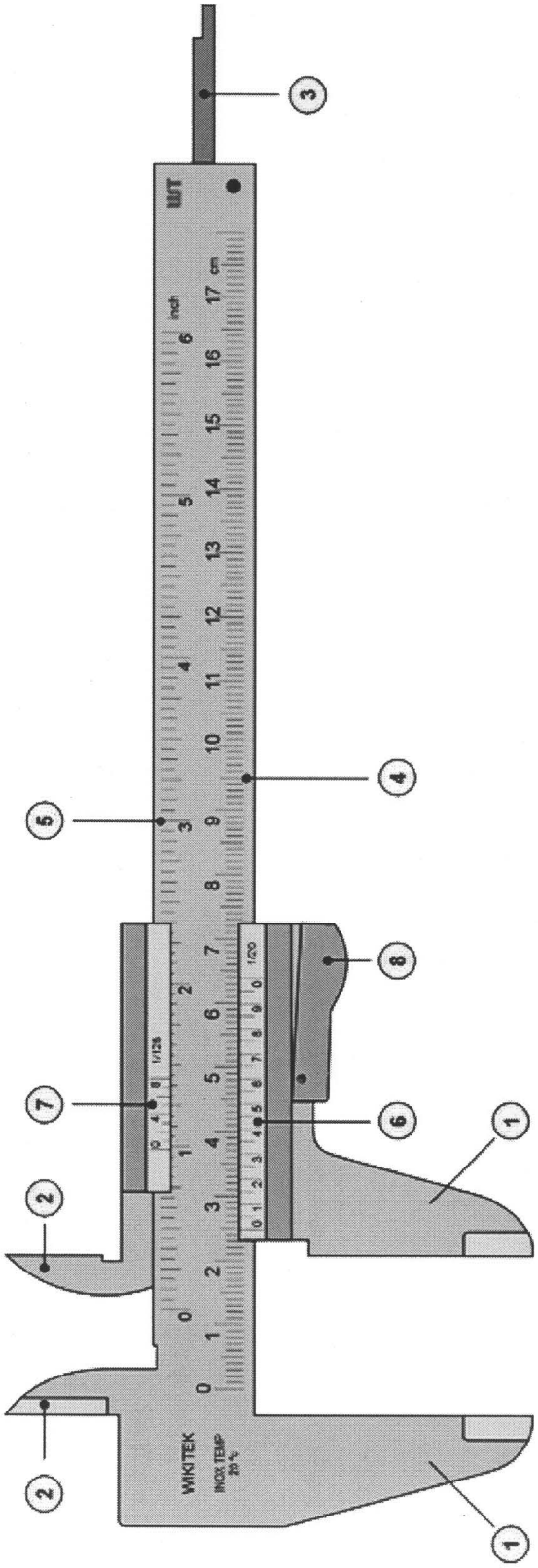
Vernier calipers and micrometers are two instruments that can be used to provide more precise measurements. Vernier calipers are precise to the nearest hundredth of a centimetre and micrometers are precise to the nearest thousandth of a centimetre.

Imagine a simple plastic cap that fits onto the end of a ballpoint pen. The manufacturer who makes this cap has to use precision measurements. If the inside diameter of the cap is too small, it will not fit. If the diameter is too large, the cap will fall off. The workers must be sure to use exact, precise measurements such as those made by Vernier calipers or micrometers when manufacturing these caps.

Vernier Calipers

This Vernier caliper has various parts, including the ones listed below and shown on the diagram on the opposite page.

1. **Outside jaws:** used to take external measures of objects
2. **Inside jaws:** used to take internal measures of objects
3. **Depth probe:** used to measure the depth of objects
4. **Main scale** (cm)
5. **Main scale** (inch)
6. **Vernier scale** (cm)
7. **Vernier scale** (inch)
8. **Retainer:** used to block movable parts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4
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INOX TEMP
20 °C

Three devices for measuring:

1. The outside jaws are used to measure the outer dimensions of objects, such as the outer diameter of a pipe.
2. The inside jaws are used to measure the inner dimensions of objects, such as the inside diameter of a pipe.
3. The depth gauge is used to measure the depth of objects, such as the depth of a small container.

Two measurement scales:

1. A fixed or main scale, in both metric and imperial units
2. A moving or sliding Vernier scale, in both metric and imperial units

The fixed scale does not move, and the moving scale is called the Vernier scale.

In this course, you will measure lengths using a *metric* Vernier caliper.

The fixed scale on a Vernier caliper is divided into millimetres, which are 0.1 cm or $\frac{1}{100}$ of a centimetre. The moving Vernier scale is divided into 0.1 millimetres, which is the same as $\frac{1}{10} \times \frac{1}{10} = \frac{1}{100}$ cm.

Therefore, measurements taken with a Vernier caliper are precise to the nearest hundredth of a centimetre $\left(\frac{1}{100} \text{ of a centimetre} = \frac{1}{10} \text{ of a millimetre}\right)$.

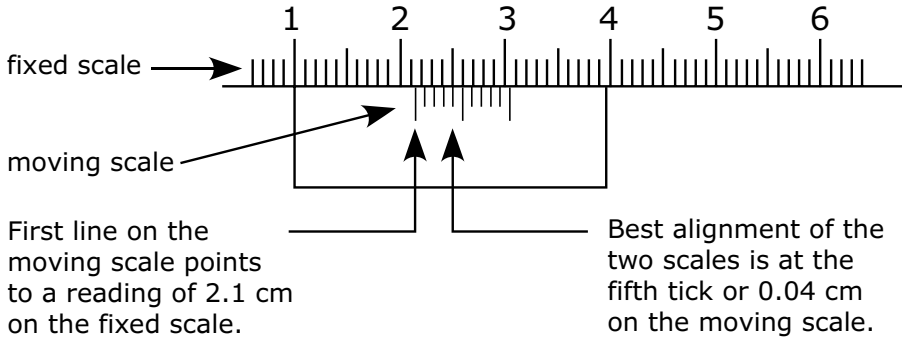
The only possible reading from the Vernier scale is one of the following numbers: 0.00, 0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, or 0.09.

Reading Vernier Calipers

The following examples will help you read a Vernier caliper.

Example 1

Read the following Vernier caliper measurement.



Solution

Step 1: Read the fixed scale, using the first (left) line on the moving scale as a pointer. This line points to a place between 2.1 cm and 2.2 cm. You state the reading from the fixed scale as 2.1 cm, giving you a precision unit to the nearest tenth of a centimetre. You had this much precision with a ruler.

Step 2: Find the line on the moving scale that most closely aligns with a mark on the fixed scale. In this case, the line that best matches is the fifth line on the moving scale. Since the moving scale has 10 divisions, and each division represents 0.01 cm, the reading is 0.04 cm.

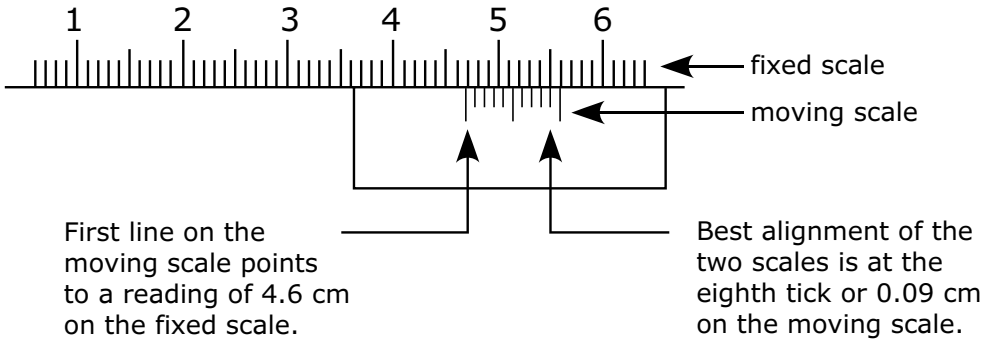
Step 3: State the total measurement.

In this case, the reading on the caliper = 2.1 cm + 0.04 cm = 2.14 cm.

Now you have a measurement that is precise to the nearest hundredth of a centimetre. This is considerably more precise than using a ruler.

Example 2

Read the following Vernier caliper measurement.



Solution

Step 1: The first arrow on the movable scale points to a place on the fixed scale between 4.6 and 4.7. The reading is 4.6 cm.

Step 2: The second arrow points to the alignment of the two scales at the eighth tick mark on the moving scale. The reading is 0.09 cm.

Step 3: Therefore, the total reading = 4.6 cm + 0.09 cm = 4.69 cm.

Using Vernier Calipers and/or Virtual Calipers

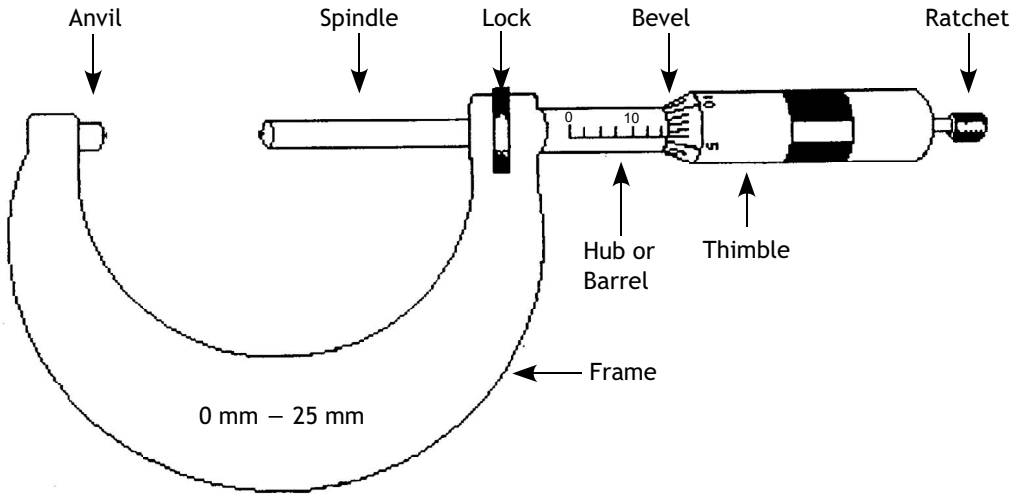
If you have access to a Vernier caliper, use it to practise measuring the widths of various small objects. If you have access to the Internet, you can use virtual calipers to practise reading the measurements. If you don't have access to a Vernier caliper or the Internet, you should still be able to answer the questions in this lesson.

There are many Internet sites that include virtual calipers. You set the width, and read the scale. Then the site tells you if you read it correctly. Enter "Vernier caliper virtual" into your search engine, and try some of them. They are very good practice for reading Vernier scales.

Micrometers

Micrometers are often even more precise than Vernier calipers, with a precision of *one-thousandth* of a centimetre. This is 10 times more precise than a Vernier caliper.

The following diagram shows the key components of a micrometer.



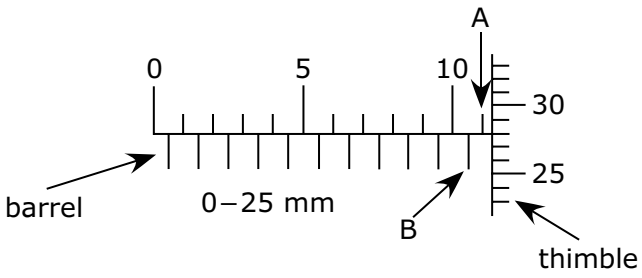
Note the following parts of the instrument.

- The measuring device is called the jaws. The anvil and spindle are used to measure small lengths between 0 mm and 25 mm (as indicated on the device).
- There are two measurement scales. The fixed scale is on the barrel, which has 25 main divisions (1 mm each) and 25 subdivisions (marking 0.5 mm). The moving scale is called the thimble, and has 50 divisions (marking 0.01 mm each). The scale of the thimble makes it possible to measure accurately to the nearest hundredth of a millimetre, or thousandth of a centimetre.
- On any micrometer, there is only one system of measurement—either metric or imperial, not both. To get measurements in both systems, you would need two different micrometers.

Reading Micrometers

Example 3

Read the following micrometer measurement.



Solution

Step 1: Read the upper barrel scale in mm. The reading will be a whole number from 0 mm to 24 mm. In this diagram, the measure of the last marking showing on the upper scale, indicated by the arrow at A, is 11 mm.

Step 2: Read the lower barrel scale. This scale marks points halfway between each millimetre marking on the top scale. The reading will be either 0.0 mm or 0.5 mm. In this diagram, the arrow at B is before the arrow at A, so the reading is 0.0 mm. Thus, the final reading will be between 11.00 mm and 11.50 mm.

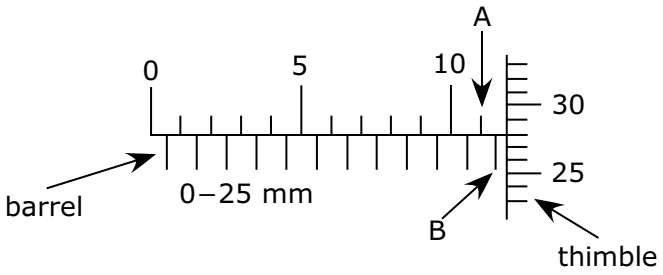
Step 3: The thimble reading is written as a decimal from 0.00 mm to 0.49 mm. In the diagram, the reading on the thimble is 0.28 mm.

Step 4: Add the readings from Steps 1, 2, and 3 to arrive at the final answer.

The sum is 11 mm + 0.0 mm + 0.28 mm = 11.28 mm.

Example 4

Read the following micrometer measurement.



Solution

Step 1: The measure of the last marking showing on the upper barrel scale, indicated by arrow A, is 11 mm.

Step 2: The lower barrel scale shows a marking, indicated by arrow B, to the right of arrow A. This means the reading is 0.5 mm. In other words, the reading is more than halfway past 11 mm. The final reading will be between 11.50 mm and 11.99 mm.

Step 3: The thimble reading is 0.28 mm.

Step 4: The resulting measurement: 11 mm + 0.5 mm + 0.28 mm = 11.78 mm.

Using Micrometers and/or Virtual Micrometers

If you have access to a micrometer, use it to practise measuring the widths of various small objects. To get accurate readings from your micrometer, you may need to calibrate it. You can do this by closing the micrometer to check that it reads 0.000 when closed. If the closed reading is not 0.000, you will need to adjust your final readings accordingly to get an accurate measurement. If you have access to the Internet, you can practise taking measurements using virtual micrometers. If you don't have access to a micrometer or the Internet, you should still be able to answer the questions in this lesson.

With your micrometer, find the thickness of 20 sheets of paper, a hairpin, or even the rim of a coffee mug. Place the object between the jaws, and then rotate the thimble using the ratchet. When the object is secure and you have heard a few clicks on the ratchet, read the measurement.

There are many Internet sites that have virtual micrometers. You set the width and read the scale. Then the site tells you whether you read it correctly. If you have access to the Internet, enter "micrometer virtual" into your search engine and try some of them. They provide good practice for reading a micrometer.

Learning Activity 8.3

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Calculate the volume of a cube with each side measuring 30 cm.
2. Calculate: $\frac{9}{16}$ of 24
3. What is the unit price of a pen if 10 pens cost $5?
4. 0.42 km = _____ m
5. Calculate the price, including the taxes, of a $25 DVD on sale for 20% off.

Part B: Vernier Caliper and Micrometer Measurements

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

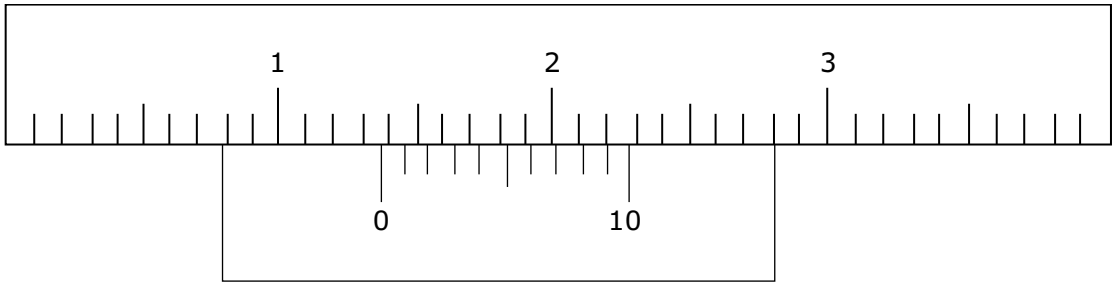
Note: This material will be on your next assignment. However, the material in this learning activity will not be on your final examination.

Write the measurement as shown on the following Vernier caliper diagrams. Read the measurements to the nearest hundredth of a centimetre.

continued

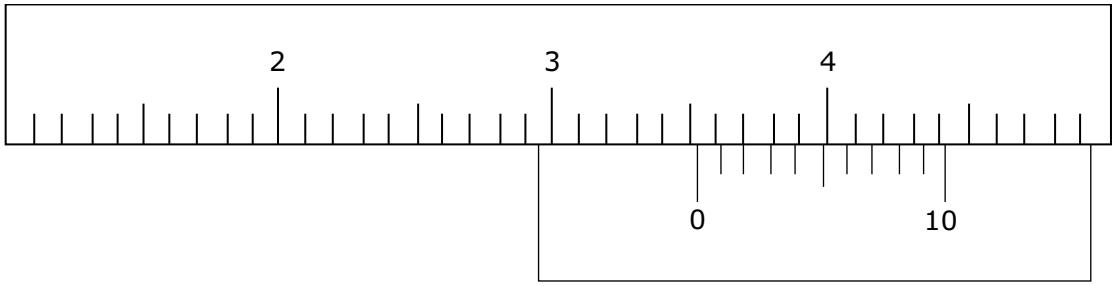
Learning Activity 8.3 (continued)

1.



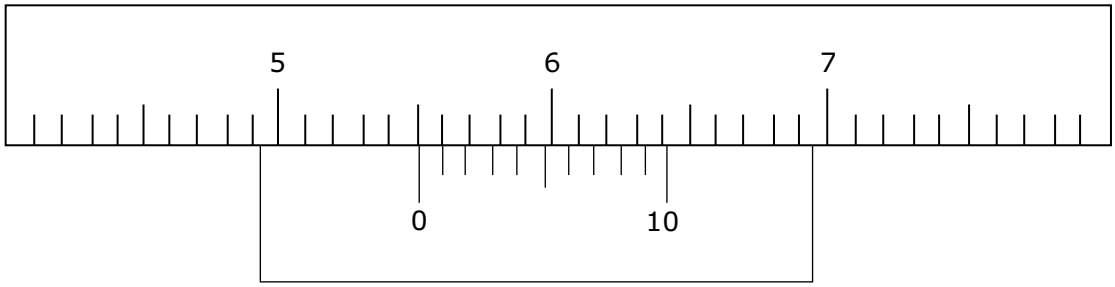
Reading = _____

2.



Reading = _____

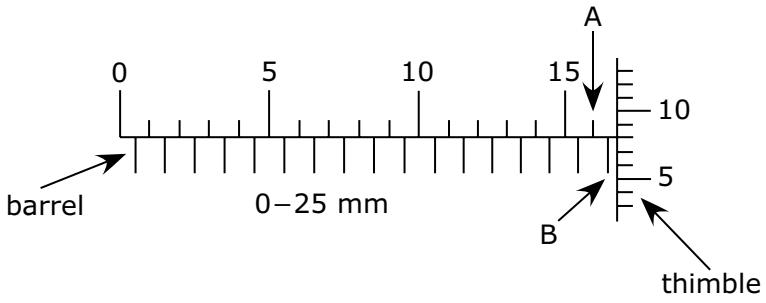
3.



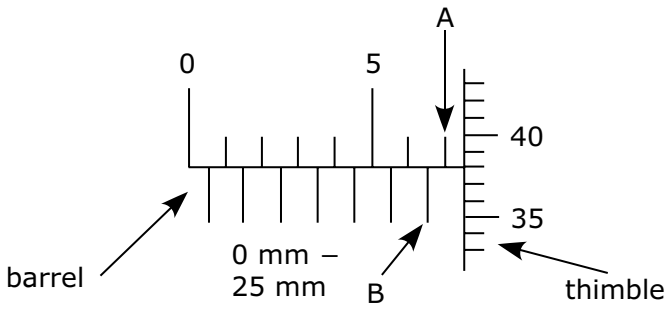
Reading = _____

continued

4. Read the following micrometer measurement.



5. Read the following micrometer measurement.



Limitations of Measuring Instruments

You should now be able to use at least three measuring devices to measure length: a ruler, a Vernier caliper, and a micrometer. Each of these three instruments has its own limitations.

Compare your answers to the list of potential limitations provided at the end of this lesson. Include on your resource sheet all of these limitations, as well as the ones you come up with on your own.

Ruler

A ruler is mostly used for measuring the length, width, and depth of an object. Rulers have many limitations. One example is the following:

- Rulers are only precise to the nearest millimetre.

Together with your learning partner, try to think of other limitations you have when measuring with a ruler.

Vernier Calipers

Vernier calipers are used to measure the external and internal dimensions of an object, as well as the depth of an object. Measurements with a Vernier caliper are more precise than measurements with a ruler. But Vernier calipers still have some limitations. One example is the following:

- Some Vernier calipers may be made of inexpensive material and therefore may not be as accurate as more expensive Vernier calipers.

Together with your learning partner, try to think of other limitations you have when measuring with a Vernier caliper.

Micrometer

Micrometers are used to measures external dimensions, and are more precise than Vernier calipers. However, micrometers still have some limitations. One example is the following:

- Micrometers can only measure shorter lengths.

Together with your learning partner, try to think of other limitations you have when measuring with a micrometer.

Comparing the Accuracy of Precision Measurement Instruments

When precision measuring instruments are properly calibrated (in other words, these instruments are measuring the correct distance), the instrument with the greater degree of precision should yield a more accurate measurement than the instrument with a smaller degree of precision. Consider the following example.

Example 5

The length of an object is 5.7437 mm, as determined by a very precise and accurate measuring device. This object is now measured four times with four different measuring tools.

Figure A

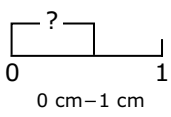


Figure B

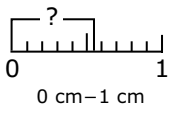


Figure C

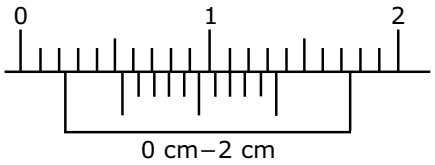
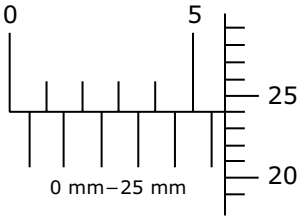


Figure D



a) Find the measurement of Figure A.

b) Find the measurement of Figure B.

c) Find the measurement of Figure C.

d) Find the measurement of Figure D.

e) Compare the degree of accuracy of these four measurements using tools with varying degrees of precision. Which of these measurements represents the lowest degree of accuracy? Which of these measurements represents the highest degree of accuracy?

Solution

a) Figure A is between 0 cm and 1 cm. An approximate measurement would be 1 cm ± 0.5 cm.

b) Figure B is between 5 and 6 mm. An approximate measurement would be 0.6 mm ± 0.05 mm.

c) Figure C represents a measurement of 0.57 cm ± 0.005 cm or 5.7 mm ± 0.05 mm.

d) Figure D represents a measurement of 5.74 mm ± 0.05.

e) The lowest degree of accuracy is achieved using a tool with a low degree of precision and is represented by the measurement from Figure A where the uncertainty is ±0.5 cm. The highest degree of accuracy is achieved using a tool with a high degree of precision and is represented by the measurement from Figure D where the uncertainty is ±0.005 mm.

Learning Activity 8.4

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Complete the pattern : 9, 18, 27, 36, _____ , _____
2. Solve for x: $\frac{7}{8} + 4 = \frac{x}{8}$
3. Claudia is 5′5″ tall. Calculate her approximate height in centimetres. (1 inch = 2.54 cm)
4. What is the perimeter of a triangle with sides measuring 3.6 cm, 3.2 cm, and 4.1 cm?
5. Evaluate: $\frac{3}{7} - \frac{1}{4}$

Part B: Analyzing Measurements

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Consider the following scenarios. State which measuring device (ruler/tape measure, Vernier caliper, or micrometer) is most suitable for each situation.
   a) Instead of hiring a carpenter to redo your kitchen, you have decided to install your own cupboards. Which measuring device should you use? Explain.
   b) You are trying to install your above-ground pool. In order to get the pump working, you need to measure the inside of one pipe to find another pipe that will fit. Which measuring device should you use? Explain.

continued

c) A mechanic for a stock car racing team must measure the diameter of a crankshaft (part of an engine) to determine whether it is worn too much to use for the next race. Which measuring device should he use? Explain.

d) You are measuring your room to determine whether your room is large enough for a queen size bed. Which measuring device should you use?

2. Consider a Vernier caliper and a micrometer that are calibrated properly.

   a) Explain which device would yield more precise measurements when both devices are used to measure the same object.

   b) Explain why these measurements are never completely accurate.

Limitations of Measuring Instruments Answer Key

Ruler

- It is difficult to measure curved objects with a ruler.
- You can only use rulers on straight edges.
- It is difficult to measure the depth of a narrow container.

Vernier Calipers

- Vernier calipers may sometimes be difficult to read, depending on your eyesight.
- It can be difficult to judge when to stop tightening or closing the jaws.
- The precision of a Vernier caliper is only 1/100th of a millimetre, which is not as high as the precision of a micrometer.
- Most Vernier calipers can be used to measure objects no larger than about 15 centimetres

Micrometer

- It can be difficult to judge when to stop turning the thimble if you are measuring a flexible object.
- A micrometer cannot be used to measure the interior of a hollow object, such as a pipe.

Lesson Summary

In this lesson, you reviewed the procedures for determining length when using a Vernier caliper and a micrometer. You compared the precision and accuracy of a ruler, a Vernier caliper, and a micrometer. Then you explored the limitations of using each of these three tools.

In the next lesson, you will study tolerance, which is the amount of variation acceptable in manufactured goods.

Notes

Lesson 4: Tolerance

Lesson Focus

In this lesson, you will

- ❑ explore the need for tolerance in measurements of manufactured goods
- ❑ write the lower and upper limits of measurement (i.e., the tolerance levels) in four ways
- ❑ calculate the tolerance of a measurement, given the lower and upper levels of measurement
- ❑ calculate the tolerance, upper, and lower limits for area and volume

Lesson Introduction

When objects are manufactured, no two will be exactly the same size. This is due to errors in construction that cannot be totally overcome. As a result, designers allow for error, but only to a set limit. The measurements still need to be accurate to within a certain degree so that parts fit properly.

Tolerance

When designers give dimensions for objects to be built, they know the actual dimensions will not match exactly. The builders come as close as possible to the specified target value, called the **nominal value**.

The limit of error that designers allow in the construction of an object is called the **tolerance level**.

Include these definitions on your resource sheet.

Different situations call for different levels of tolerance. For example, when the wheels are made for a particular type of car, the hole pattern of the wheels must be very similar to the bolt pattern on the vehicle or the wheel will not fit the vehicle. When the wheels are constructed, they must be made with a tolerance level of ± 0.001 inches.

When carpenters build a house, the tolerance level for the measurements will be greater. Even though accuracy is important, the fact that measurements may be off by a small amount (for example, $\pm\frac{1}{16}$ of an inch) will not affect the function of the house.

Some manufactured goods must be built to a very low level of tolerance. For example, tolerance levels for many aircraft parts are ±0.0001 inch. The equipment used to manufacture the parts requires a high degree of precision.

Tolerance Limits

The nominal (target) value and the tolerance levels are always given by the designer of the object. These tolerance levels will determine the allowable limits of the size of an object.

Example 1

A measurement calls for 8.231 ± 0.002. What is the measurement's upper and lower limits?

Solution

The maximum limit is 8.231 + 0.002 = 8.233.

The minimum limit is 8.231 − 0.002 = 8.229.

Example 2

What are the maximum and minimum limits of a measurement of $92 \pm \frac{1}{4}$?

Solution

The maximum limit is $92\frac{1}{4}$.

The minimum limit is $91\frac{3}{4}$.

Tolerance is the difference between the maximum limit and the minimum limit.

Tolerance = maximum limit − minimum limit

Include this definition on your resource sheet.

For the above examples, the tolerances would be:

Example 1: $8.233 - 8.229 = 0.004$ and

Example 2: $92\frac{1}{4} - 91\frac{3}{4} = \frac{1}{2}$

Methods of Stating Tolerance Levels

Although there is only one way of calculating tolerance, there are different ways of stating tolerance levels.

1. **Limit Dimensioning:** This method states the maximum and minimum limits for the measurement. It can be stated horizontally or vertically. If stated horizontally, the lower limit is followed by the upper limit, separated by a hyphen. If the vertical approach is used, the higher limit is stated on top and the lower limit below.

   Examples

   7.75 − 7.79 would indicate a lower limit of 7.75 and an upper limit of 7.79.

   The **nominal** value is 7.77, which is the mean of the upper and lower limits.

   $\begin{matrix}83.16\\82.98\end{matrix}$ indicates an upper limit of 83.16 and a lower limit of 82.98.

   The **nominal** value is 83.07, which is the mean of the upper and lower limits.

2. **Plus and Minus Tolerance Level Notation:** In this method, the basic measurement is stated, followed by plus and minus tolerance levels.

   Example

   8.231 ± 0.002 would indicate a maximum limit of 8.233 and a minimum limit of 8.229. The **nominal** value is 8.231.

3. **Bilateral Tolerance Level Notation:** This method indicates tolerance levels that may be different. The upper tolerance level is written above the lower tolerance level, and both are to the right of the basic measurement.

   Example

   $52.6\,^{0.3}_{-0.1}$ indicates an upper limit of 52.9 and a lower limit of 52.5. The **nominal** value is 52.6 as given (notice it is not the mean in this notation).

4. **Unilateral Tolerance Level Notation:** This is stated exactly as in the bilateral approach, but one dimension has a tolerance of 0, and the other dimension is stated with either a plus or minus sign.

   Example

   $636\,^{0}_{-5}$ indicates an upper limit of 636 and a lower limit of 631. The **nominal** value is 636 as given (notice it is not the mean in this notation).

Note: Each of these four methods of stating tolerance levels are used in a variety of trades. If you have access to the Internet or know some people who work in a trade or trades that you are interested in pursuing, find out which method is preferred by which trade or industry.

Example 3

Given the following measurements with tolerance levels, calculate the upper and lower limits of measurement and the tolerance. Remember, tolerance is the maximum limit minus the minimum limit.

a) $A = 56.0 \pm 0.3$

b) $B = 5.23 - 6.34$

c) $C = 5.3^{0.4}_{-0.3}$

d) $D = 3.65^{+0.07}_{0}$

Solution

a) The upper limit is $56.0 + 0.3 = 56.3$.
The lower limit is $56.0 - 0.3 = 55.7$.
The tolerance is: $56.3 - 55.7 = 0.6$.

b) The upper limit is 6.34.
The lower limit is 5.23.
The tolerance is: $6.34 - 5.23 = 1.11$.

c) The upper limit is $5.3 + 0.4 = 5.7$.
The lower limit is $5.3 - 0.3 = 5.0$.
The tolerance is: $5.7 - 5.0 = 0.7$.

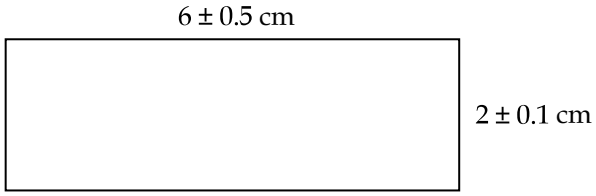
d) The upper limit is $3.65 + 0.07 = 3.72$.
The lower limit is $3.65 - 0 = 3.65$.
The tolerance is: $3.72 - 3.65 = 0.07$.

Effects of Tolerance Levels on Area and Volume

Tolerance levels affect calculations for area, surface area, and volume. The calculated values will have their own tolerance levels. These values are important because they indicate the amount of material required to build dimensional objects. The calculations for the tolerance levels of area, surface area, and volume are performed with the maximum and minimum limit sizes, using the same formulas as for any linear measurement.

Example 4

Find the tolerance level and upper and lower limits on the area of the given rectangle.



Solution

$A = lw$

Upper limit $= (6 + 0.5)(2 + 0.1)\ \text{cm}^2$

$= (6.5)(2.1)\ \text{cm}^2$

$= 13.65\ \text{cm}^2$

Lower limit $= (6 - 0.5)(2 - 0.1)\ \text{cm}^2$

$= (5.5)(1.9)\ \text{cm}^2$

$= 10.45\ \text{cm}^2$

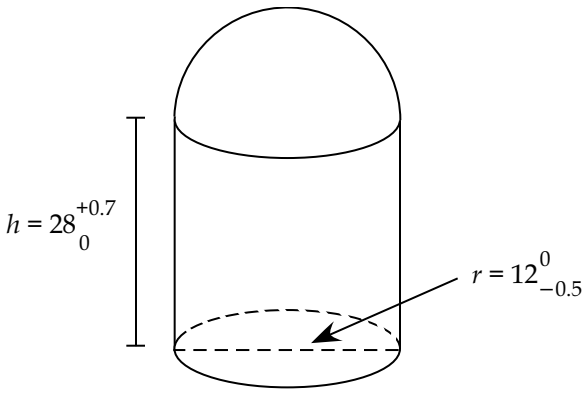
Tolerance $= 13.65 - 10.45 = 3.20\ \text{cm}^2$

In addition, the manufacturing tolerance can be indicated using any of these notations:

$10.45^{+3.20}_{-0}$ cm or $13.65^{+0}_{-3.20}$ cm or $\begin{matrix}13.65\\10.45\end{matrix}$ cm or 12.05 ± 1.6 cm

Example 5

Find the tolerance and upper and lower limits for the surface area of the following storage tank. (Measurements are given in feet.)



Solution

Surface area = top + cylindrical side + base

$$= \frac{1}{2}\left(4\pi r^2\right) + 2\pi rh + \pi r^2$$

Upper limit $= \left(\frac{1}{2}\right)\left(4\pi \times 12^2\right) + (2\pi \times 12)(28.7) + \left(\pi \times 12^2\right)$

$= 3521.097 \text{ ft.}^2$

Lower limit $= \left(\frac{1}{2}\right)\left(4\pi \times 11.5^2\right) + (2\pi \times 11.5)(28) + \left(\pi \times 11.5^2\right)$

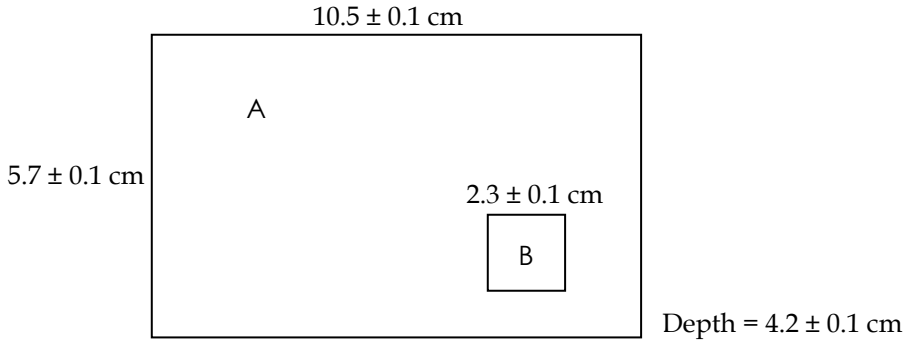
$= 3269.613 \text{ ft.}^2$

Tolerance $= 3521.097 - 3269.613 \text{ ft.}^2$

$= 251.484 \text{ ft.}^2$

Ex**ample 6**

The diagram shows a mould for a metal casting. Find the tolerance and the upper and lower limits of the volume of metal that will be required.



Solution

The casting is a rectangular solid with a rectangle top, A, a square hole, B, and a depth as given.

To find the upper limit of the volume, you need to find the largest volume possible. To do this, take the largest value for the area of A and subtract the lowest value for the area of B. This will give you the largest area. Then, you multiply this value by the largest depth. This will give you the largest volume.

Upper limit of volume:

= [Upper limit of area A − Lower limit of area B] × (Upper limit of the depth)

= [(10.6 × 5.8) − (2.2 × 2.2)] × 4.3 cm^3

= [61.48 − 4.84] × 4.3 cm^3 = 243.55 cm^3

To find the lower limit of the volume, you need to find the smallest volume possible. To do this, you take the smallest value for the area of A and subtract the largest value for the area of B. This will give you the smallest area. Then, you multiply this value by the smallest depth. This will give you the smallest volume.

Lower limit of volume:

= [Lower limit of area A − Upper limit of area B] × (Lower limit of depth)

= [(10.4 × 5.6) − (2.4 × 2.4)] × 4.1 cm^3

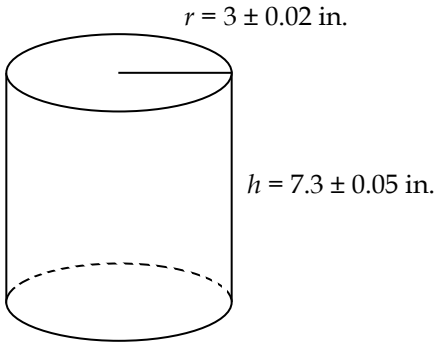
= [58.24 − 5.76] × 4.1 cm^3 = 215.17 cm^3

Tolerance = 243.55 − 215.17 cm^3

= 28.38 cm^3

Example 7

Find the tolerance and maximum and minimum limits for the volume of the following cylinder.



Solution

$V = \pi r^2 h$

Upper limit = $\pi(3.02)^2(7.35)$ $in.^3$

= 210.596 $in.^3$

Lower limit = $\pi(2.98)^2(7.25)$ $in.^3$

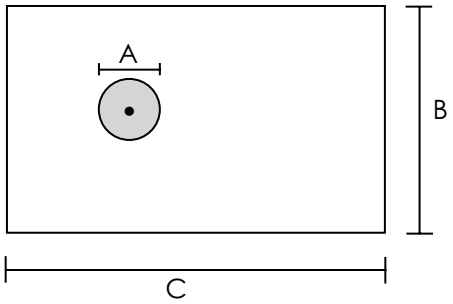
= 202.265 $in.^3$

Tolerance = 210.596 $in.^3$ − 202.265 $in.^3$

= 8.331 $in.^3$

Example 8

Consider the following object.



Given the following measurements with tolerances, fill in the following charts. The first chart deals with tolerances, as well as upper and lower limits. The second chart deals with area and volume.

$A = 4 \pm 0.1$

$B = 12\,^{0.4}_{-0.2}$

$C = \begin{matrix} 7.25 \\ 6.75 \end{matrix}$

The thickness of the object is: 4 units ± 0.2 units

Dimension	Nominal Value	Upper Limit	Lower Limit	Tolerance
A				
B				
C				

Measurement	Nominal Value	Minimum Limit	Maximum Limit	Tolerance
Area of circle				
Area of non-shaded				
Volume of object (non-shaded)				

Solution

Before completing the second chart that deals with area and volume, the first chart must be filled in.

The column titled "Nominal Value" refers to the desired size of the object (not including the tolerance levels).

The column titled "Upper Limit" refers to the upper limit of the measure of the object.

The column titled "Lower Limit" refers to the lower limit of the measure of the object.

The column titled "Tolerance" refers to the tolerance of the measurement. Remember, tolerance is the upper limit minus the lower limit.

Dimension	Nominal Value	Upper Limit	Lower Limit	Tolerance
A	4	$4 + 0.1 = 4.1$	$4 - 0.1 = 3.9$	$4.1 - 3.9 = 0.2$
B	12	$12 + 0.4 = 12.4$	$12 - 0.2 = 11.8$	$12.4 - 11.8 = 0.6$
C	7 (the mean of 7.25 and 6.75)	7.25	6.75	$7.25 - 6.75 = 0.5$

Now, complete the second table by calculating the areas and volumes.

Dimension	Nominal Value	Upper Limit	Lower Limit	Tolerance
Area of circle	$A = \pi r^2$ $A = \pi \left(\frac{4}{2}\right)^2$ $A = 12.57 \text{ units}^2$	$A = \pi r\text{Max}^2$ $A = \pi \left(\frac{4.1}{2}\right)^2$ $A = 13.20 \text{ units}^2$	$A = \pi r\text{Min}^2$ $A = \pi \left(\frac{3.9}{2}\right)^2$ $A = 11.95 \text{ units}^2$	Max Limit − Min Limit = 13.20 − 11.95 = 1.25
Area of non-shaded	$A = A_{\text{Complete Figure}} - A_{\text{One Circle}}$ $A = (B \times C) - (12.57)$ $A = (12 \times 7) - 12.57$ $A = 71.43 \text{ units}^2$	$A = A_{\text{Max Complete Figure}} - A_{\text{Min One Circle}}$ $A = (B_{\text{Max}} \times C_{\text{Max}}) - (11.95)$ $A = (12.4 \times 7.25) - 11.95$ $A = 77.95 \text{ units}^2$	$A = A_{\text{Min Complete Figure}} - A_{\text{Max One Circle}}$ $A = (B_{\text{Min}} \times C_{\text{Min}}) - (13.2)$ $A = (11.8 \times 6.75) - 13.2$ $A = 66.45 \text{ units}^2$	Max Limit − Min Limit = 77.95 − 66.45 = 11.5
Volume of object (non-shaded)	$V = A \times \text{Thickness}$ $V = (71.43 \times 4)$ $V = 285.72 \text{ units}^3$	$V = A_{\text{Max}} \times \text{Thickness}_{\text{Max}}$ $V = (77.95 \times 4.2)$ $V = 327.39 \text{ units}^3$	$V = A_{\text{Min}} \times \text{Thickness}_{\text{Min}}$ $V = (66.45 \times 3.8)$ $V = 252.51 \text{ units}^3$	Max Limit − Min Limit = 327.39 − 252.51 = 74.88

Learning Activity 8.5

Complete the following, and check your answers in the learning activity keys found at the end of this module.

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Complete the pattern : 59, 53, 47, 41, _____ , _____
2. Simplify this fraction: $\frac{14}{64}$
3. Solve for x: $3x - 2 = 16$
4. A 171-page book has nine chapters. Assuming each chapter has the same number of pages, how many pages are there in each chapter?
5. Calculate 6% of $550.

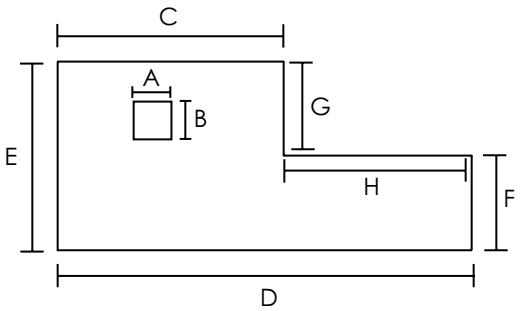
continued

Learning Activity 8.5 (continued)

Part B: Tolerances

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Given the following measurements with tolerance levels, complete the following chart with respect to these tolerance levels and maximum and minimum limits.



$A = 1^{0}_{-0.1}$ $B = 1.2 \pm 0.1$ $C = 4.5 \pm 0.5$

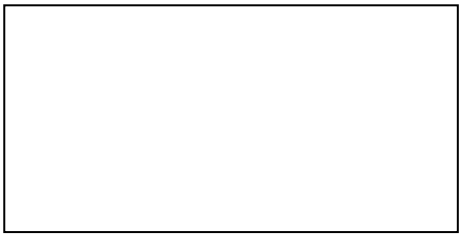
$D = 10^{0}_{-0.25}$ $E = \begin{matrix}3.60\\3.30\end{matrix}$ $F = 1.4^{0.2}_{-0.4}$

Dimension	Nominal Value	Tolerance	Upper Limit	Lower Limit
A				
B				
C				
D				
E				
F				
G				
H				

continued

Learning Activity 8.5 (continued)

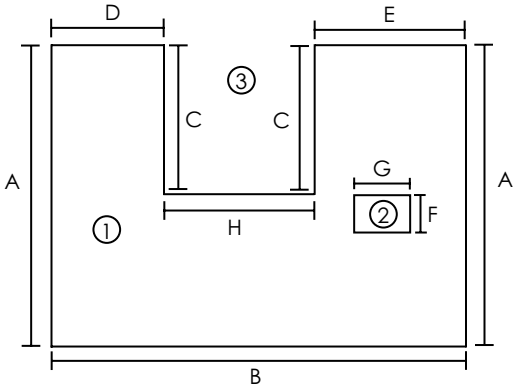
2. Calculate the upper and lower limits for the area of the given rectangle. What is the area's tolerance? Also, calculate the percentage of tolerance with respect to the lower limit.



5.7 ± 0.02 cm

7.0 ± 0.6 cm

3. This diagram shows a mould for a metal casting. Find the tolerance and the upper and lower limits of the volume of metal that will be required.



Depth is 5.2 ± 0.1

$A = 4\,^{0.1}_{-0}$ $B = 10.62 \pm 0.04$ $C = 2.1 \pm 0.1$

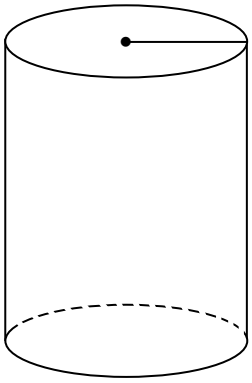
$D = {}^{1.72}_{1.70}$ $F = 0.4\,^{0}_{-0.01}$ $G = 1.3 \pm 0.05$

$E = 3.6\,^{0.4}_{-0.2}$

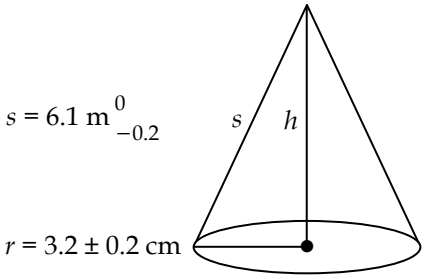
continued

Learning Activity 8.5 (continued)

4. Determine the tolerance and maximum and minimum limits for the volume of the following cylinder. Also, calculate the percentage by which the larger volume is greater than the lower volume.



5. Calculate the tolerance and maximum and minimum values for the surface area of the following cone.



Lesson Summary

In this lesson, you explored the need for tolerance in the measures of manufactured goods. You wrote tolerance levels in four different ways. After that, you calculated the upper and lower limits of length, area, and volume of a variety objects, and then calculated the tolerances of the calculated values.

It is now time to complete Assignment 8.2. If any material seems challenging to you, be sure to ask your tutor/marker or learning partner for help. Also, make sure your resource sheet is up to date with all definitions and sample solutions for some of the more difficult questions.

Notes

Assignment 8.2

Measurements and Tolerances

Total: 49 marks

Note to Students: Now is a good time to check that your resource sheet is up to date with all definitions, formulas, and other important information, so that you can use it to answer the following questions.

1. The questions below are based on the following measurements of the inside diameter of a pipe.

   The measurement using a metric ruler is 3.2 cm ± 0.05 cm.

   The measurement using a Vernier caliper is 3.21 cm.

   The actual measurement of the pipe, using an even more precise measuring device, is 3.2146 cm. This measurement is considered as correct.

   a) Is the measurement using the metric ruler accurate? Explain. *(2 marks)*

   b) Is the measurement using the Vernier caliper accurate? Explain. *(2 marks)*

   c) Which measurement is more precise: the measurement using the ruler or the Vernier caliper? Explain. *(2 marks)*

continued

Assignment 8.2: Measurements and Tolerances (continued)

2. Name the measuring device that should be used in each case below. *(4 marks)*

   a) Measure the dimensions of a room in a house.

   b) Measure a component in a car engine to the nearest $\frac{1}{1000}$ of an inch.

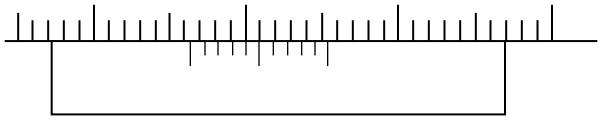
   c) Measure the inside diameter of a pipe to the nearest 0.1 millimetre.

   d) Measure the length of screws required to build a deck if the screws must be four inches long.

3. Read and record the following Vernier caliper measurements. These measurements are in centimetres. *(3 marks)*

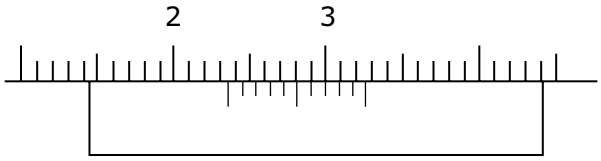
   Note: There may be variations of ±0.01 cm in these readings.

   a)



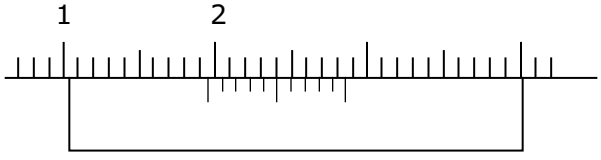
   Reading = _____

   b)



   Reading = _____

   c)



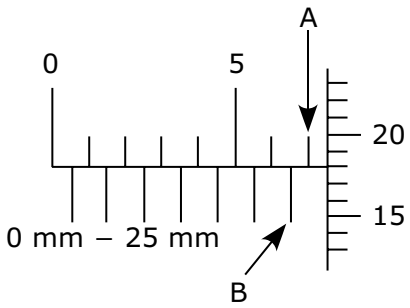
   Reading = _____

continued

Assignment 8.2: Measurements and Tolerances (continued)

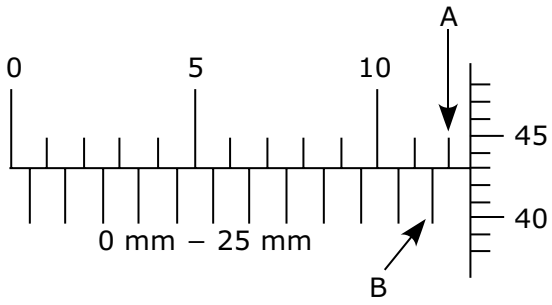
4. Read and record the following micrometer measurements. These measurements are metric. *(3 marks)*

a)



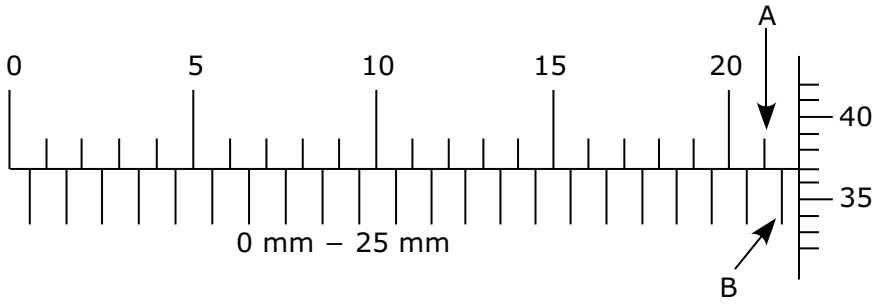
Reading = _____

b)



Reading = _____

c)



Reading = _____

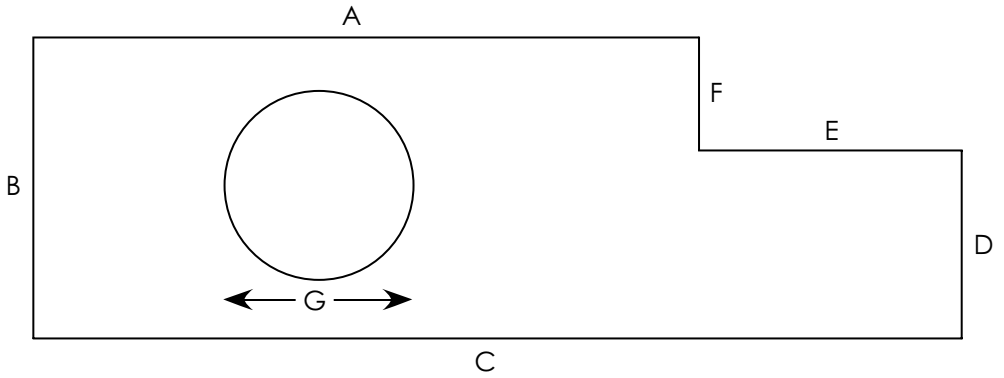
continued

Assignment 8.2: Measurements and Tolerances (continued)

Questions 5 to 9 are all related to the diagram in question 5.

5. The diagram below shows a metal object with side lengths A, B, C, D, E, and F. The thickness of the object is dimension H. All corners are right angles. Dimension G is the diameter of a circle that represents a hole in the object.

   Complete the chart to show all dimensions and tolerances. *(8 marks – 32 × 1/4)*



$A = 14.4 \pm 0.2$ $B = 6.5 \pm 0.1$ $C = 19.6\ ^{+0}_{-0.2}$

$D = \ ^{3.9}_{3.7}$ $G = 4\ ^{+0.2}_{-0}$ H = thickness $= 0.9 \pm 0.1$

Dimension	Nominal Value	Tolerance	Upper Limit	Lower Limit
A				
B				
C				
D				
E				
F				
G				
H				

continued

Assignment 8.2: Measurements and Tolerances (continued)

6. Use the information from Question 5 to answer the following questions. Calculate the various areas and tolerance of the circle as indicated below. *(4 marks)*

   a) Nominal area

   b) Maximum area

   c) Minimum area

   d) Tolerance

7. Use the information from Question 5 to answer the following questions. Calculate the various areas and tolerance for the object with sides A, B, C, D, E and F as indicated: (Do not subtract the area of the circle.) *(4 marks)*

   a) Nominal area

   b) Maximum area

   c) Minimum area

   d) Tolerance

continued

Assignment 8.2: Measurements and Tolerances (continued)

8. Use the information from the previous answers to answer the following questions.

   Calculate the various areas and tolerance of the object, taking the circular hole into account (i.e., subtract the area of the circle from the area of the object with sides A, B, C, D, E, and F), as indicated below. *(4 marks)*

   a) Nominal area

   b) Maximum area

   c) Minimum area

   d) Tolerance

9. Use the information from the previous answers to answer the following questions. Calculate the various volumes and tolerance of the object with the hole, as indicated below. *(4 marks)*

   a) Nominal volume

   b) Maximum volume

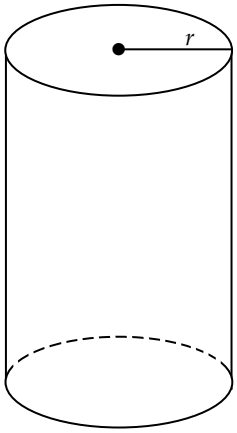
   c) Minimum volume

   d) Tolerance

continued

Assignment 8.2: Measurements and Tolerances (continued)

10. A cylindrical metal can with dimensions is shown in the diagram. Calculate the following. *(5 marks)*



$r = 4.3 \pm 0.1$ cm

$h = 11.8 \pm 0.1$ cm

a) Nominal volume

b) Maximum volume

c) Minimum volume

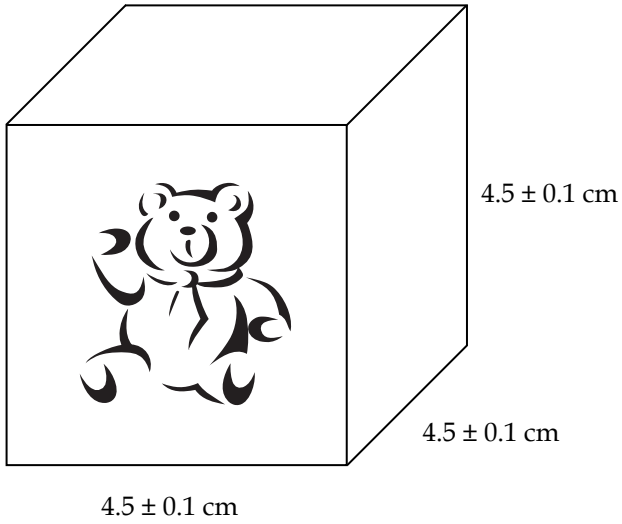
d) Tolerance in the volume measurement

e) Percentage of the minimum volume that is tolerance

continued

Assignment 8.2: Measurements and Tolerances (continued)

11. A toy company manufactures wooden blocks for small children. The blocks are cubes with each side length 4.5 ± 0.1 cm. Calculate the following. *(4 marks)*



a) Maximum surface area

b) Minimum surface area

c) Tolerance in surface area measurement

d) The percent of difference between the smallest and largest possible blocks when compared to the surface area of the smallest permissible blocks

Module 8 Summary

Congratulations! You have now completed all the modules in this course! All you have left to do is to write your final examination.

In this module, you studied precision and accuracy in measurement. You learned that there is always some uncertainty when something is measured. Sometimes you need to write a measurement showing the tolerance levels, which depend on the precision of the measuring device. You also calculated upper and lower limits of area and volume for a variety of objects. You learned that because there is uncertainty in measurement, there is a need to accept some tolerance (variation from exact measurement) in manufactured goods.

As you can see, precision and accuracy in measurement is very important to all of us in many areas of everyday life.

Submitting Your Assignments

It is now time for you to submit the Module 8 Cover Assignment and Assignments 8.1 and 8.2 to the Distance Learning Unit so that you can receive some feedback on how you are doing in this course. Remember that you must submit all the assignments in this course before you can receive your credit.

Make sure you have completed all parts of your Module 8 assignments and organize your material in the following order:

- ❑ Module 8 Cover Sheet (found at the end of the course Introduction)
- ❑ Module 8 Cover Assignment: Puzzles in Design
- ❑ Assignment 8.1: Accuracy, Precision, and Uncertainty
- ❑ Assignment 8.2: Measurements and Tolerances

For instructions on submitting your assignments, refer to How to Submit Assignments in the course Introduction.

Final Examination

Congratulations, you have finished Module 8 in the course. The final examination is out of 100 marks and worth 12.5% of your final mark. In order to do well on this examination, you should review all of your learning activities and assignments from Modules 5 to 8.

You will complete this examination while being supervised by a proctor. You should already have made arrangements to have the examination sent to the proctor from the Distance Learning Unit. If you have not yet made arrangements to write it, then do so now. The instructions for doing so are provided in the Introduction to this module.

You will need to bring the following items to the examination: pens/pencils (2 or 3 of each), blank paper, a scientific or graphing calculator, and your Final Examination Resource Sheet. A maximum of 3.0 hours is available to complete your final examination. When you have completed it, the proctor will then forward it for assessment. Good luck!

At this point you will also have to combine your resource sheets from Modules 5 to 8 onto one 8½" × 11" paper (you may use both sides). Be sure you have all the formulas, definitions, and strategies that you think you will need. This paper can be brought into the examination with you. We suggest that you divide your paper into two quadrants on each side so that each quadrant contains information from one module.

Front

Module 5
Module 6

Back

Module 7
Module 8

Examination Review

You are now ready to begin preparing for your final examination. Please review the content, learning activities, and assignments from Modules 5 to 8.

The final practice examination is also an excellent study aid for reviewing Modules 5 to 8.

You will learn what types of questions will appear on the examination and what material will be assessed. Remember, your mark on the final examination determines 12.5% of your final mark in this course and you will have 3.0 hours to complete the examination.

Final Practice Examination and Answer Key

To help you succeed in your examination, a practice examination can be found in the learning management system (LMS). The final practice examination is very similar to the actual examination that you will be writing. The answer key is also included so that, when you have finished writing the practice examination, you can check your answers. This will give you the confidence that you need to do well on your examination. If you do not have access to the Internet, contact the Distance Learning Unit at 1-800-465-9915 to get a copy of the practice examination and the answer key.

To get the most out of your final practice examination, follow these steps:

1. Study for the final practice examination as if it were an actual examination.
2. Review those learning activities and assignments from Modules 5 to 8 that you found most challenging. Reread those lessons carefully and learn the concepts.
3. Contact your learning partner and your tutor/marker if you need help.
4. Review your lessons from Modules 5 to 8, including all of your notes, learning activities, and assignments.
5. Use your module resource sheets to make a draft of your Final Examination Resource Sheet. You can use both sides of an 8½" by 11" piece of paper.
6. Bring the following things to the final practice examination: pens/pencils (2 or 3 of each), blank paper, a scientific or graphing calculator, a geometry set (which includes a ruler, a protractor, and a compass), and your Final Examination Resource Sheet.

7. Write your final practice examination as if it were an actual examination. In other words, write the entire examination in one sitting, and don't check your answers until you have completed the entire examination. Remember that the time allowed for writing the examination is 3.0 hours.

8. Once you have completed the entire practice examination, check your answers against the answer key. Review the questions that you got wrong. For each of those questions, you will need to go back into the course and learn the things that you have missed.

9. Go over your resource sheet. Was anything missing or is there anything that you didn't need to have on it? Make adjustments to your Final Examination Resource Sheet. Once you are happy with it, make a photocopy that you can keep.

Grade 12 Essential Mathematics (40S)

Module 8
Precision Measurement

Learning Activity Answer Keys

Module 8:
Precision Measurement

Learning Activity 8.1

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Suzanna scores $\frac{26}{75}$ on her world issues test. Estimate the percent score Suzanna receives on this test.
2. What percentile rank is also called the median?
3. 7′2″ = _____ inches
4. How many mm^2 are there in 26 cm^2?
5. There are 15 students missing from a class of 50 students. Write this as a fraction in lowest terms.

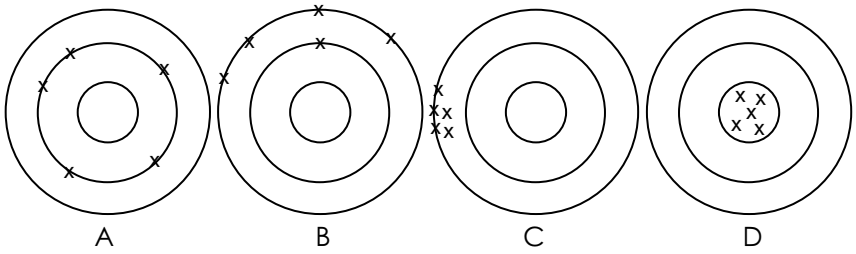
Answers:

1. 33.3% $\left(\frac{26}{75} \cong \frac{25}{75} = \frac{1}{3}\right)$
2. 50th percentile
3. 86 inches (There are 12 inches in a foot; $12 \times 7 + 2 = 86$ inches.)
4. 2600 mm^2 (1 cm = 10 mm, and so $(1\text{ cm})^2 = (10\text{ mm})^2 = 100\text{ mm}^2$; $26\text{ cm}^2 = 100 \times 26 = 2600\text{ mm}^2$)
5. $\frac{3}{10}$ $\left(\frac{15}{50} = \frac{3}{10}\right)$

Part B: Accuracy and Precision

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Determine whether each of the following target practices demonstrates accuracy, precision, or both accuracy and precision.



Answer:

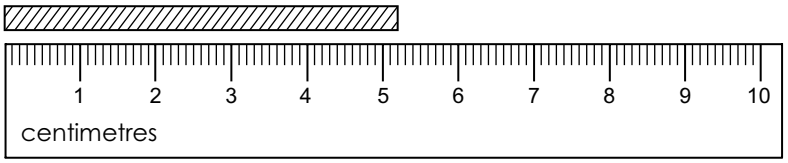
The first target has poor accuracy and poor precision.

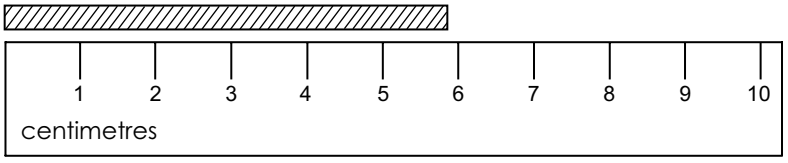
The second target has poor accuracy and poor precision.

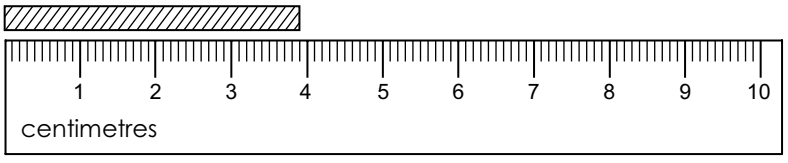
The third target has poor accuracy but good precision.

The fourth target has good accuracy and good precision.

2. a) Measure each of the following strings using the given ruler.
   b) How precise is each measurement?







Answers:

a) First String: 5.2 cm
   Second String: 6 cm
   Third String: 3.9 cm

b) First String: Precise to the nearest tenth of a centimetre
   Second String: Precise to the nearest centimetre
   Third String: Precise to the nearest tenth of a centimetre

3. Calculate the precision for each of the following measurements.
   a) 49.8 mm
   b) 36 m
   c) 22.47 cm
   d) 0.0216 mm
   e) 479.203 cm

   Answers:

   a) to the nearest tenth of a millimetre
   b) to the nearest metre
   c) to the nearest hundredth of a centimetre
   d) to the nearest ten-thousandth of a millimetre
   e) to the nearest thousandth of a centimetre

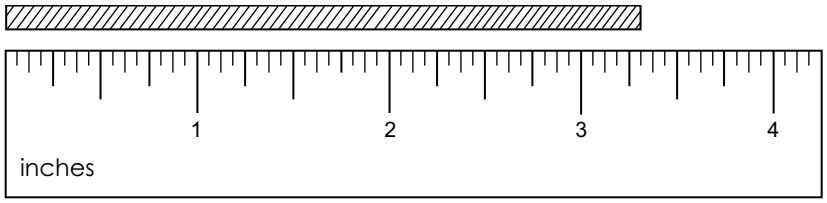
4. Measure the length of the following string, precise to the nearest indicated unit, using the given imperial ruler.

   a) $\frac{1}{2}''$

   b) $\frac{1}{16}''$

   c) $\frac{1}{4}''$

   d) $\frac{1}{8}''$



Answers:

a) $3\frac{1}{2}$ inches

b) $3\frac{5}{16}$ inches

c) $3\frac{1}{4}$ inches

d) $3\frac{3}{8}$ inches

5. A farmer wishes to rope off a rectangular field. He measures the dimensions of the field to be 203 m by 83 m.

   a) How precise is each of his measurements?

   b) What is the perimeter of his property?

   Answers:

   a) His measurements are precise to the nearest metre.

   b) Perimeter = 203 + 203 + 83 + 83 = 572 m.

Learning Activity 8.2

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. If the volume of a $2 \times 2 \times 2$ cube is 8 units, approximately how many times larger would the volume be if the dimensions of the cube were $5 \times 5 \times 5$?
2. 135 cm = _____ m
3. Simplify this fraction: $\frac{40}{300}$
4. 3 feet and 1212 inches = _____ feet
5. Consider the expression $y = 3x$. What is the value of x when $y = 54$?

Answers:

1. ~15 ($2 \times 2 \times 2 = 8$; $5 \times 5 \times 5 = 125$; $8 \times 15 = 120$; $8 \times 16 = 128$; $\frac{125}{8} = \sim 15$)
2. 1.35 m
3. $\frac{2}{15}$ $\left(\frac{40}{300} = \frac{4}{30} = \frac{2}{15}\right)$
4. 104 feet $\left(\frac{1200}{12} = 100; \frac{12}{12} = 1; 3 + 100 + 1 = 104 \text{ feet}\right)$
5. 18 $\left((54 = 3x \text{ or } \frac{54}{3} = x \text{ or } x = 18\right)$

Part B: Uncertainty

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Describe the precision of the measuring device used and the uncertainty of the following measurements.
   a) 54.3 mm
   b) 48 m
   c) 46.4 cm
   d) 0.35733 mm
   e) 2362.24 cm

   Answers:

   a) This measurement is precise to the nearest 0.1 millimetre and has an uncertainty of ±0.05 mm.
   b) This measurement is precise to the nearest metre and has an uncertainty of ±0.5 m.
   c) This measurement is precise to the nearest millimetre and has an uncertainty of ±0.5 mm. OR

      This measurement is precise to the nearest 0.1 centimetre and has an uncertainty of ±0.05 centimetres.
   d) This measurement is precise to the nearest 0.00001 mm and has an uncertainty of ±0.000005 mm.
   e) This measurement is precise to the nearest 0.01 cm and has an uncertainty of ±0.005 cm.

2. Fredrick measures the radius of a circle and finds the radius to be 35.75 mm.
   a) State the precision of the measuring device.
   b) State the uncertainty of the measuring device.
   c) State the measurement Fredrick should report (including the uncertainty).

   Answers:

   a) This measuring device is precise to the nearest 0.01 mm.
   b) The uncertainty of this measuring device is ±0.005 mm.
   c) Fredrick should report that the radius of the circle is 35.75 mm ± 0.005 mm.

3. Consider the connection between accuracy and uncertainty. Explain why some measurements may be inaccurate; include the concept of uncertainty in your explanation.

   Answer:

   All measurements contain some degree of uncertainty. A measurement is considered accurate if the accepted measurement of an object falls within the range of uncertainty. However, sometimes measurements are inaccurate and the accepted measurement of an object does not fall within the range of uncertainty. This may happen when an instrument isn't calibrated correctly, the instrument is faulty, the scale is read incorrectly, or other human errors.

4. The accepted value for π is 3.14. Arianna measured the circumference and diameter of a circle, and then divided the circumference by the diameter to determine a value for π. Arianna calculated that π was equal to 3.1 ± 0.1. Is the accepted value for π within the range of uncertainty that Arianna calculated? Explain why Arianna may have received this result.

   Answer:

   The lowest value for π in the range that Arianna calculated is 3.0. The highest value for π in the range that Arianna calculated is 3.2. Therefore, the accepted value for π, 3.14, does fall within the range of uncertainty.

   It seems that Arianna took accurate and precise measurements with instruments that were properly calibrated.

Learning Activity 8.3

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Calculate the volume of a cube with each side measuring 30 cm.
2. Calculate: $\frac{9}{16}$ of 24
3. What is the unit price of a pen if 10 pens cost $5?
4. 0.42 km = _____ m
5. Calculate the price, including the taxes, of a $25 DVD on sale for 20% off.

Answers:

1. 27 000 cm^3 ($30 \times 30 \times 30 = 27\,000$)
2. 13.5 $\left(\left(\frac{9}{16}\right) \times 24 = \frac{(9 \times 24)}{16} = \frac{9 \times 8 \times 3}{2 \times 8} = \frac{(9 \times 3)}{2} = \frac{27}{2} = 13.5\right)$
3. \$0.50/pen $\left(\frac{5}{10} = 0.50\right)$
4. 420 m
5. \$22.40 (\$25 × 20% = \$5; 20% off \$25 is \$20; tax on \$10 is \$1.20, tax on \$20 is \$2.40; total is 20 + 2.40)

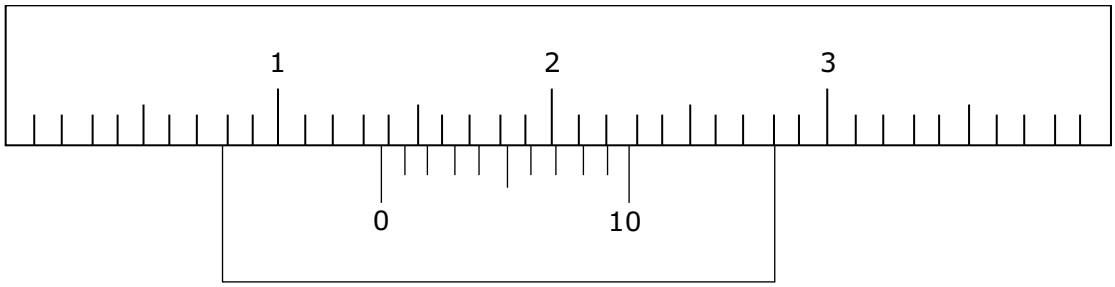
Part B: Vernier Caliper and Micrometer Measurements

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

Note: This material will be on your next assignment. However, the material in this learning activity will not be on your final examination.

Write the measurement as shown on the following Vernier caliper diagrams. Read the measurements to the nearest hundredth of a centimetre.

1.



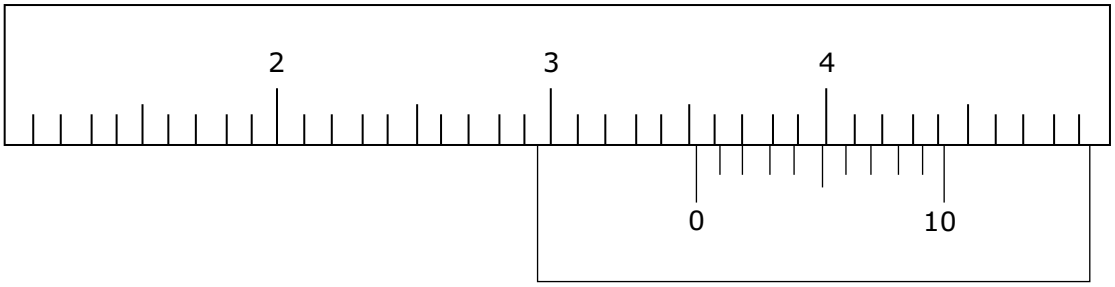
Answer:

The first line of the moving scale (bottom), at a reading of 0, points to a space between 1.3 and 1.4 on the fixed scale. Thus, the first reading is 1.3 cm.

The two scales align at the ninth tick on the moving scale, giving a reading of 0.09 cm.

The total reading = 1.3 + 0.09 = 1.39 cm.

2.



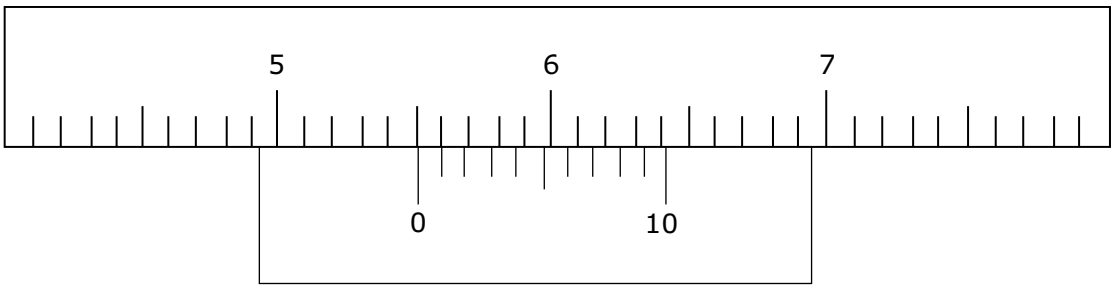
Answer:

The first line of the moving scale, at a reading of 0, points to a space between 3.5 and 3.6. Thus, the first reading is 3.5 cm.

The two scales align at the second tick on the moving scale, giving a reading of 0.02 cm.

The total reading = 3.5 + 0.02 = 3.52 cm.

3.



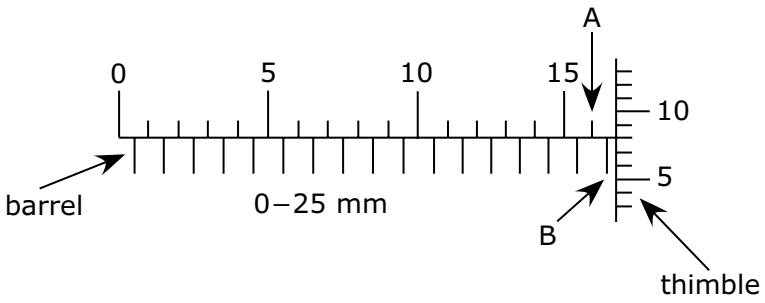
Answer:

first line of the moving scale, at a reading of 0, points to a space between 5.5 and 5.6. The first reading is 5.5 cm.

The two scales align at the first tick, giving a reading of 0.01 cm.

The total reading = 5.5 + 0.01 = 5.51 cm.

4. Read the following micrometer measurement.



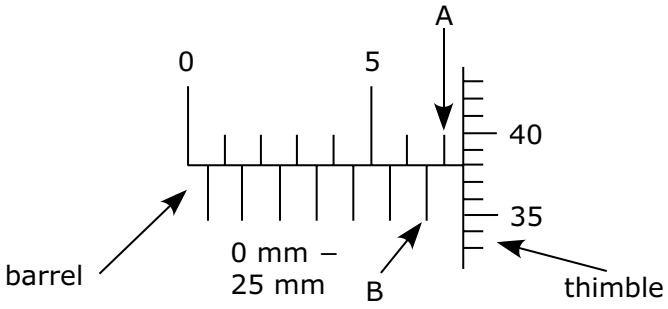
Answer:

Read the number from the upper barrel as 16 mm and the lower as 0.5 mm. Thus, the total barrel reading is 16.5 mm.

The thimble reading yields 0.08 mm.

The sum and resulting measurement is 16 mm + 0.5 mm + 0.08 mm = 16.58 mm.

5. Read the following micrometer measurement.



Answer:

Read the number from the barrel as 7 mm (**Note:** The marking indicated by arrow B is to the left of the marking indicated by arrow A).

The thimble reading is 0.38 mm.

The sum and resulting measurement = 7 mm + 0.38 mm = 7.38 mm.

Learning Activity 8.4

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Complete the pattern: 9, 18, 27, 36, _____ , _____

2. Solve for x: $\frac{7}{8} + 4 = \frac{x}{8}$

3. Claudia is 5′ 5″ tall. Calculate her approximate height in centimetres. (1 inch = 2.54 cm)

4. What is the perimeter of a triangle with sides measuring 3.6 cm, 3.2 cm, and 4.1 cm?

5. Evaluate: $\frac{3}{7} - \frac{1}{4}$

Answers:

1. 45, 54

2. 39 $\left(8\left(\frac{7}{8}\right) + 8(4) = x;\ 7 + 32 = x;\ x = 39 \text{ or } \frac{7}{8} + \frac{32}{8} = \frac{x}{8};\ x = 39\right)$

3. 163 cm
   (5 × 12 = 60; 5′5″ = 60 + 5 = 65 inches;
   Now, you need to approximate 65 × 2.54.
   65 × 2 = 130; 65 × 0.5 = 32.5; 65 × 2.5 = 130 + 32.5 = 162.5 cm)

4. 10.9 cm (3.6 + 3.2 + 4.1 = 10.9)

5. $\frac{5}{28}$ $\left(\frac{12}{28} - \frac{7}{28} = \frac{5}{28}\right)$

Part B: Analyzing Measurements

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Consider the following scenarios. State which measuring device (ruler/ tape measure, Vernier caliper, or micrometer) is most suitable for each situation.

   a) Instead of hiring a carpenter to redo your kitchen, you have decided to install your own cupboards. Which measuring device should you use? Explain.

   Answer:

   Tape measure

   A sample explanation is the following:

   A tape measure is the only tool for measuring lengths large enough to measure a kitchen cabinet.

   A tape measure may be precise to the nearest $\frac{1}{16}$ of an inch, which is adequate for installing kitchen cabinets.

   b) You are trying to install your above-ground pool. In order to get the pump working, you need to measure the inside of one pipe to find another pipe that will fit. Which measuring device should you use? Explain.

   Answer:

   Vernier caliper

   A sample explanation is the following:

   A Vernier caliper is more precise than a ruler. In order to have pipes that fit together properly, a Vernier caliper should be used for greater precision. Also, Vernier calipers have inside jaws that can be used to measure accurately the inside of a pipe.

c) A mechanic for a stock car racing team must measure the diameter of a crankshaft (part of an engine) to determine whether it is worn too much to use for the next race. Which measuring device should he use? Explain.

Answer:

Micrometer

The following is a sample explanation:

The precision required when measuring a crankshaft is at least $\frac{1}{1000}$ of an inch and probably $\frac{1}{10\ 000}$ of an inch.

A micrometer is the only instrument with sufficient precision.

d) You are measuring your room to determine whether it is large enough for a queen size bed. Which measuring device should you use?

Answer:

Tape measure

A sample explanation is:

A tape measure is the only measuring device that can be used to measure something as large as a bed or a room. Also, the precision of a tape measure is adequate.

2. Consider a Vernier caliper and a micrometer that are calibrated properly.

a) Explain which device would yield more precise measurements when both devices are used to measure the same object.

Answer:

A micrometer is precise to the nearest thousandth of a centimetre while a Vernier caliper is only precise to the nearest hundredth of a centimetre. Therefore, a more precise answer can be obtained using the micrometer.

b) Explain why these measurements are never completely accurate.

Answer:

There is always a degree of uncertainty to every measurement. The measurement may be inaccurate because of an uncalibrated device, a faulty instrument, the instrument being misread, or other human errors.

Learning Activity 8.5

Part A: BrainPower

You should be able to complete the following five questions in just a few minutes without using a calculator or paper and pencil.

1. Complete the pattern : 59, 53, 47, 41, _____ , _____
2. Simplify this fraction: $\frac{14}{64}$
3. Solve for x: $3x - 2 = 16$
4. A 171-page book has nine chapters. Assuming each chapter has the same number of pages, how many pages are there in each chapter?
5. Calculate 6% of $550.

Answers:

1. 35, 29
2. $\frac{7}{32}$
3. $6 \left(3x = 18; x = \frac{18}{3} = 6\right)$
4. Each chapter has 19 pages.
   $\left(\frac{171}{9} = ?; 9 \times 9 = 81;\right.$

   This leaves $171 - 81 = 90$.

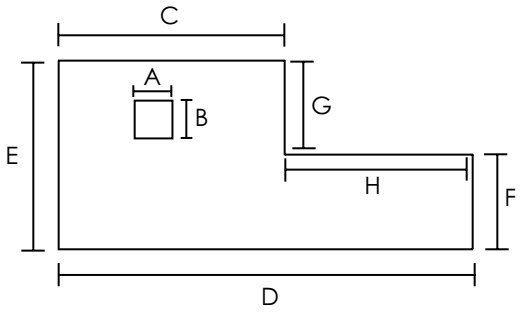
   $\frac{90}{9} = 10$

   Therefore, $171 = 9 \times 9 + 9 \times 10 = 9(9 + 10) = 9(19)$).
5. $33 (1% of $550 = $5.50; 6% of $550 = $5.50 × 6 = $33)

Part B: Tolerances

Remember, these questions are similar to the ones that will be on your assignments and final examination. If you are able to answer them correctly, you are likely to do well on your assignments and final examination. If you are not able to answer them correctly, you need to go back to the lesson to review the information you do not understand.

1. Given the following measurements with tolerance levels, complete the following chart with respect to these tolerance levels and maximum and minimum limits.

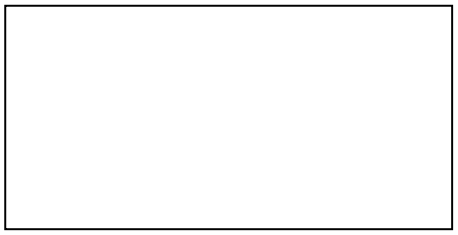


$A = 1^{\ 0}_{-0.1}$ $B = 1.2 \pm 0.1$ $C = 4.5 \pm 0.5$

$D = 10^{\ 0}_{-0.25}$ $E = {}^{3.60}_{3.30}$ $F = 1.4^{\ 0.2}_{-0.4}$

Dimension	Nominal Value	Tolerance	Upper Limit	Lower Limit
A	1	0.1	1	0.9
B	1.2	0.2	1.3	1.1
C	4.5	1.0	5.0	4.0
D	10	0.25	10	9.75
E	3.45	0.30	3.60	3.30
F	1.4	0.6	1.6	1.0
G	$E - F =$ $3.45 - 1.4 = 2.05$	$0.30 + 0.6 =$ 0.9	$E_{Max} - F_{Min} =$ $3.60 - 1.0 = 2.60$	$E_{Min} - F_{Max} =$ $3.30 - 1.6 = 1.70$
H	$D - C =$ $10 - 4.5 = 5.5$	$1.0 + 0.25 =$ 1.25	$D_{Max} - C_{Min} =$ $10 - 4 = 6$	$D_{Min} - C_{Max} =$ $9.75 - 5.0 = 4.75$

2. Calculate the upper and lower limits for the area of the given rectangle. What is the area's tolerance? Also, calculate the percentage of tolerance with respect to the lower limit.



Answer:

$A = lw$

Upper limit = $(7.6 \times 5.72)\ \text{cm}^2$

$= 43.47\ \text{cm}^2$

Lower limit = $(6.4 \times 5.68)\ \text{cm}^2$

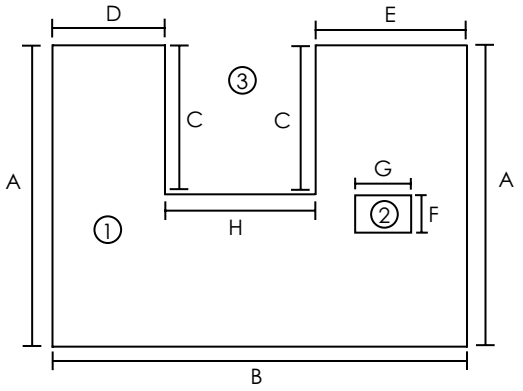
$= 36.35\ \text{cm}^2$

Tolerance = $43.47 - 36.35 = 7.12\ \text{cm}^2$

$$\% \text{ Tolerance} = \left(\frac{7.12}{36.35}\right) \times 100 = 19.6\%$$

This means that the upper limit (maximum area) is 19.6% larger than the lower limit (minimum area).

3. This diagram shows a mould for a metal casting. Find the tolerance and the upper and lower limits of the volume of metal that will be required.



Depth is 5.2 ± 0.1

$A = 4\,^{0.1}_{-0}$ $\quad B = 10.62 \pm 0.04$ $\quad C = 2.1 \pm 0.1$

$D = {}^{1.72}_{1.70}$ $\quad F = 0.4\,^{0}_{-0.01}$ $\quad G = 1.3 \pm 0.05$

$E = 3.6\,^{0.4}_{-0.2}$

Answer:

Upper limit of the volume

= (Maximum area of outer rectangle 1 − Minimum area of rectangle 2 − Minimum area of rectangle 3) × (Maximum Depth).

$= [(A_{Max} \times B_{Max}) - (F_{Min} \times G_{Min}) - (C_{Min} \times H_{Min})] \times (5.3)$

$= [(4.1 \times 10.66) - (0.39 \times 1.25) - (2.0 \times 4.86)] \times (5.3)$

Note: $H_{Min} = B_{Min} - D_{Max} - E_{Max} = 10.58 - 1.72 - 4.0 = 4.86$

Upper limit of volume $= 33.4985 \times 5.3 = 177.54$ units^3

Lower limit of the volume

= (Minimum area of rectangle 1 − Maximum area of rectangle 2 − Maximum area of rectangle 3) × (Minimum Depth).

$= [(A_{Min} \times B_{Min}) - (F_{Max} \times G_{Max}) - (C_{Max} \times H_{Max})] \times (5.1)$

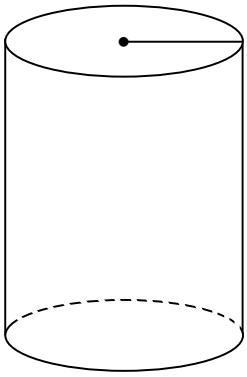
$= [(4 \times 10.58) - (0.4 \times 1.35) - (2.2 \times 5.56)] \times (5.1)$

Note: $H_{Max} = B_{Max} - D_{Min} - E_{Min} = 10.66 - 1.70 - 3.4 = 5.56$

Lower limit of the volume $= 29.548 \times 5.1 = 150.69$ units^3

Tolerance $= 177.54 - 150.69 = 26.85$ units^3

4. Determine the tolerance and maximum and minimum limits for the volume of the following cylinder. Also, calculate the percentage by which the larger volume is greater than the lower volume.



Answer:

$V = \pi r^2 h$

Max volume $= \pi(6.35)^2(13.2)\ \text{cm}^3$

$= 1672.13\ \text{cm}^2$

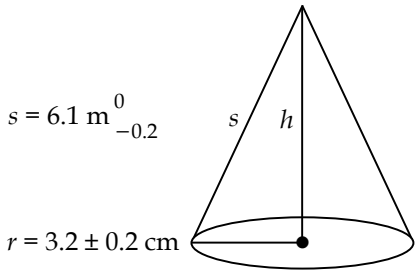
Min volume $= \pi(6.25)^2(12.8)\ \text{cm}^3$

$= 1570.80\ \text{cm}^2$

Tolerance $= 1672.13 - 1570.80 = 101.33\ \text{cm}^3$

$$\%\ \text{difference in volumes} = \left(\frac{101.33}{1570.80}\right) \times 100 = 6.45\%$$

5. Calculate the tolerance and maximum and minimum values for the surface area of the following cone.



Answer:

Surface Area = $\pi rs + \pi r^2$

Maximum area = $\pi(3.4)(6.1) + \pi(3.4)^2$

$= 65.1566 + 36.3168 = 101.47\ \text{m}^2$

Minimum area = $\pi(3.0)(5.9) + \pi(3.0)^2$

$= 55.6062 + 28.2743 = 83.88\ \text{m}^2$

Tolerance = $101.47 - 83.88 = 17.59\ \text{m}^2$

GRADE 12 ESSENTIAL MATHEMATICS (40S)

Appendix A: Glossary

APPENDIX A: GLOSSARY

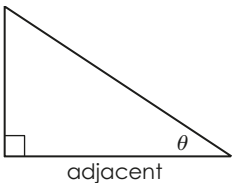
acute angle
An angle between 0^o and 90^o.

accounts receivable
Money owed to a company by customers.

accuracy
How close a measurement comes to the true value or quantity.

adjacent side
The side of a right triangle beside the angle (θ^o)—not the hypotenuse.

Example



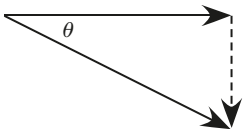
all-purpose passenger vehicle
A classification Autopac uses for insurance purposes in which a vehicle can be used for pleasure driving, for driving to and from work or school, and for business purposes.

amortization period
The number of years you will take to repay the entire mortgage (usually between 15 and 40 years).

amortize
To pay back a loan.

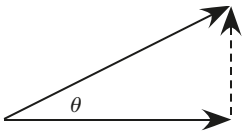
angle of depression
The angle (θ) formed between your natural line of sight (a horizontal line) and your downward line of sight.

Example



angle of elevation
The angle (θ) created between your natural line of sight (a horizontal line) and your elevated line of sight.

Example



appraisal fee
When borrowing money, the lender must determine the value of the property; a certified appraiser will be appointed by the lending agency (bank) to appraise the property to determine its value.

area
The space taken up by a 2-D object; measured in m^2, $ft.^2$, etc.

asset
For a company—any item of value that could be converted to cash (typically by selling the item or borrowing money against it).

Autopac claim
A claim completed and submitted to Autopac when you have an accident, there is damage done to your vehicle, or your vehicle is stolen.

Autopac rate
The yearly fee you pay for Autopac coverage.

balance sheet
In business—a worksheet used to determine the Net Worth (the value of the company after paying off all its debts) as well as its Working Capital (which is the amount of operating cash available after subtracting the Current Liabilities from the Current Assets).

basic Autopac coverage
The least amount of insurance you can buy from Autopac; coverage includes Basic All Perils Coverage, a Personal Injury Protection Plan, and Basic Third Party Liability.

BEDMAS (Brackets, Exponents, Division, Multiplication, Addition, Subtraction)
Division and multiplication (and addition and subtraction) must be completed in the order in which they appear from left to right in a mathematical expression (see order of operations).

bias
A sample that emphasizes one part of the population more than others.

Boeckh EvaluRate
A program used by home insurance brokers to determine the replacement cost of your home and/or contents.

book value of a vehicle
The average value of a specific year, make, and model of a vehicle; this is roughly what you can expect to pay for the vehicle, depending on its condition.

breakage fee
A fee one must pay to renegotiate the interest rate or payment schedule of a closed mortgage.

break-even point
The point where the amount received (in dollars) is equal to the costs of producing and selling a product.

$$\text{break-even point} = \frac{\text{total production costs}}{\text{selling price}}$$

total production costs = number of products × unit cost

budget
An organized way of looking at where you earn and spend your money that allows you to set and achieve financial goals.

business
The production and sale of goods or services.

business location
The place where you have your main base of operation.

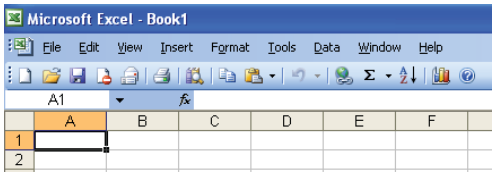
Canada Child Tax Benefit
A tax-free monthly payment that is fully indexed to the cost of living to help with the cost of raising children under age 18, based on the family net income.

carrying capacity of a vehicle
The amount of weight the vehicle can carry, including cargo and passengers.

cash flow projection
An estimate of net sales in dollars for a specific time period, typically one year.

cell
A single box in a spreadsheet with specific coordinates (e.g., A1).

Example



census
A survey of the entire population.

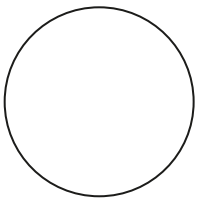
centi (c)
A metric prefix; multiplication factor = $10^{-2} = 0.01$.

chart
A diagram that illustrates information in the form of a table, graph, or picture.

circle

A curve where all points on the curve are equidistant from a fixed point, which is the centre.

Example



circumference

The distance around the edge of a circle (also known as the perimeter); $C = 2\pi r$ or $C = \pi d$.

closed mortgage

A mortgage with fixed interest rates and fixed payments for the term of the mortgage.

closing date

The day the ownership of a house is officially transferred from the seller to the buyer; also known as the possession date.

compass

An instrument used to locate points at a given distance from a fixed point and to describe circles and arcs.

Example

competition

The result when two or more businesses try to sell the same goods or services to the same customers.

complementary angles

Two angles with a sum of 90°.

comprehensive home insurance

Insurance company offers protection for the building (like Standard insurance) but contents are covered for more perils; more expensive than Standard insurance.

consecutive angles

Two interior angles of a polygon that are at the ends of one side of the polygon.

consumers

The people who purchase goods and services.

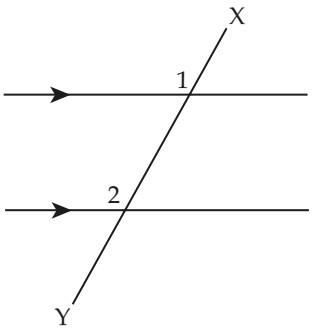
convertible mortgage

Similar to a closed mortgage, but it can be repaid ahead of schedule without paying a breakage fee; also, the interest rate can be locked in at any time without paying a penalty.

corresponding angles

Angles that are located in similar positions with respect to parallel lines. In the diagram below, ∠1 and ∠2 are both located to the left of the transversal and above the parallel lines.

Example



cosine law

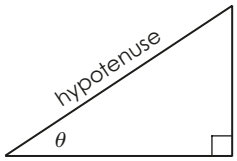
A formula used to solve non-right triangles.

$$a^2 = b^2 + c^2 - 2bc \cos \angle A$$

cosine ratio

The ratio relating the adjacent side and the hypotenuse to the angle (θ^o).

$$\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$



credit

The borrowing of money with a promise to pay it back in a specified amount of time.

cube root $\left(\sqrt[3]{\ }\right)$

The number (factor) that, when multiplied with itself 3 times, produces the given cube.

Example:

$\sqrt[3]{64} = 4$

current assets

Assets such as bank accounts that can easily be converted to cash; also known as liquid assets.

current liabilities

Short-term business debts that need to be paid within a short period of time.

daily home maintenance

Tasks that you perform on a regular basis (daily or at least weekly) in your home.

data

Information that is collected; usually numerical, sometimes organized in charts and/or displayed by graphs.

data set

A set of data; a collection of information about a specific topic, or a specific event.

debt

Any amount of money that you owe and have committed to pay back.

deci (d)

A metric prefix; multiplication factor = $10^{-1} = 0.1$.

deductible

When making a claim for damage to a home, the homeowner must pay this amount (often $500) and the insurance company pays the rest.

deferred payment

The total cost of a vehicle when you finance the purchase of the vehicle; the base price plus cost of options plus excise tax plus destination charge plus tire tax plus PST and GST plus loan interest.

deficit

In your budget, when you spend more money than you earn, the amount available for other savings is negative. It is signified by writing the number in brackets ( ).

deca (da)

A metric prefix; multiplication factor = $10^1 = 10$.

demand

The willingness of consumers to pay for a good or service.

denominator

The number below the line in a fraction that can state the total number of items, or the number of equal pieces that something is divided into.

Example

$\frac{2}{3}$ ← denominator

dependant

A child or relative who depends on someone else for support (financially).

depreciation

The decrease in the value of an object due to age and use.

diagnostic test
An inspection of a vehicle by a certified technician to determine the quality of the vehicle, and whether the vehicle will require repair work; should be done before buying a used vehicle.

diagonal
A line segment joining two non-consecutive vertices of a polygon.

disbursements
Purchase costs that your lawyer pays on your behalf when you purchase a home.

down payment
The portion of the costs of the house that you pay when you first buy it.

easement
The right of way by the town, city, or utility company to access your land for specific purposes, such as putting up telephone wires.

emergency repairs
Repairs that occur when a system or item breaks in your home and must be fixed immediately.

encroachment
An intrusion on your land by a neighbour's structure, or possibly an intrusion on your neighbour's land by something on your property.

entrepreneurship
The recognition of business opportunities (needs, wants, or problems) and the use of resources to implement ideas for new, thoughtfully planned ventures.

equilateral triangle
A triangle that has three equal sides and three equal angles.

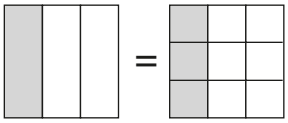
equilibrium
The balance that is reached between the willingness of a consumer to pay a given price and the willingness of a producer to supply the product at that price.

equity
The value of the property calculated as the difference between the market value of the property and the outstanding amount owed on the mortgage(s) related to the property.

equivalent fractions
Fractions that represent the same value.

Examples

$\frac{1}{3} = \frac{3}{9}$



estimate
To find the approximate value.

evaluate
To find the value of an expression.

event
A possible outcome in a situation where more than one outcome is possible; for example, rolling two ones with two dice is an event.

expenses
Any outflow (spending) of money to another person or company to pay for an item or service; also known as costs.

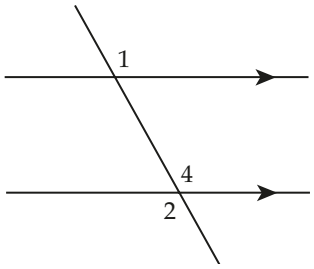
expected value
The likelihood of a gain or a loss in a situation that involves chance.

experimental probability
Probability calculations based on experimental data.

experimental results
Are the results, or data, gathered from an experiment.

exterior alternate angles
Angles located on the exterior of parallel lines and on opposite sides of the transversal. $\angle 1$ and $\angle 2$ are exterior alternate angles.

Example



fair game
A game in which the expected value is equal to zero; you have an equal chance of winning or losing.

finance
In a business, it is the record of all money coming into and going out of a business.

finance charge
The difference between the deferred payment and the total purchase price; the cost of interest when making a loan to pay for a car.

fixed assets
Long-term assets such as buildings, land, or a patent.

fixed liabilities
Long-term debts, such as a mortgage for land and buildings.

fixed-rate mortgage
A mortgage having an interest rate that is locked in for the full term of the mortgage.

fuel consumption rate
The number of litres of gasoline a vehicle needs to drive 100 kilometres.

$$\text{fuel consumption} = \frac{\text{litres of gasoline required}}{\text{kilometres driven}} \times 100$$

goods
Articles of merchandise that are bought or produced by a business and sold to customers for profit.

Goods and Services/Harmonized Sales Tax (GST/HST) Credit
A credit for people who have low incomes, which offsets all or part of the GST/HST.

Gross Debt Service ratio
A ratio that compares the total cost of your monthly mortgage payment, taxes, and heating to your gross monthly income (from all sources). The Gross Debt Service ratio should not exceed 32%.

$$\text{Gross Debt Service Ratio} = \frac{\text{Monthly Mortgage Payment} + \text{Property Taxes} + \text{Heating}}{\text{Gross Monthly Income}} \times 100$$

gross profit
Revenue – Cost of Goods

gross vehicle weight rating
The total weight of the vehicle plus its carrying capacity.

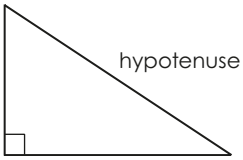
guaranteed residual value
An estimate of how much a vehicle will be worth after being used for the length of a lease; this value is given to you when you lease the vehicle.

hecto (h)
A metric prefix; multiplication factor = $10^2 = 100$.

human resources
The people in a business: employees, managers, owners.

hypotenuse
The side of a right triangle across from the right angle; the longest side of a right triangle.

Example



imperial system
The system of measurement used in the US, and sometimes still in Canada and Britain; includes feet, yards, pounds, gallons, and quarts.

improper fraction
A fraction that is larger than 1; the numerator is larger than the denominator.

Example

$\frac{9}{4}$

inspection fee
Before you make a decision to purchase a home, it is highly recommended you pay a professional building inspector to inspect the home.

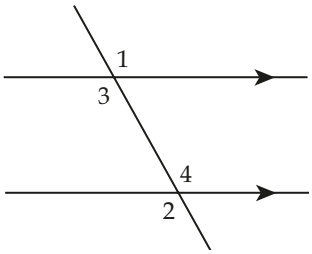
interest (*I*)
Money earned on an investment or charged on a loan; determined by the amount of money invested/borrowed, the interest rate, and the term.

interest-free period
A period of time after you make a purchase on a credit card during which you do not have to pay interest.

interest rate (*r*)
The percent that indicates how much interest you will earn or be charged.

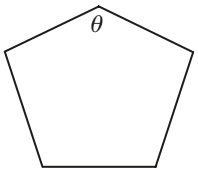
interior alternate angles
Angles located on the interior of parallel lines and on opposite sides of the transversal ($\angle 3$ and $\angle 4$ are interior alternate angles).

Example



interior angles of a polygon
The angle shown as θ is one of the interior angles of a polygon.

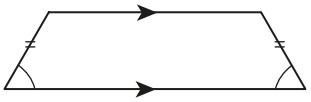
Example



irregular polygons
All polygons that are not regular polygons; the side lengths and/or interior angle measures are not all equal.

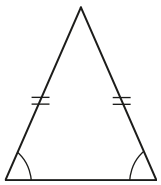
isosceles trapezoid
A trapezoid where the non-parallel sides are the same length, and the base angles are the same size.

Example



isosceles triangle
A triangle that has at least two equal sides; in any triangle, the angles opposite equal sides are also equal.

Example



kilo (k)
A metric prefix; multiplication factor = 10^3 = 1 000.

land transfer tax
The tax the home buyer pays to the Manitoba Land Titles Office at the time when the title of the new home is registered.

law of demand
When the price of a product or service decreases, the demand for the product usually increases.

law of supply
The relationship between the price of a product or service and its quantity offered for sale.

lawyer's fees
The fees charged by a lawyer for the legal work involved in the purchase of a home; part of the cost of purchasing a home.

liabilities
Debts and financial obligations that the business is required, by law, to pay.

lien search
A lien search is a search for claims on the car by a creditor.

lifestyle
The way a person lives, which includes this person's habits, tastes, financial status, ethical standards, and activities of every sort.

management
In a business, it is the planning and organizing of all business activities; this includes short-term and long-term goal setting.

Manitoba Public Insurance Corporation (MPIC)
A not-for-profit Crown corporation in Manitoba that provides basic automobile insurance for all Manitobans; the program is called Autopac.

Manufacturer's Suggested Retail Price (MSRP)
The selling price of a car that the manufacturer recommends to the retailer; the sticker price, which includes the base price, any optional equipment, an air-conditioning excise tax, and a destination or freight charge.

marketing
In a business, it includes planning, pricing, promoting, and distributing goods and services to customers.

mean
A measure of central tendency found by adding the numbers in a set and then dividing that sum by the number of items in the set; the average.

measure of central tendency
A single number that in some way represents the "middle" of a set of numbers; three measures of central tendency are mean, median, and mode.

median
A measure of central tendency calculated by finding the middle number of a data set when the numbers are written in numerical order; if a data set has an even number of numbers, the median is the mean of the two middle numbers.

mega (M)
A metric prefix; multiplication factor = $10^6 = 1\ 000\ 000$.

metric system
See *système internationale*.

micro (μ)
A metric prefix; multiplication factor = $10^{-6} = 0.000\ 001$.

micrometer
A measuring device precise to the nearest thousandth (0.001) of a centimetre.

milli (m)
A metric prefix; multiplication factor = $10^{-3} = 0.001$.

mill rate
A tax of $1 for every $1000 of proportional assessed value.

mixed number
A number larger than 1, written as a whole number and a proper fraction.

Example:

$2\frac{1}{4}$

mode
The number that occurs most frequently in a set of numbers; a measure of central tendency.

mortgage
The loan from a financial institution that you use to pay for your house.

mortgage application fee
Your financial institution may charge a fee for processing your mortgage application.

mortgage payment
The amount you pay regularly, consisting of principal and interest, to the financial institution where you have your mortgage.

municipal taxes
Consist of the General Municipal tax and Local Improvement taxes.

$$\text{General Municipal Tax} = \frac{\text{total portioned assessment}}{1000} \times \text{municipal mill rate}$$

Local Improvement Tax = frontage × cost of improvement per foot of property frontage

mutually bisecting diagonals
Diagonals in a polygon that cut each other in half.

nano (n)
A metric prefix; multiplication factor = $10^{-9} = 0.000\ 000\ 001$.

needs
Essential things that people must have to live, such as food, clothing, and shelter.

net income
For income tax purposes, the amount of income after certain deductions have been subtracted from the total income on the income tax return.

net worth
The value of a company after paying off all its debts.

nominal data
Data that does not consist of numerical values. Examples of nominal data include the most popular baby names or video games, and electing a new prime minister.

nominal value
Given a range of acceptable values, the nominal value is the target value for the measured quantity.

Example:

3.0 ± 0.1 cm has a nominal value of 3.0 cm.

non-refundable tax credits

Deductions from income that reduce the amount of income tax you owe; you do not receive a refund if the credits are more than your income.

non-right triangle

A triangle that does not have a 90° angle.

numerator

The number above the line in a fraction that states the number of parts being considered.

Example

$\frac{2}{3}$ ← numerator

obtuse angle

An angle between 90° and 180°.

odds against an event occurring

The likelihood of an event not occurring.

$$\text{Odds against an event} = \frac{\text{number of ways the event cannot occur}}{\text{number of ways the event can occur}}$$

odds in favour of an event occurring

The likelihood of an event occurring.

$$\text{Odds in favour of an event} = \frac{\text{number of ways the event can occur}}{\text{number of ways the event cannot occur}}$$

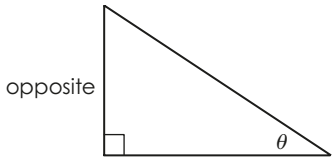
open mortgage

A flexible mortgage where additional payments can be made ahead of schedule without having to pay the breakage costs.

opposite side

The side of a triangle opposite the angle (θ^o)—not the hypotenuse.

Example



optional Autopac coverage

A type of Autopac coverage consisting of a range of insurance choices to increase your Basic Autopac coverage. (e.g., a lower deductible).

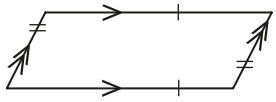
outliers

Numbers that are widely separated from the other numbers in the set.

parallelogram

A four-sided polygon where the opposite sides are parallel and equal in length

Example



percent

A number expressed in relation to 100 (e.g., 88 out of 100 is 88%).

percentile rank

The percentage of values in a data set that are the same or lower than a certain data value.

$$\text{percentile rank} = \frac{(B + 0.5E)}{n} \times 100$$

where

B = the number of scores below a given score

E = the number of scores equal to the given score, including the given score

n = the total number of scores

perimeter
The distance around the outside of a 2-D figure.

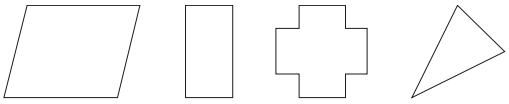
perpendicular bisecting diagonals
Diagonals that form four 90° angles where they meet in a polygon and also bisect each other.

perpendicular diagonals
Diagonals in a polygon that form four right angles (90° angles) at the point where they meet.

pleasure passenger vehicle
A classification Autopac uses for insurance purposes in which a vehicle has limited business use. It can only be driven to or from—or partway to or from—work or school up to 4 days in one month and not more than 1609 kilometres a year. However, it can be used to drive dependent children to and from school without limits.

polygon
A 2-D figure made up of three or more line segments that are joined to enclose space.

Examples



possession date
The day the ownership of a house is officially transferred from the seller to the buyer; also known as the closing date.

precision
Precision refers to the smallest measurement on the measuring device being used. Additionally, when you are stating the precision of a number, refer to the place-value of the last digit.

Example:

The precision of 3.45 is one-hundredth; the precision of 678.9 is one-tenth.

precision of a measuring device
The smallest scale division of a measuring device; a ruler with the smallest scale division marks of one millimetre is precise to the nearest millimetre. Also, the degree of agreement among several measurements made with the same instrument in the same way.

preventative maintenance
Tasks that you can do infrequently in your home so that you can avoid major repair costs later on.

principal (*P*)
The original amount invested or borrowed.

probability
The chance of an event occurring.

$$\text{Probability of an event} = \frac{\text{number of ways the event can occur}}{\text{total number of possible outcomes}}$$

production
In a business, it is the process of converting the resources of a business into goods and services.

profit
The net money earned, and can be considered the reward for taking a risk and starting a business.

proper fraction
A fraction that is less than 1; the numerator is less than the denominator.

Example:

$$\frac{5}{8}$$

property tax formulas
Portion percentage is assigned to each property by the municipality.

portioned assessment = portion percentage × market value assessment

Property Tax Rate (mills) =

$$\frac{\text{total revenue required}}{\text{total portioned assessment}} \times 1000$$

General Municipal Tax =

$$\frac{\text{total portioned assessment}}{1000} \times \text{municipal mill rate}$$

Local Improvement Tax =
frontage × cost of improvement per foot of property frontage

Education Taxes =

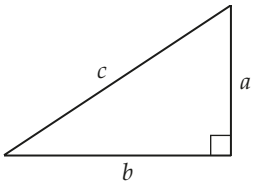
$$\frac{\text{total portioned assessment}}{1000} \times \text{education mill rate}$$

producers
The people and businesses that make goods and provide services.

Pythagorean Theorem
The sum of the squares of the legs (a and b) of a right triangle equals the square of the hypotenuse (c).

Example:

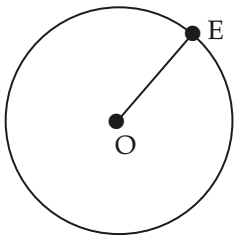
$a^2 + b^2 = c^2$



quadrilaterals
Polygons that have four sides, and the sum of their interior angles is 360°.

radius
A line from the centre of a circle to the edge (circumference) of the circle; half the diameter.

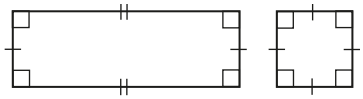
Example



ratio
A comparison of two like numbers or quantities.

rectangle
A 4-sided polygon that has four right angles (90^o), and opposite sides are congruent (equal length).

Examples



refundable tax credits
Deductions from income that reduce the amount of income tax you owe; you receive a refund if the credits are more than your income.

registered education savings plan
A plan that helps people save for their children's post-secondary education.

registered pension plan
A pension plan registered by the CCRA, funded by the employer [and employees].

registered retirement savings plan
A plan to which an individual contributes money toward their retirement.

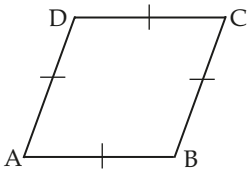
regular polygons
Polygons where all of the sides are equal and all of the angles are equal.

replacement cost
The amount it would cost to replace your home/contents if your home burned to the ground; not the same as present value.

résumé
A brief summary prepared by someone applying for a job, stating his or her personal, educational, and professional qualifications and experience.

rhombus
A quadrilateral with all four sides equal in length.

Example



right angle
An angle that is 90°.

right-angled triangles
Triangles with one interior angle that measures 90°.

safety inspection
A procedure in which a vehicle is inspected to ensure that it conforms to regulations governing safety, emissions, or both; required in Manitoba by Autopac before registering a vehicle for the first time.

sample
A part of the group being studied that represents the whole group.

sample size
The number of people or items surveyed or studied in an experiment.

scale
In drawings, a drawing of an object that is larger or smaller than the actual object, but the two are similar (proportional).

scale factor
The ratio describing the relationship between the actual object and the drawing of the object.

scalene triangle
A triangle with three unequal side lengths and three unequal angles.

serial number
A unique seventeen-digit combination of letters and numbers assigned to a vehicle to distinguish it from every other vehicle.

services
Helpful acts such as home cleaning, nursing, or dental care.

simplify
Combine like terms so that you are left with the simplest form of an equation or expression.

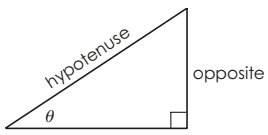
sine law
A formula used to solve non-right triangles.

$$\frac{\sin \angle A}{a} = \frac{\sin \angle B}{b} = \frac{\sin \angle C}{c} \text{ or}$$
$$\frac{a}{\sin \angle A} = \frac{b}{\sin \angle B} = \frac{c}{\sin \angle C}$$

sine ratio
The ratio relating the opposite side and the hypotenuse to the angle (θ^{o}).

Example:

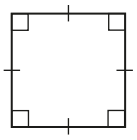
$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$$



solve
Find the answer to an equation or problem, or to find the value of a variable.

square
A quadrilateral with four sides of equal length, and all interior angles equal to 90°.

Example



square root $(\sqrt{\ })$
A number (factor) that, when multiplied by itself, produces the given square.

Example:

$\sqrt{16} = 4$

standard home insurance
Insurance company offers protection for the building and some specified perils to contents.

statistics
The branch of mathematics that deals with the collection, organization, and analysis of data.

sticker price
The Manufacturer's Suggested Retail Price (MSRP) of a car includes the base price, any optional equipment, an air-conditioning excise tax, and a destination or freight charge.

subjective judgments
An individual's personal judgment or decision in a situation that may be based on personal experiences, biases, or opinions.

subjective probability
Probability calculations made by an individual based on subjective judgments.

supplementary angles
Two angles whose sum is 180°.

supply
The availability of a product or service, which is controlled by the producer.

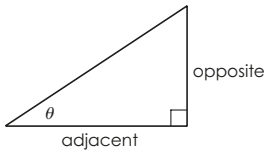
survey certificate
A document that includes a property survey that shows the exact location of the property, as well as the location of any buildings or other structures on the property; normally required by the financial institution when the home buyer wants to get a mortgage; must be paid for by the buyer.

système internationale (SI)
Measurement system based on the multiples of 10; commonly used throughout the world; also known as the metric system.

tangent ratio
The ratio relating the opposite and adjacent sides – not the hypotenuse - to the angle (θ^o).

Example

$$\tan\theta = \frac{\text{opposite}}{\text{adjacent}}$$



tax credits
In the T1 General income tax return, deductions from total income that reduce the amount of income tax payable.

taxable income
In the T1 General income tax return, the amount of income left after certain allowable deductions have been subtracted from the net income; the amount of income tax payable is based on this amount.

10% trimmed mean

The value you get by calculating the mean after removing the lowest 5% and the highest 5% of your data values.

term

The amount of time that the conditions of the loan are in effect.

T4 information slip

A slip containing information such as total employment income as well as the amounts withheld by the employer for the Canada Pension Plan (CPP) and Employment Insurance (EI). It also contains the amount contributed to the employee's registered pension plan, and the amounts deducted for federal and provincial income tax.

theoretical probability

The probability of an event occurring in an ideal situation; the ratio of the number of ways a specific outcome can occur to the total possible number of outcomes.

tolerance

The measurement variation allowed by designers in the construction of an object.

tolerance = maximum limit – minimum limit.

total debt service ratio

A ratio similar to the Gross Debt Service Ratio; however, other debt repayments (such as a vehicle loan) are included in the calculation. The Total Debt Service Ratio should never exceed 40%.

$$\text{Total Debt Service Ratio (TDS)} = \text{Monthly Housing Costs} + \frac{\text{All Other Monthly Debts}}{\text{Gross Monthly Income}} \times 100$$

trade-in allowance

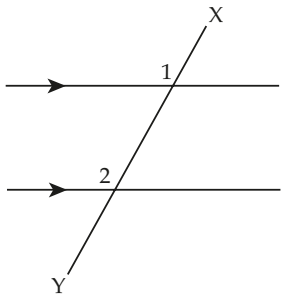
The amount of money taken off the selling price of a new car in exchange for the older car you are trading in.

transversal

A line that intersects two or more lines. The lines may or may not be parallel.

Example

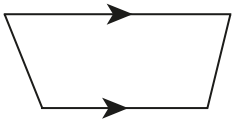
In the figure below, XY is a transversal. It creates eight angles with the two parallel lines.



trapezoid

A four-sided polygon with two parallel sides.

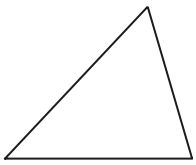
Example



triangle

A three-sided polygon with three angles; sides and angles can but don't have to be equal.

Example



trimmed mean

A measure of central tendency that ignores outliers in the calculation of the mean.

two-dimensional (2-D)

A figure that only has two measures (a rectangle is 2-D because it is described using only length and width).

uncertainty

Uncertainty of a measurement refers to the margin of error of the measurement and is usually half the precision of the measuring device (sometimes it is given as a specific value).

Example:

If the precision on a metre stick is 1 mm, the uncertainty of a measurement is ± 0.5 mm.

unit cost

The cost to produce one product.

unit selling price

The price of one product.

variable-rate mortgage

A mortgage having a flexible interest rate that changes with the market.

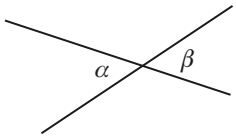
Vernier caliper

A measuring device precise to the nearest hundredth (0.01) of a centimetre.

vertically opposite angles

Angles that are opposite each other when two lines cross; α and β are vertically opposite angles, and are therefore equal.

Example



wants

Things that people enjoy having, and that may make life easier, but are not necessary for survival.

weighted mean

A calculation similar to the mean except each item has a different weight and therefore contributes in different amounts to the weighted mean.

Weighted Mean Formula: $\frac{\sum(x \times w)}{\sum w}$

where:

w = the weight of each individual value

x = the individual value

Σ = the symbol for sum

working capital

The amount of working capital available for operating and enlarging a business.

working capital = current assets – current liabilities

Grade 12 Essential Mathematics (40S)

Bibliography

Bibliography

Canada Revenue Agency. *2011 T1 General Income Tax and Benefit Return*. Ottawa, ON: Canada Revenue Agency, 2011. Current forms available online at <www.cra-arc.gc.ca>.

____. T4 Slip. Ottawa, ON: Canada Revenue Agency, 2011. Current forms available online at <www.cra-arc.gc.ca>.

City of Winnipeg. *2008-2010 Adopted Operating Budget*. Winnipeg, MB: Corporate Finance, The City of Winnipeg, March 26, 2008. Available online at <www.winnipeg.ca/Finance/files/2008_adopted_operating_budget_service_based_view(aug5).pdf>.

____. *Services – Local Improvements*. Winnipeg, MB: The City of Winnipeg, 2012. Available online at <www.winnipeg.ca/publicworks/services/LocalImprovements.asp>.

Flynn, Tim. *Career Test*. St. Louis, MO: Similarminds.com, 2013. Available online at <http://similarminds.com/career.html>.

Government of Canada. *Working in Canada: Explore Careers by Skills and Knowledge*. Ottawa, ON: Government of Canada, 2012. Available online at <www.workingincanada.gc.ca/report_skillknowledge-eng.do>.

Manitoba Public Insurance. *Driver Safety Rating*. Winnipeg, MB: Manitoba Public Insurance, 2014. Available online at <www.mpi.mb.ca/en/DL/DL/DSR/pages/dsroverview.aspx>.

Manitoba Public Insurance. *Manitoba Public Insurance 2011 Rate Application Tables*. Winnipeg, MB: Manitoba Public Insurance, 2010.

____. *Registration*. Winnipeg, MB: Manitoba Public Insurance, 2013. Available online at <www.mpi.mb.ca/english/Registration/reg_Transfers.html#COI>.

Miva AK. *Career Personality Quiz*. Kansas City, MO: Acknowledge, 2013. Available online at <www.mycareerquizzes.com/career-personality-quiz>.

Province of Manitoba. *Budget Paper C: Taxation Adjustments*. Winnipeg, MB: Province of Manitoba, 2011. Available online at <www.gov.mb.ca/finance/budget13/papers/taxation.pdf>.

Statistics Canada. "Average total income of the population 15 years and over by highest certificate, diploma or degree, by province and territory (2006 Census)." Census of Population. Oct. 9, 2009. Available online at <http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/labor50b-eng.htm>. (30 June 2014).

TPR Education. *The Princeton Review Career Quiz*. Princeton, NJ: The Princeton Review, 2013. Available online at <www.princetonreview.com/careers-after-college.aspx>.

Notes

GRADE 12 ESSENTIAL MATHEMATICS (40S)

Midterm Practice Exam

GRADE 12 ESSENTIAL MATHEMATICS

Midterm Practice Exam

Name: _____

Student Number: _____

Attending ❑ Non-Attending ❑

Phone Number: _____

Address: _____

_____

_____

For Marker's Use Only

Date: _____

Final Mark: _____ /100 = _____ %

Comments:

Instructions

The midterm examination is based on Modules 1 to 4 of the Grade 12 Essential Mathematics course. It is worth 12.5% of your final mark in this course.

Time

You will have a maximum of **3.0 hours** to complete the midterm examination.

Format

The format of the examination will be as follows:

Module 1: Home Finance	33 marks
Module 2: Geometry and Trigonometry	27 marks
Module 3: Business Finance	17 marks
Module 4: Probability	23 marks
Total	100 marks

(see over)

Instructions (continued)

Resources Provided

The following tables are provided at the end of this examination

- Amortization Table
- Manitoba Homeowner's Insurance Rates ($500 deductible)
- Interest Rate Factor Table
- Local Improvement Costs for Property Tax Credits

Resources Required (Not Provided)

To complete this examination, you will need:

- pens/pencils (2 or 3 or each)
- blank paper
- scientific or graphing calculator
- Midterm Exam Resource Sheet (The Midterm Exam Resource Sheet must be handed in with the exam. You will receive your Midterm Exam Resource Sheet back from your tutor/marker with the next module that is submitted for marking.)

Notes

- show all calculations and formulas
- include units where appropriate
- use decimal places in your calculations and round the final answers to the correct number of decimal places
- clearly state your final answer
- diagrams may not be drawn to scale

Name: _____

Answer all questions to the best of your ability. Show all your work.

Module 1: Home Finance *(33 marks)*

1. Alec wants to purchase a home where the monthly mortgage payment would be $739. He has a gross monthly income of $4100. He also knows that the monthly property taxes would be $163 and the monthly heating costs would be around $119. *(3 marks)*

   a) Calculate the Gross Debt Service Ratio. (Module 1, Lesson 1)

   b) Would the financial institution grant a mortgage in this case? (Module 1, Lesson 1)

2. Haylee would like to purchase a condominium. Haylee has a gross annual income of $59,900. She has saved $19,000 for a down payment. Her financial institution has offered her a 3.5% interest rate on a mortgage amortized over 25 years. Haylee estimates her monthly property taxes will be $119 and her monthly heating costs will be $96. Condo fees are $450 per month.

   a) Use the chart to calculate the maximum price Haylee can pay for her condominium. *(4 marks)* (Module 1, Lesson 1)

Maximum Affordable Home Price		
Gross monthly household income		$_____
Multiply: (GDSR)	_____	
Total affordable household expenses		$_____
Subtract:		
Monthly property taxes	$_____	
Monthly heating costs	$_____	
One-half of condo/strata fees (if applicable)	$_____	
Monthly affordable mortgage payment		$_____
Divide: Interest factor (from Chart 1.1)	_____	
Amount of affordable mortgage		$_____
Add: Cash down payment	$_____	
Maximum affordable home price		$_____

b) The condominium manager tells Haylee that he will cover emergency repairs, but that she needs to maintain her condo with daily and preventative maintenance. Describe which tasks the manager will complete and which tasks Haylee must do. *(2 marks)* (Module 1, Lesson 4)

3. The Russell family owns a home with a Boeckh replacement value of $195,000. The home is located in Metro Winnipeg. The family chooses Standard homeowner's insurance with a deductible of $200. (Module 1, Lesson 3)

   a) What is the replacement value of a home based on? *(1 mark)*

   b) Calculate the Russell family's annual insurance premium. *(2 marks)*

   c) Explain the difference between Comprehensive homeowner's insurance and Standard homeowner's insurance. *(2 marks)*

Name: _____

4. Chance has just purchased a new home for $360,000. The possession date is October 15th. Annual property taxes are $1989 and they are due on June 30th. Chance's home insurance is renewed December 1 of each year. He has to increase his home insurance from $300 to $460 per year and pay the difference for the extra months. (Module 1, Lesson 1)

   a) Calculate Chance's home insurance adjustment. *(3 marks)*

   b) Calculate Chance's property tax adjustment. *(2 marks)*

   c) Calculate the land transfer tax. *(4 marks)*

5. Kade has purchased a home for $187,900. He makes a down payment of $21,000 and takes out a fixed-rate 25-year mortgage at 2.5% for the balance of the purchase price. (Module 1, Lesson 2)

   a) Determine the monthly mortgage payments. *(2 marks)*

   b) Calculate the total amount of interest that Kade will pay on his mortgage over 25 years. *(2 marks)*

   c) Calculate the interest on the unpaid balance for the first month. *(1 mark)*

   d) Complete a schedule of mortgage payments for Kade for the first month. *(3 marks)*

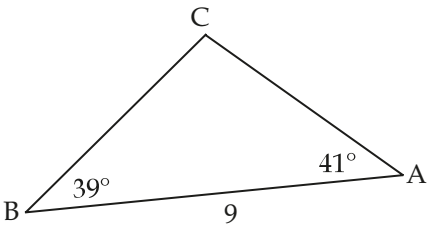
Payment #	Payment	Interest	Principal	Unpaid Balance	Owner's Equity
				$166,900.00	$21,000.00
1					

6. List one benefit of renting an apartment and one benefit of buying a house or condo. *(2 marks)* (Module 1, Lesson 5)

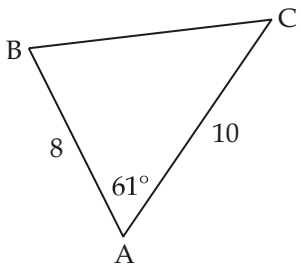
Name: _____

Module 2: Geometry and Trigonometry *(27 marks)*

1. Find the missing measures indicated.
   a) Find side *a*. *(3 marks)* (Module 2, Lesson 5)

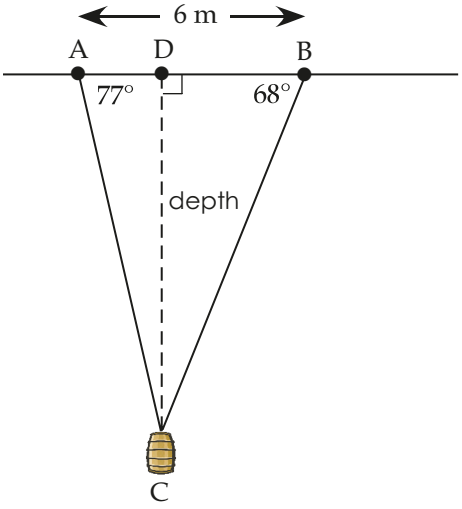


b) Find side *a*, and angle B. *(3 marks)* (Module 2, Lesson 6)

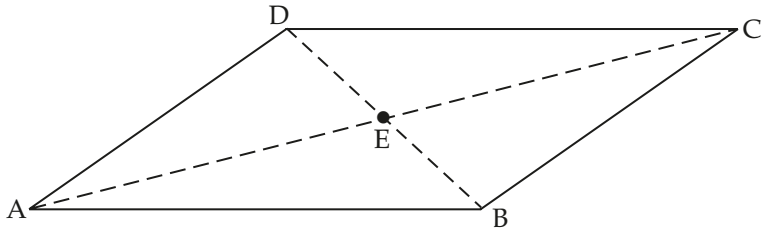


Name: _____

2. Two ropes are being used to raise a heavy object from the bottom of a lake. The heavy object (point C) is between points A and B. How far is the heavy object below the surface of the water if the distance between A and B is 6 metres? Round your answer to one decimal place. *(5 marks)* (Module 2, Lesson 5)



3. Find the measures in the following parallelogram ABCD. *(4 marks)* (Module 2, Lesson 3)



Given: ∠DAB = 35°

segment $\overline{DE}$ = 4 cm

segment $\overline{CE}$ = 1.5 times segment $\overline{BE}$

Find:

a) ∠ADC

b) ∠DCB

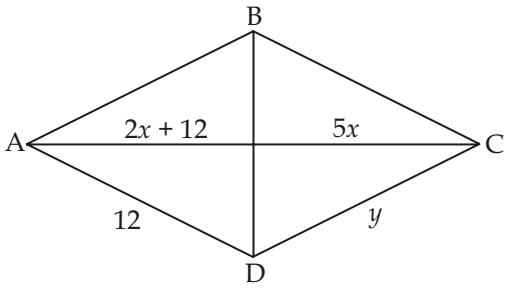
c) Diagonal length DB

d) Diagonal length AC

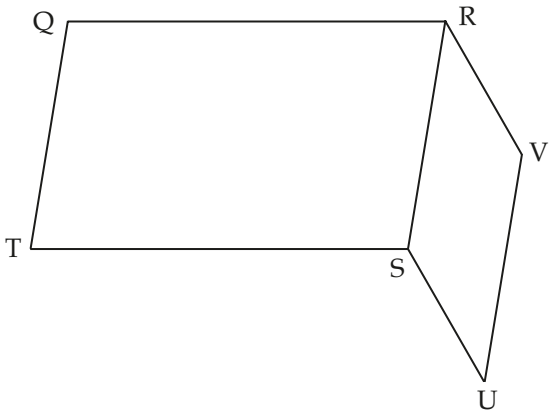
4. Describe when the Sine Law may be useful in a construction, industrial, commercial, or artistic application. *(2 marks)* (Module 2, Lesson 6)

Name: _____

5. a) ABCD is a rhombus. Find x and y. *(2 marks)* (Module 2, Lesson 2)



b) QRST and RSUV are parallelograms. State why $\overline{QT}$ is the same length as VU. *(2 marks)* (Module 2, Lesson 2)



6. a) State the definition of an equilateral triangle. *(1 mark)* (Module 2, Lesson 4)

   b) Are all equilateral triangles regular polygons? *(1 mark)*

7. Consider an octagon. (Module 2, Lesson 4)
   a) A polygon can be divided into a series of triangular regions by drawing diagonals from one of the vertices. How many triangular regions can be drawn inside an octagon? *(1 mark)*

   b) What is the sum of the interior angles of an octagon? *(1 mark)*

   c) What is the sum of the interior angles of a nonagon? A nonagon has nine sides. *(1 mark)*

   d) Is it possible for the sum of the interior angles of a polygon to be 1980^{o}? How do you know? *(1 mark)*

Name: _____

Module 3: Business Finance (17 marks)

1. State two possible advantages of working in a larger business rather than in a small business. *(2 marks)* (Module 3, Lesson 1)

2. Leah is trying to determine which small business idea is most feasible in her community as a way to earn money in the summer. Her community is a small town in northern Manitoba with 100 people. Leah is considering the two businesses below and she has asked your advice. Is each of the following two businesses feasible in the community? Explain your answer for both businesses. *(2 marks)* (Module 3, Lesson 1)

   a) Lawn Care

   b) Sports Equipment Rental

3. Identify three expenses that you may have when operating a small business. You may identify business expenses or capital expenses. *(3 marks)* (Module 3, Lesson 1)

4. A business plans to produce 600 calendars and sell them for $13 each. The unit cost is $7 per calendar. How many calendars must be sold for the company to reach the break-even point? *(1 mark)* (Module 3, Lesson 2)

5. Hillary plans to make and sell 200 pairs of earrings. The cost for the metal required to make the earrings is $2050. (Module 3, Lesson 2)
   a) Will Hillary make a profit if she charges $15.00 per pair of earrings? Justify your answer. *(1 mark)*

   b) Will Hillary make a profit if she charges $9.00 per pair of earrings? Justify your answer. *(1 mark)*

   c) How much must Hillary charge to break even? *(1 mark)*

Name: _____

6. For a summer job, Curtis runs an exterior window cleaning business. His business expenses each week are for soap at $13.44, cloths at $11.20, and gas at $170. He also has a weekly expense of $70.20 for a loan he needed to buy ladders. He works 5 days each week and cleans the windows of 4 houses each day. Curtis charges $45 per house. (Module 3, Lesson 2)
   a) Calculate Curtis's weekly profit. *(2 marks)*

   b) Describe one thing Curtis might consider doing to increase the profit. *(1 mark)*

7. List the four sections of the T1 General income tax return. *(2 marks)* (Module 3, Lesson 3)

8. Which of the following expenses can be claimed only under business expenses and not under personal expenses? Circle the best answer. *(1 mark)* (Module 3, Lesson 3)
   a) telephone and utilities
   b) child care costs
   c) medical costs
   d) tuition fees

Module 4: Probability *(23 marks)*

1. In a class of 32 students where they each take one option, 18 students take an Art option, 10 other students take a Drama option, and the rest of the students take a Choir option. One student is selected at random. Find the following: *(4 marks)* (Module 4, Lesson 2)
   a) the odds in favour of the selected student taking Drama

   b) the odds against the selected student taking Choir

   c) the odds in favour of the selected student either taking Art or Choir

   d) the probability of the selected student either taking Art or Choir

2. The odds against a spring flood in Winnipeg are 6:7. *(2 marks)* (Module 4, Lesson 2)
   a) What are the odds in favour of a spring flood in Winnipeg?

   b) What is the probability of a spring flood in Winnipeg?

Name: _____

3. Keira studied how often Friday the 13th occurs. The following chart indicates her data showing how often the 13th day of the month falls on each of the seven days of the week. *(6 marks)*

Days of the Week	S	M	T	W	T	F	Sa
How Often the 13th Day Occurs	687	685	685	687	684	688	684

a) Find the probability that the 13th day of the month occurs on a Friday. Express this probability as a percent, decimal (rounded to two decimal places), and a fraction. *(2 marks)* (Module 4, Lesson 1)

b) Find the probability that the 13th day of the month does not occur on a Friday. Express this probability as a percent. *(2 marks)* (Module 4, Lesson 1)

c) Is this an example of theoretical probability or experimental probability? Explain. *(2 marks)* (Module 4, Lesson 4)

4. State an example of a situation where you would use the following type of probability to predict an outcome or make a decision: *(3 marks)* (Module 4, Lesson 4)

   a) Theoretical probability

   b) Experimental probability

   c) Subjective probability

5. An expert is to make a decision about the safety of the design of a vehicle. What kind of probability will be used as a basis for the decision? Explain. *(2 marks)*
   (Module 4, Lesson 4)

Name: _____

6. Consider the following game. It costs $5 each time you draw a card from a shuffled standard deck. If you draw an ace, you win $50. If you draw a king, you win $25. If you draw any other card, you receive nothing. An expected value chart is included in this question. Use it only if you find it helpful. (Module 4, Lesson 3)

   a) Determine your expected value of the game. *(4 marks)*

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability x Payoff
Ace					
King					
Other Card					

   b) If you play this game 15 times, how much money can you expect to gain or lose? *(1 mark)*

   c) Is this a fair game? Explain why or why not. *(1 mark)*

Amortization Table					
Amortization Period of Mortgage Loan (Blended payment of principal and interest per $1,000 of loan)					
Interest Rate	**5 years**	**10 years**	**15 years**	**20 years**	**25 years**
1.50%	$17.31	$8.98	$6.21	$4.82	$4.00
1.75%	17.42	9.09	6.32	4.94	4.11
2.00%	17.52	9.20	6.43	5.05	4.23
2.25%	17.63	9.31	6.55	5.17	4.36
2.50%	17.74	9.42	6.66	5.29	4.48
2.75%	17.85	9.53	6.78	5.41	4.61
3.00%	17.96	9.65	6.90	5.54	4.73
3.25%	18.07	9.76	7.02	5.66	4.86
3.50%	18.18	9.88	7.14	5.79	4.99
3.75%	18.29	9.99	7.26	5.91	5.13
4.00%	18.40	10.11	7.38	6.04	5.26
4.25%	18.51	10.23	7.50	6.17	5.40
4.50%	18.62	10.34	7.63	6.30	5.53
4.75%	18.74	10.46	7.75	6.44	5.67
5.00%	18.85	10.58	7.88	6.57	5.82
5.25%	18.96	10.70	8.01	6.71	5.96
5.50%	19.07	10.82	8.14	6.84	6.10
5.75%	19.19	10.94	8.27	6.98	6.25
6.00%	19.30	11.07	8.40	7.12	6.40
6.25%	19.41	11.19	8.53	7.26	6.55
6.50%	19.53	11.31	8.66	7.41	6.70
6.75%	19.64	11.43	8.80	7.55	6.85
7.00%	19.75	11.56	8.93	7.70	7.00
7.25%	19.87	11.68	9.07	7.84	7.16
7.50%	19.98	11.81	9.21	7.99	7.32
7.75%	20.10	11.94	9.34	8.13	7.47
8.00%	20.21	12.06	9.48	8.28	7.63
8.25%	20.33	12.19	9.62	8.43	7.79
8.50%	20.45	12.32	9.76	8.59	7.95
8.75%	20.56	12.45	9.90	8.74	8.12
9.00%	20.68	12.58	10.05	8.89	8.28
9.25%	20.80	12.71	10.19	9.05	8.44
9.50%	20.91	12.84	10.33	9.20	8.61
9.75%	21.03	12.97	10.48	9.36	8.78
10.00%	21.15	13.10	10.62	9.52	8.94
10.25%	21.27	13.24	10.77	9.68	9.11
10.50%	21.38	13.37	10.92	9.84	9.28
10.75%	21.50	13.50	11.06	9.99	9.45
11.00%	21.62	13.64	11.21	10.16	9.63

*Interest compounded semi-annually. Actual payment amount may differ slightly.

Manitoba Homeowner's Insurance Rates ($500 deductible)								
Boeckh Calculator	**Metro Winnipeg**		**Area 2**		**Area 3**		**Area 4**	
Amount	**Standard**	**Comprehensive**	**Standard**	**Comprehensive**	**Standard**	**Comprehensive**	**Standard**	**Comprehensive**
$ 50,000	195	214	147	161	196	216	261	287
$ 55,000	216	238	160	176	217	239	289	318
$ 60,000	237	260	173	190	237	261	315	347
$ 65,000	252	277	187	205	255	281	339	373
$ 70,000	266	303	200	220	270	297	359	395
$ 75,000	294	324	210	231	285	314	379	417
$ 80,000	310	323	221	243	302	332	402	438
$ 85,000	318	333	226	249	313	344	416	462
$ 90,000	324	349	231	254	324	356	431	474
$ 95,000	348	370	244	268	345	380	459	505
$100,000	364	393	260	286	361	397	480	528
$105,000	390	417	278	306	378	416	503	553
$110,000	402	441	293	322	393	432	523	575
$115,000	418	464	299	329	409	450	544	598
$120,000	436	487	309	340	424	466	564	620
$125,000	451	510	319	351	444	488	591	650
$130,000	472	543	339	373	466	513	620	682
$135,000	498	557	345	380	477	525	634	697
$140,000	523	580	358	394	496	546	660	726
$145,000	538	596	375	413	508	559	676	744
$150,000	550	604	385	424	520	572	692	761
$155,000	557	613	398	438	551	606	733	806
$160,000	565	622	413	454	569	626	757	833
$165,000	572	629	425	468	589	648	783	861
$170,000	590	647	441	485	609	670	810	891
$175,000	607	668	451	496	624	686	830	913
$180,000	620	686	466	513	648	713	862	948
$185,000	636	702	478	526	667	734	887	976
$190,000	652	717	492	541	705	776	938	1032
$195,000	678	742	504	554	720	792	958	1054
$200,000	692	771	519	571	726	799	966	1063
Additional Amounts per $1000 coverage	Add: $3.15	Add: $3.50	Add: $2.75	Add: $3.03	Add: $3.55	Add: $3.91	Add: $4.72	Add: $5.19

$200 deductible—Increase premium by 10%

Chart 1.1 Interest Rate Factor Table Based on 25-Year Amortization	
Interest Rate	**Payment Factor For Each Dollar of Loan**
2.5%	0.00448
3.0%	0.00473
3.5%	0.00499
4.0%	0.00526
4.5%	0.00553
5.0%	0.00582
5.5%	0.00610
6.0%	0.00640
6.5%	0.00670
7.0%	0.00700
7.5%	0.00732
8.0%	0.00763

Local Improvement Costs for Property Tax Credits	
Property Improvement	**Cost per Frontage Foot per Year**
Asphalt surfacing roadways	$ 26.22
Boulevard construction	$ 10.81
Concrete sidewalk	$ 7.86
Concrete street paving	$ 39.32
Granular surface lane	$ 9.01
Land drainage system	$ 8.62
Lane lighting	$ 1.80
Lane oiling	$ 9.00
Lane paving	$ 11.80
Ornamental lighting (lane)	$ 10.82
Ornamental lighting (street)	$ 14.42
Road oiling	$ 8.00
Wastewater sewers	$ 9.98
Water mains	$ 11.54

Source: http://winnipeg.ca/publicworks/Services/LocalImprovements.asp

GRADE 12 ESSENTIAL MATHEMATICS (40S)

Midterm Practice Exam
Answer Key

Grade 12 Essential Mathematics

Midterm Practice Exam
Answer Key

Name: _____

Student Number: _____

Attending ❑ Non-Attending ❑

Phone Number: _____

Address: _____

_____

_____

For Marker's Use Only

Date: _____

Final Mark: _____ / 100 = _____ %

Comments:

Instructions

The midterm examination is based on Modules 1 to 4 of the Grade 12 Essential Mathematics course. It is worth 12.5% of your final mark in this course.

Time

You will have a maximum of **3.0 hours** to complete the midterm examination.

Format

The format of the examination will be as follows:

Module 1: Home Finance	33 marks
Module 2: Geometry and Trigonometry	27 marks
Module 3: Business Finance	17 marks
Module 4: Probability	23 marks
Total	100 marks

(see over)

Instructions (continued)

Resources Provided

The following tables are provided at the end of this examination

- Amortization Table
- Manitoba Homeowner's Insurance Rates ($500 deductible)
- Interest Rate Factor Table
- Local Improvement Costs for Property Tax Credits

Resources Required (Not Provided)

To complete this examination, you will need:

- pens/pencils (2 or 3 or each)
- blank paper
- scientific or graphing calculator
- Midterm Exam Resource Sheet (The Midterm Exam Resource Sheet must be handed in with the exam. You will receive your Midterm Exam Resource Sheet back from your tutor/marker with the next module that is submitted for marking.)

Notes

- show all calculations and formulas
- include units where appropriate
- use decimal places in your calculations and round the final answers to the correct number of decimal places
- clearly state your final answer
- diagrams may not be drawn to scale

Name: _____

Answer all questions to the best of your ability. Show all your work.

Module 1: Home Finance *(33 marks)*

1. Alec wants to purchase a home where the monthly mortgage payment would be $739. He has a gross monthly income of $4100. He also knows that the monthly property taxes would be $163 and the monthly heating costs would be around $119. *(3 marks)*

   a) Calculate the Gross Debt Service Ratio. (Module 1, Lesson 1)

   Answer:

   $$\text{GSDR} = \frac{739 + 163 + 119}{4100} \times 100 = \frac{1021}{4100} \times 100 = 24.9\%$$

   b) Would the financial institution grant a mortgage in this case? (Module 1, Lesson 1)

   Answer:

   Yes, because the Gross Debt Service Ratio is less than 32%.

2. Haylee would like to purchase a condominium. Haylee has a gross annual income of $59,900. She has saved $19,000 for a down payment. Her financial institution has offered her a 3.5% interest rate on a mortgage amortized over 25 years. Haylee estimates her monthly property taxes will be $119 and her monthly heating costs will be $96. Condo fees are $450 per month.

   a) Use the chart to calculate the maximum price Haylee can pay for her condominium. *(4 marks)* (Module 1, Lesson 1)

   Answer:

Maximum Affordable Home Price		
Gross monthly household income		$ 4991.67
Multiply: (GDSR)	0.32	
Total affordable household expenses		$ 1597.33
Subtract:		
Monthly property taxes	$ 119.00	
Monthly heating costs	$ 96.00	
One-half of condo/strata fees (if applicable)	$ 225.00	
Monthly affordable mortgage payment		$ 1157.33
Divide: Interest factor (from Chart 1.1)	0.00499	
Amount of affordable mortgage		$231,930.53
Add: Cash down payment	$ 19,000.00	
Maximum affordable home price		$250,930.53

b) The condominium manager tells Haylee that he will cover emergency repairs, but that she needs to maintain her condo with daily and preventative maintenance. Describe which tasks the manager will complete and which tasks Haylee must do. *(2 marks)* (Module 1, Lesson 4)

Answer:

The manager will repair faulty plumbing such as hot water tanks, toilets that don't work properly, or taps that leak. The manager is also responsible for faulty doors and windows, worn out flooring, heating and air conditioning systems, as well as emergency repairs.

Haylee will be responsible for the general cleaning of her condo, changing light bulbs, as well as checking that windows and doors close properly. She will also have to check walls for cracks, and check that vents are clear, taps are not leaking, the toilet does not waste water, and other preventative measures. She needs to report any problems to the manager.

3. The Russell family owns a home with a Boeckh replacement value of $195,000. The home is located in Metro Winnipeg. The family chooses Standard homeowner's insurance with a deductible of $200. (Module 1, Lesson 3)

a) What is the replacement value of a home based on? *(1 mark)*

Answer:

The replacement value of a home is the amount it would cost to replace the home with another house of equal value if it is burned to the ground.

b) Calculate the Russell family's annual insurance premium. *(2 marks)*

Answer:

Standard insurance rate for $195000 in Metro Winnipeg = $678

Extra deductible (for $200) = 10% × $678 = $67.8

Insurance cost = $678 + $67.8 = $745.80

c) Explain the difference between Comprehensive homeowner's insurance and Standard homeowner's insurance. *(2 marks)*

Answer:

With **Standard insurance**, the contents are covered only for specified perils.

With **Comprehensive insurance**, the contents are covered for more perils.

Name: _____

4. Chance has just purchased a new home for $360,000. The possession date is October 15th. Annual property taxes are $1989 and they are due on June 30th. Chance's home insurance is renewed December 1 of each year. He has to increase his home insurance from $300 to $460 per year and pay the difference for the extra months. (Module 1, Lesson 1)

   a) Calculate Chance's home insurance adjustment. *(3 marks)*

   Answer:

   Insurance Increase = $460 – $300 = $160

   Time period = October 15 – December 1 = 1.5 months

   Adjustment = $\left(\frac{1.5}{12}\right) \times 160 = \$20$

   b) Calculate Chance's property tax adjustment. *(2 marks)*

   Answer:

   Tax adjustment = $\left(\frac{2.5}{12}\right) \times \$1989 = \$414.38$

   c) Calculate the land transfer tax. *(4 marks)*

   Answer:

   Amount under $30,000 = $30,000.

   Tax on this amount = $0

   Amount between $30,000 and $90,000 = $60,000.

   Tax on this amount = 0.5% × 60,000 = $300

   Amount between $90,000 and $150,000 = $60,000.

   Tax on this amount = 1.0% × 60,000 = $600

   Amount between $150,000 and $200,000 = $50,000.

   Tax on this amount = 1.5% × 50,000 = $750

   Amount over $200,000 = $360,000 – $200,000 = $160,000.

   Tax on this amount = 2.0% × 160,000 = $3200

   Total Land Transfer Tax = 0 + 300 + 600 + 750 + 3200

   = $4850

5. Kade has purchased a home for $187,900. He makes a down payment of $21,000 and takes out a fixed-rate 25-year mortgage at 2.5% for the balance of the purchase price. (Module 1, Lesson 2)

   a) Determine the monthly mortgage payments. *(2 marks)*

   Answer:

   Cost per $1000 at 2.5% for 25 years = 4.48 (from amortization table given)

   Mortgage: $187,900 – $21,000 = $166,900

   Monthly payment = $\frac{\$166,900}{1000} \times 4.48 = 166.9 \times 4.48 = \$747.71$

   b) Calculate the total amount of interest that Kade will pay on his mortgage over 25 years. *(2 marks)*

   Answer:

   Total cost of mortgage = $747.71 × 12 × 25 = $224,313.00

   Interest = $224,313.00 – $166,900.00 = $57,413.00

   c) Calculate the interest on the unpaid balance for the first month. *(1 mark)*

   Answer:

   $166,900 × 0.025 = $4172.50 annually

   $4172.50 ÷ 12 = $347.71 monthly

   d) Complete a schedule of mortgage payments for Kade for the first month. *(3 marks)*

   Answer:

Payment #	Payment	Interest	Principal	Unpaid Balance	Owner's Equity
				$166,900.00	$21,000.00
1	$747.71	$347.71	$400.00	$166,500.00	$21,400.00

6. List one benefit of renting an apartment and one benefit of buying a house or condo. *(2 marks)* (Module 1, Lesson 5)

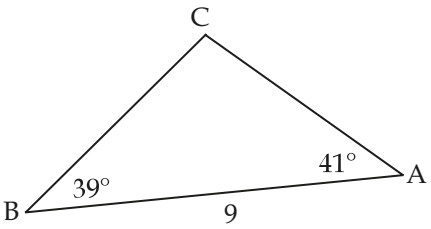
   Answer:

   - A benefit of renting an apartment is that you are not responsible for the repairs and maintenance costs. Or, you could say a benefit is that you do not need a large sum of cash to put toward a down payment.
   - A benefit of buying a house or condo is that you make monthly payments that increase your equity, which results in you eventually having an asset you own. Or, you could say a benefit of buying is that you are in control of decisions about possible renovations or house improvements.

Name: _____

Module 2: Geometry and Trigonometry *(27 marks)*

1. Find the missing measures indicated.
   a) Find side *a*. *(3 marks)* (Module 2, Lesson 5)



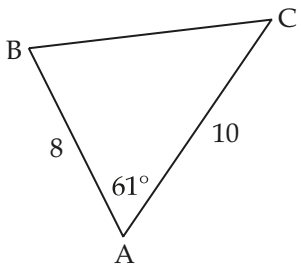
Answer:

$\angle C = 180° - 39° - 41° = 100°$

$$\frac{a}{\sin 41°} = \frac{9}{\sin 100°}$$

$$a = 5.995$$

b) Find side *a*, and angle B. *(3 marks)* (Module 2, Lesson 6)



Answer:

$a^2 = 8^2 + 10^2 - 2 \times 8 \times 10(\cos 61°)$

$a^2 = 64 + 100 - 77.57$

$a^2 = 86.43$

$a = 9.3$

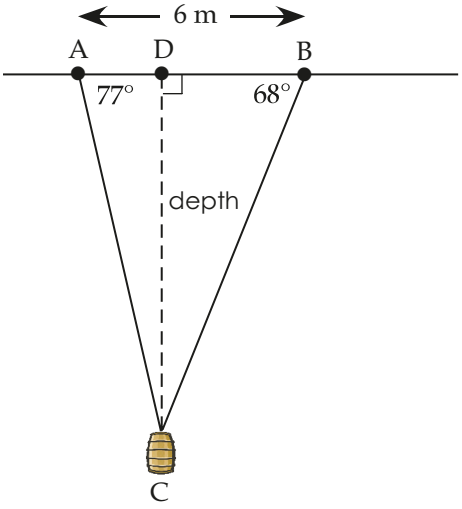
$$\frac{\sin \angle B}{10} = \frac{\sin 61°}{9.3}$$

$\sin \angle B = 0.940$

$\angle B = 70.1°$

Name: _____

2. Two ropes are being used to raise a heavy object from the bottom of a lake. The heavy object (point C) is between points A and B. How far is the heavy object below the surface of the water if the distance between A and B is 6 metres? Round your answer to one decimal place. *(5 marks)* (Module 2, Lesson 5)



Answer:

In ΔABC:

C = 180° – 77° – 68° = 35°

$$\frac{b}{\sin 68°} = \frac{6}{\sin 35°}$$

$$b = \frac{6 \sin 68°}{\sin 35°} = 9.70 \text{ m}$$

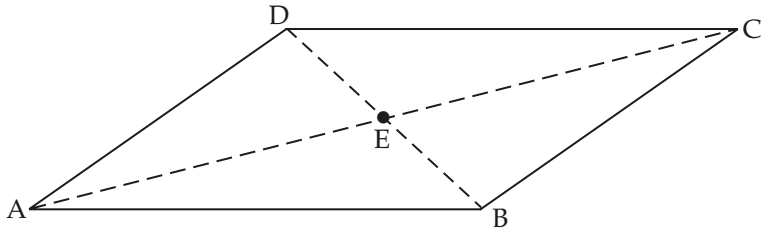
In ΔACD:

$$\sin 77° = \frac{CD}{9.70}$$

$$CD = 9.70 \sin 77° = 9.45 \text{ m}$$

Depth = 9.5 m.

3. Find the measures in the following parallelogram ABCD. *(4 marks)* (Module 2, Lesson 3)



Given: ∠DAB = 35°

segment $\overline{DE}$ = 4 cm

segment $\overline{CE}$ = 1.5 times segment $\overline{BE}$

Find:

a) ∠ADC

Answer:

145°

b) ∠DCB

Answer:

35°

c) Diagonal length DB

Answer:

8

d) Diagonal length AC

Answer:

12

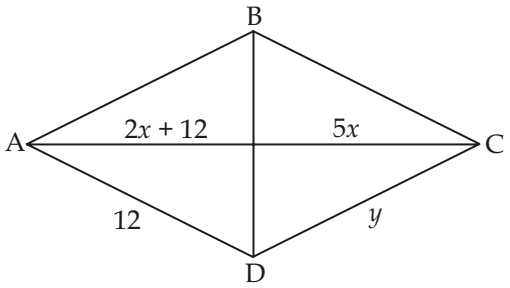
4. Describe when the Sine Law may be useful in a construction, industrial, commercial, or artistic application. *(2 marks)* (Module 2, Lesson 6)

Answer:

When given specifications that involve measures of a non-right angle for applications such as designing a garden or a window, the Sine Law would be used to calculate the measures of sides or angles when one side and its opposite angle are known.

Name: _____

5. a) ABCD is a rhombus. Find x and y. *(2 marks)* (Module 2, Lesson 2)



Answer:

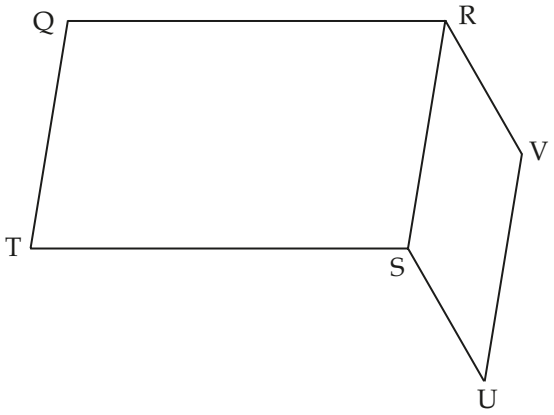
$2x + 12 = 5x$

$12 = 3x$

$4 = x$ and

$12 = y$ (all sides same for rhombus)

b) QRST and RSUV are parallelograms. State why $\overline{QT}$ is the same length as VU. *(2 marks)* (Module 2, Lesson 2)



Answer:

QRST is a parallelogram; therefore, $\overline{QT}$ is parallel and equal to $\overline{RS}$.

RSUV is a parallelogram; therefore, $\overline{RS}$ is parallel and equal to $\overline{VU}$.

Therefore, $\overline{QT}$ is parallel and equal to $\overline{VU}$.

6. a) State the definition of an equilateral triangle. *(1 mark)* (Module 2, Lesson 4)

Answer:

Equilateral triangles have three equal sides and three equal angles.

b) Are all equilateral triangles regular polygons? *(1 mark)*

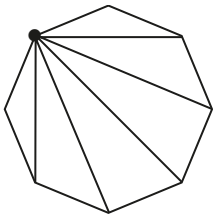
Answer:

Yes, because all angles are equal and all sides are equal.

7. Consider an octagon. (Module 2, Lesson 4)

a) A polygon can be divided into a series of triangular regions by drawing diagonals from one of the vertices. How many triangular regions can be drawn inside an octagon? *(1 mark)*

Answer:



Number of triangular regions = number of sides – 2

For an octagon, number of triangles = 8 – 2 = 6

b) What is the sum of the interior angles of an octagon? *(1 mark)*

Answer:

Sum = # of triangles × 180° = 6 × 180° = 1080°.

c) What is the sum of the interior angles of a nonagon? A nonagon has nine sides. *(1 mark)*

Answer:

A nonagon has one more triangular region than an octagon. Therefore, 1080° + 180° = 1260° = sum of angles in a nonagon.

d) Is it possible for the sum of the interior angles of a polygon to be 1980°? How do you know? *(1 mark)*

Answer:

Any polygon can be drawn as a series of triangular regions.

$$\frac{1980^\circ}{180^\circ} = 11 \text{ triangular regions}$$

Therefore, the sum of the interior angles of a polygon can equal 1980°.

Name: _____

Module 3: Business Finance (17 marks)

1. State two possible advantages of working in a larger business rather than in a small business. *(2 marks)* (Module 3, Lesson 1)

   Answer:

   Answers may vary. Answers may include something similar to the following:

   - Small businesses normally have one manager in charge of decision making, while larger companies may have department managers and supervisors. Therefore, in a larger company you can discuss ideas before making a decision.
   - Small businesses may have one person completing many tasks and having many responsibilities while larger businesses typically have one employee doing one job. Therefore, if you enjoy focusing on only one job, working for a large business would be an advantage.
   - Larger businesses may have benefits available to employees while small businesses often do not.

2. Leah is trying to determine which small business idea is most feasible in her community as a way to earn money in the summer. Her community is a small town in northern Manitoba with 100 people. Leah is considering the two businesses below and she has asked your advice. Is each of the following two businesses feasible in the community? Explain your answer for both businesses. *(2 marks)* (Module 3, Lesson 1)

   a) Lawn Care

   b) Sports Equipment Rental

   Answer:

   You may state that the business is either feasible or it is not feasible. The advice given must be justified with an appropriate statement.

   Lawn Care: This business may be feasible because Leah already owns the equipment required for the job and there are many elderly people in the community who cannot do the lawn care themselves. OR

   This business may not be feasible because most residents in the community let their land grow wild, so little care is needed.

   Sports Equipment Rental: This business may be feasible because visitors often come to the community and need fishing or boating equipment. You have an excess of the required equipment. OR

   This business may not be feasible because it would cost too much to purchase the equipment that you would rent out.

3. Identify three expenses that you may have when operating a small business. You may identify business expenses or capital expenses. *(3 marks)* (Module 3, Lesson 1)

   Answer:

   Answers given may be specific or general. Some possible expenses include: cost of purchasing equipment, the interest on a loan to buy equipment, cost of advertising, cost of a computer for the office, cost of supplies, and cost of a business license.

4. A business plans to produce 600 calendars and sell them for $13 each. The unit cost is $7 per calendar. How many calendars must be sold for the company to reach the break-even point? *(1 mark)* (Module 3, Lesson 2)

   Answer:

   $$\text{Break-even point} = \frac{(600 \times 7)}{13} = 323.07 \text{ calendars}$$

5. Hillary plans to make and sell 200 pairs of earrings. The cost for the metal required to make the earrings is $2050. (Module 3, Lesson 2)

   a) Will Hillary make a profit if she charges $15.00 per pair of earrings? Justify your answer. *(1 mark)*

      Answer:

      200 × 15 = $3000; since 3000 is more than 2050, she will make a profit.

   b) Will Hillary make a profit if she charges $9.00 per pair of earrings? Justify your answer. *(1 mark)*

      Answer:

      200 × 9 = $1800; since 1800 is less than 2050, she will lose money.

   c) How much must Hillary charge to break even? *(1 mark)*

      Answer:

      Break-even point = 2050 ÷ 200 = $10.25

      She needs to charge $10.25 per pair of earrings to break even.

Name: _____

6. For a summer job, Curtis runs an exterior window cleaning business. His business expenses each week are for soap at $13.44, cloths at $11.20, and gas at $170. He also has a weekly expense of $70.20 for a loan he needed to buy ladders. He works 5 days each week and cleans the windows of 4 houses each day. Curtis charges $45 per house. (Module 3, Lesson 2)

   a) Calculate Curtis's weekly profit. *(2 marks)*

      Answer:

      Revenue: $45 \times 4 \times 5 = \$900$

      Expenses: $13.44 + 11.20 + 170.00 + 70.20 = \$264.84$

      Profit: $900.00 - 264.84 = \$635.16$

   b) Describe one thing Curtis might consider doing to increase the profit. *(1 mark)*

      Answer:

      Increase revenue by charging more money per house, cleaning more houses each week

      Or

      Decrease expenses by buying cheaper supplies, paying off loan sooner

7. List the four sections of the T1 General income tax return. *(2 marks)* (Module 3, Lesson 3)

   Answer:

   Identification, Total Income, Net Income and Taxable Income, Refund or Balance Owing

8. Which of the following expenses can be claimed only under business expenses and not under personal expenses? Circle the best answer. *(1 mark)* (Module 3, Lesson 3)

   a) telephone and utilities
   b) child care costs
   c) medical costs
   d) tuition fees

   Answer:

   The correct answer is (a). Telephone and utilities can be claimed for a business but not for personal use.

Module 4: Probability *(23 marks)*

1. In a class of 32 students where they each take one option, 18 students take an Art option, 10 other students take a Drama option, and the rest of the students take a Choir option. One student is selected at random. Find the following: *(4 marks)* (Module 4, Lesson 2)

   a) the odds in favour of the selected student taking Drama

   Answer:

   Odds in favour of Drama = 10 : 22 or 5 : 11

   b) the odds against the selected student taking Choir

   Answer:

   Odds against Choir = 28 : 4 or 7 : 1

   c) the odds in favour of the selected student either taking Art or Choir

   Answer:

   Odds in favour of Art or Choir = (18 + 4) : 10 = 22 : 10 or 11 : 5

   d) the probability of the selected student either taking Art or Choir

   Answer:

   $$\text{P(Art or Choir)} = \frac{22}{32} \text{ or } \frac{11}{16}$$

2. The odds against a spring flood in Winnipeg are 6 : 7. *(2 marks)* (Module 4, Lesson 2)

   a) What are the odds in favour of a spring flood in Winnipeg?

   Answer:

   Odds in favour = 7 : 6

   b) What is the probability of a spring flood in Winnipeg?

   Answer:

   $$\text{P(Flood)} = \frac{7}{(7 + 6)} = \frac{7}{13}$$

Name: _____

3. Keira studied how often Friday the 13th occurs. The following chart indicates her data showing how often the 13th day of the month falls on each of the seven days of the week. *(6 marks)*

Days of the Week	S	M	T	W	T	F	Sa
How Often the 13th Day Occurs	687	685	685	687	684	688	684

a) Find the probability that the 13th day of the month occurs on a Friday. Express this probability as a percent, decimal (rounded to two decimal places), and a fraction. *(2 marks)* (Module 4, Lesson 1)

Answer:

$$\text{P(Friday)} = \frac{688}{(687 + 685 + 685 + 687 + 684 + 688 + 684)}$$

$$\text{P(Friday)} = \frac{688}{4800} = 14.33\% = 0.14$$

b) Find the probability that the 13th day of the month does not occur on a Friday. Express this probability as a percent. *(2 marks)* (Module 4, Lesson 1)

Answer:

$$\text{P(Not Friday)} = \frac{(4800 - 688)}{4800} = \frac{4112}{4800} = 85.67\%$$

c) Is this an example of theoretical probability or experimental probability? Explain. *(2 marks)* (Module 4, Lesson 4)

Answer:

This is an example of experimental probability because Keira gathered data and the probability/conclusions are based on this data.

4. State an example of a situation where you would use the following type of probability to predict an outcome or make a decision: *(3 marks)* (Module 4, Lesson 4)

   a) Theoretical probability

      Answer:

      Answers will vary. Answers must contain an example in an IDEAL situation, such as rolling a "one" (die) or flipping "heads" (coin), or calculating expected value in a game of chance.

   b) Experimental probability

      Answer:

      Answers will vary. Answers must be based on data from a survey or EXPERIMENT to determine the number of students in the cafeteria who prefer cheese pizza, or the likelihood of having a car accident during a snowstorm.

   c) Subjective probability

      Answer:

      Answers will vary. Answers cannot be based on calculations. Answers must contain an instance of BIAS/OPINION. For example, someone may say that seatbelts are unsafe because they know of someone who was injured by a seatbelt.

5. An expert is to make a decision about the safety of the design of a vehicle. What kind of probability will be used as a basis for the decision? Explain. *(2 marks)*
   (Module 4, Lesson 4)

   Answer:

   The expert will use experimental probability. Several cars will need to be crash tested to create data to determine the vehicle safety. The theoretical probability cannot be determined exactly, even when many experiments are conducted.

Name: _____

6. Consider the following game. It costs $5 each time you draw a card from a shuffled standard deck. If you draw an ace, you win $50. If you draw a king, you win $25. If you draw any other card, you receive nothing. An expected value chart is included in this question. Use it only if you find it helpful. (Module 4, Lesson 3)

   a) Determine your expected value of the game. *(4 marks)*

   Answer:

Event	Probability	Amount Won	Cost of Playing	Payoff	Probability x Payoff
Ace	$\frac{4}{52}$	$50	$5	$45	$3.46
King	$\frac{4}{52}$	$25	$5	$20	$1.54
Other Card	$\frac{44}{52}$	$0	$5	–$5	–$4.23

   Expected value: $3.46 + $1.54 – $4.23 = $0.77

   b) If you play this game 15 times, how much money can you expect to gain or lose? *(1 mark)*

   Answer:

   Expected gain = 15 × ($0.77) = $11.55

   You can expect to gain $11.55.

   c) Is this a fair game? Explain why or why not. *(1 mark)*

   Answer:

   This game isn't fair. Fair games have an expected value of 0. Even though you are more likely to win some money, this game isn't fair for the company/people giving out the money.

Amortization Table					
Amortization Period of Mortgage Loan (Blended payment of principal and interest per $1,000 of loan)					
Interest Rate	**5 years**	**10 years**	**15 years**	**20 years**	**25 years**
1.50%	$17.31	$8.98	$6.21	$4.82	$4.00
1.75%	17.42	9.09	6.32	4.94	4.11
2.00%	17.52	9.20	6.43	5.05	4.23
2.25%	17.63	9.31	6.55	5.17	4.36
2.50%	17.74	9.42	6.66	5.29	4.48
2.75%	17.85	9.53	6.78	5.41	4.61
3.00%	17.96	9.65	6.90	5.54	4.73
3.25%	18.07	9.76	7.02	5.66	4.86
3.50%	18.18	9.88	7.14	5.79	4.99
3.75%	18.29	9.99	7.26	5.91	5.13
4.00%	18.40	10.11	7.38	6.04	5.26
4.25%	18.51	10.23	7.50	6.17	5.40
4.50%	18.62	10.34	7.63	6.30	5.53
4.75%	18.74	10.46	7.75	6.44	5.67
5.00%	18.85	10.58	7.88	6.57	5.82
5.25%	18.96	10.70	8.01	6.71	5.96
5.50%	19.07	10.82	8.14	6.84	6.10
5.75%	19.19	10.94	8.27	6.98	6.25
6.00%	19.30	11.07	8.40	7.12	6.40
6.25%	19.41	11.19	8.53	7.26	6.55
6.50%	19.53	11.31	8.66	7.41	6.70
6.75%	19.64	11.43	8.80	7.55	6.85
7.00%	19.75	11.56	8.93	7.70	7.00
7.25%	19.87	11.68	9.07	7.84	7.16
7.50%	19.98	11.81	9.21	7.99	7.32
7.75%	20.10	11.94	9.34	8.13	7.47
8.00%	20.21	12.06	9.48	8.28	7.63
8.25%	20.33	12.19	9.62	8.43	7.79
8.50%	20.45	12.32	9.76	8.59	7.95
8.75%	20.56	12.45	9.90	8.74	8.12
9.00%	20.68	12.58	10.05	8.89	8.28
9.25%	20.80	12.71	10.19	9.05	8.44
9.50%	20.91	12.84	10.33	9.20	8.61
9.75%	21.03	12.97	10.48	9.36	8.78
10.00%	21.15	13.10	10.62	9.52	8.94
10.25%	21.27	13.24	10.77	9.68	9.11
10.50%	21.38	13.37	10.92	9.84	9.28
10.75%	21.50	13.50	11.06	9.99	9.45
11.00%	21.62	13.64	11.21	10.16	9.63

*Interest compounded semi-annually. Actual payment amount may differ slightly.

Manitoba Homeowner's Insurance Rates ($500 deductible)								
Boeckh Calculator	**Metro Winnipeg**		**Area 2**		**Area 3**		**Area 4**	
Amount	**Standard**	**Comprehensive**	**Standard**	**Comprehensive**	**Standard**	**Comprehensive**	**Standard**	**Comprehensive**
$ 50,000	195	214	147	161	196	216	261	287
$ 55,000	216	238	160	176	217	239	289	318
$ 60,000	237	260	173	190	237	261	315	347
$ 65,000	252	277	187	205	255	281	339	373
$ 70,000	266	303	200	220	270	297	359	395
$ 75,000	294	324	210	231	285	314	379	417
$ 80,000	310	323	221	243	302	332	402	438
$ 85,000	318	333	226	249	313	344	416	462
$ 90,000	324	349	231	254	324	356	431	474
$ 95,000	348	370	244	268	345	380	459	505
$100,000	364	393	260	286	361	397	480	528
$105,000	390	417	278	306	378	416	503	553
$110,000	402	441	293	322	393	432	523	575
$115,000	418	464	299	329	409	450	544	598
$120,000	436	487	309	340	424	466	564	620
$125,000	451	510	319	351	444	488	591	650
$130,000	472	543	339	373	466	513	620	682
$135,000	498	557	345	380	477	525	634	697
$140,000	523	580	358	394	496	546	660	726
$145,000	538	596	375	413	508	559	676	744
$150,000	550	604	385	424	520	572	692	761
$155,000	557	613	398	438	551	606	733	806
$160,000	565	622	413	454	569	626	757	833
$165,000	572	629	425	468	589	648	783	861
$170,000	590	647	441	485	609	670	810	891
$175,000	607	668	451	496	624	686	830	913
$180,000	620	686	466	513	648	713	862	948
$185,000	636	702	478	526	667	734	887	976
$190,000	652	717	492	541	705	776	938	1032
$195,000	678	742	504	554	720	792	958	1054
$200,000	692	771	519	571	726	799	966	1063
Additional Amounts per $1000 coverage	Add: $3.15	Add: $3.50	Add: $2.75	Add: $3.03	Add: $3.55	Add: $3.91	Add: $4.72	Add: $5.19

$200 deductible—Increase premium by 10%

Chart 1.1 Interest Rate Factor Table Based on 25-Year Amortization	
Interest Rate	**Payment Factor For Each Dollar of Loan**
2.5%	0.00448
3.0%	0.00473
3.5%	0.00499
4.0%	0.00526
4.5%	0.00553
5.0%	0.00582
5.5%	0.00610
6.0%	0.00640
6.5%	0.00670
7.0%	0.00700
7.5%	0.00732
8.0%	0.00763

Local Improvement Costs for Property Tax Credits	
Property Improvement	**Cost per Frontage Foot per Year**
Asphalt surfacing roadways	$ 26.22
Boulevard construction	$ 10.81
Concrete sidewalk	$ 7.86
Concrete street paving	$ 39.32
Granular surface lane	$ 9.01
Land drainage system	$ 8.62
Lane lighting	$ 1.80
Lane oiling	$ 9.00
Lane paving	$ 11.80
Ornamental lighting (lane)	$ 10.82
Ornamental lighting (street)	$ 14.42
Road oiling	$ 8.00
Wastewater sewers	$ 9.98
Water mains	$ 11.54

Source: http://winnipeg.ca/publicworks/Services/LocalImprovements.asp

GRADE 12 ESSENTIAL MATHEMATICS (40S)

Final Practice Exam

GRADE 12 ESSENTIAL MATHEMATICS

Final Practice Exam

Name: _____

Student Number: _____

Attending ❑ Non-Attending ❑

Phone Number: _____

Address: _____

_____

_____

For Marker's Use Only

Date: _____

Final Mark: _____ /100 = _____ %

Comments:

Instructions

The final examination is based on Modules 5 to 8 of the Grade 12 Essential Mathematics course. It is worth 12.5% of your final mark in this course.

Time

You will have a maximum of **3.0 hours** to complete the final examination.

Format

The format of the examination will be as follows:

Module 5: Vehicle Finance	30 marks
Module 6: Career Life	9 marks
Module 7: Statistics	31 marks
Module 8: Precision Measurement	30 marks
Total	100 marks

(see over)

Instructions (continued)

Resources Provided

The following tables are provided at the end of this examination

- Driver Safety Rating Chart
- Amortization Table
- Manitoba Public Insurance Passenger Vehicles—2011 Rate Groups Table
- Manitoba Public Insurance 2011 Basic Rate Table

Resources Required (Not Provided)

To complete this examination, you will need:

- pens/pencils (2 or 3 or each)
- blank paper
- scientific or graphing calculator
- Final Exam Resource Sheet (The Final Exam Resource Sheet must be handed in with the exam.)

Notes

- show all calculations and formulas
- include units where appropriate
- use decimal places in your calculations and round the final answers to the correct number of decimal places
- clearly state your final answer
- diagrams may not be drawn to scale

Name: _____

Answer all questions to the best of your ability. Show all your work.

Module 5: Vehicle Finance *(30 marks)*

1. Earna Wheeler is able to make a down payment of $4000 on a two-door sedan she purchases for $23,457, including tax. In order to finance the remaining portion, she takes out a three-year car loan at a fixed interest rate of 8.5%. (Module 5, Lesson 1)

   a) Calculate her monthly payment for the two-door sedan. *(3 marks)*

   b) Calculate her deferred payment for the two-door sedan. *(2 marks)*

   c) Calculate her finance charge for the automobile. *(1 mark)*

2. A four-wheel-drive vehicle sells for $28,750, plus tax, and leases for $378 per month plus tax for a lease term of 24 months. A down payment of $5000 is required. The guaranteed residual value of the vehicle is 60% of the sales price.
(Module 5, Lesson 2 and Lesson 4)

   a) Calculate the total monthly leasing payment. *(1 mark)*

   b) Calculate the total amount paid by the end of the lease. *(2 marks)*

   c) Calculate the total residual value of the four-wheel-drive vehicle, including taxes. *(2 marks)*

   d) Calculate the total cost of the vehicle if it is purchased outright at the end of the lease. *(1 mark)*

   e) Calculate how much the vehicle depreciates in two years. *(2 marks)*

Name: _____

3. Rosa wants to purchase a used car sold privately. The price the vendor is asking is $5500. A lien search costs $4, and a diagnostic test costs $35. The technician reports that the car needs the following repairs: suspension, $350; and tires, $680. A safety check costs $45. (Module 5, Lesson 3)

   Calculate the total purchase price of this car if the book value is $5475. *(5 marks)*

4. Before purchasing a used vehicle privately, name two searches, tests, or checks that you should do. Explain why each should be done. *(2 marks)* (Module 5, Lesson 3)

5. A pick-up truck travels 72 km on 10 L of gasoline when driven on a smooth, paved road. The truck is only able to travel 48 km on the same amount of gasoline when driven on a gravel road. (Module 5, Lesson 4)

   a) Determine the fuel consumption rate of the truck on the paved road. *(1 mark)*

   b) Determine the fuel consumption rate of the truck on the gravel road. *(1 mark)*

   c) What is the percent increase in fuel consumption rates when driving on paved roads instead of gravel roads? *(1 mark)*

   d) Calculate the cost of 3500 km of highway (smooth, paved road) if the cost of gasoline is $1.23/L. *(1 mark)*

Name: _____

6. Brett is a motorist living in Territory 3. He owns a 2011 Toyota Camry Hybrid. He uses the vehicle for personal use only. He currently has 0 merit points (Module 5, Lesson 5)

   a) Calculate his 2011 Autopac rate. *(2 marks)*

   b) If he obtains one more merit from safe driving this year, what will be his Autopac rate next year? Assume the rates stay the same and still use the 2011 Basic Rate Table. *(1 mark)*

7. Mercedes is debating whether to buy a new or used vehicle. She has recently acquired a full time job as a receptionist. However, she lives in Steinbach and has to commute one hour to Winnipeg for her new job every day. Discuss at least two factors that might influence Mercedes' decision on whether to buy a new or used vehicle. *(2 marks)* (Module 5, Lessons 1–5)

Module 6: Career Life *(9 marks)*

1. State the two careers you chose to research in the Career Life module. Specify which career was your career choice and which career was your alternate career choice. Answer *all* of the following questions in paragraph form.

   For this question, you will be marked using a rubric. As you answer this question, refer to the rubric below to make sure you are answering this question correctly and completely.

	3 marks	**2 marks**	**1 mark**	**0 mark**
Information	All of the necessary information is included.	One or two pieces of information are not included.	Three or more pieces of information are not included.	Insufficient information included.
Explanation	All information is justified or explanations are included for each point.	One or two pieces of information are not justified or do not include explanations.	Three or more pieces of information are not justified or do not include explanations.	No explanation included.
Writing Conventions (spelling, capitalization, grammar) and Organization	The paragraphs are organized and free of errors.	The paragraphs have a few errors or are not organized very well.	The paragraphs have many errors and/or are not organized well.	Not written in paragraph form.
				Total _____ 9 marks

Career Choice: _____

Alternate Career Choice: _____

a) What aspect of your chosen career appeals to you the most? Explain.

_____

_____

_____

_____

_____

_____

Name: _____

b) What aspect of your chosen career appeals to you the least? Explain.

c) After completing the Career Life module, do you still plan to pursue your career choice as your career? Are you planning to choose a different career? Explain.

d) What do you believe are the most important things you learned from the Career Life module?

Module 7: Statistics *(31 marks)*

1. Haley scores 47% on her law exam. A total of 382 students, including Haley, wrote the same exam. There were 36 other students received the same score that she did, but 244 received a lower score. (Module 7, Lesson 5)

   a) Find Haley's percentile rank. *(4 marks)*

   b) Explain the difference between Haley's percentile rank and the percent mark she receives on the exam. *(2 marks)*

2. State one advantage and one disadvantage of using the trimmed mean as a measure of central tendency. *(2 marks)* (Module 7, Lesson 4)

Name: _____

3. Valerie scores 58% on a recent test. However, her percentile rank on the test was 92. (Module 7, Lesson 5)

   a) What can you conclude about the success rate of most of the other students who have written the test? *(1 mark)*

   b) Explain why the test results might be like this. *(1 mark)*

4. A stats person for a professional football team decides to track the number of touchdown passes thrown by the quarterback during a period of 20 games. She records the following numbers of touchdown passes during each game.

1	3	2	1	2	2	1	4	3	2
7	3	4	0	5	3	4	1	2	3

a) Calculate the mean of the number of touchdown passes per game. *(1 mark)* (Module 7, Lesson 1)

b) Calculate the 10% trimmed mean of the number of touchdown passes per game. *(1 mark)* (Module 7, Lesson 2)

c) Identify the outlier(s) in this set of data. *(1 mark)* (Module 7, Lesson 2)

d) Does the 10% trimmed mean get rid of the influence of outliers from this set of data? Explain. *(2 marks)* (Module 7, Lesson 2)

Name: _____

5. For the following set of numbers:

   124, 210, 318, 124, 198, 342, 180

   a) Find the mean, median, and mode. *(3 marks)* (Module 7, Lesson 1)

   b) Add the number 10 to the set. Find the mean, median, and mode of this new set of numbers. *(3 marks)* (Module 7, Lesson 1)

   c) How does adding a low outlier affect the mean, median, and mode of this data? *(3 marks)* (Module 7, Lesson 2)

   d) Which of the three measures of central tendency is most influenced by an extreme score? *(1 mark)* (Module 7, Lesson 2)

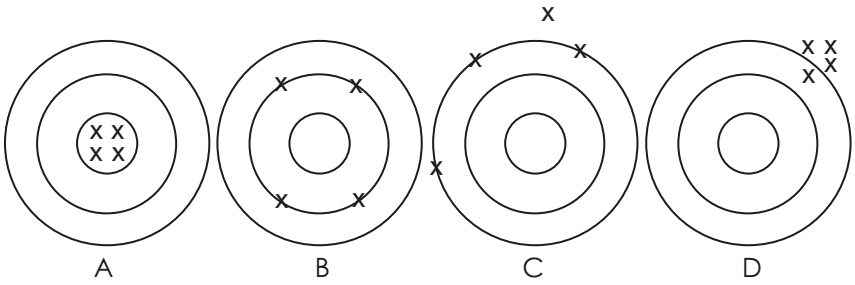
6. Cassidy is trying to figure out what her mean monthly phone bill was for the previous year. For four months, her phone bill was $52 a month. For the other eight months in the year, her phone bill was $63 a month. Since the mean of $52 and $63 is $57.50, Cassidy states that her mean phone bill for the previous year was $57.50. Is her reasoning correct? Explain. *(3 marks)* (Module 7, Lesson 3)

7. Keegan is taking an Independent Study Grade 12 Physics course. He has received a mean mark of 86% on his assignments, 77% on his midterm exam, and 65% on his final exam. Assignments are worth 50% of his final mark, while the midterm exam is worth 20% and the final exam is worth 30%. Determine Keegan's final mark in this course. *(3 marks)* (Module 7, Lesson 3)

Name: _____

Module 8: Precision Measurement *(30 marks)*

1. State whether each of the following target patterns displays a high degree of accuracy, a high degree of precision, both precision and accuracy, or neither. *(4 marks)*
   (Module 8, Lesson 1)



2. State two examples from everyday life that demonstrate the importance of not only precision, but also the importance of accuracy in measurement. *(2 marks)*
   (Module 8, Lesson 1)

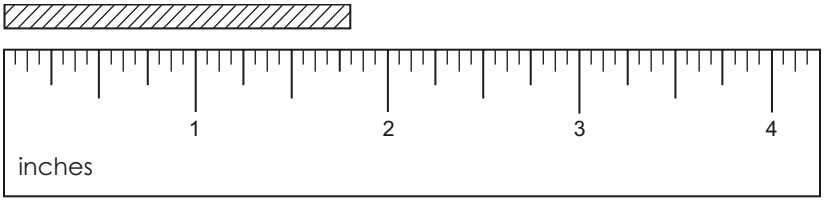
3. Measure the length of the following string, precise to the nearest indicated unit, using the given imperial ruler. *(4 marks)* (Module 8, Lesson 1)

a) $\frac{1}{8}''$ _____

b) one inch _____

c) $\frac{1}{2}''$ _____

d) $\frac{1}{4}''$ _____



Name: _____

4. A farmer wants to build a fence around a rectangular field. He measures the field, and discovers that the dimensions are 200 m by 70 m. (Module 8, Lesson 1)

   a) How precise are each of the measurements? *(1 mark)*

   b) What is the perimeter of the field? *(1 mark)*

   c) What is the area of the field? *(1 mark)*

5. Is it possible to have a measuring device that is precise but not accurate? Explain. Illustrate your explanation with an example. *(2 marks)* (Module 8, Lesson 2)

6. Thomas measures the diameter of a toonie (a $2 coin). The diameter of the coin is 2.815 cm. *(3 marks)* (Module 8, Lesson 2)

   a) State the precision of the measuring device used.

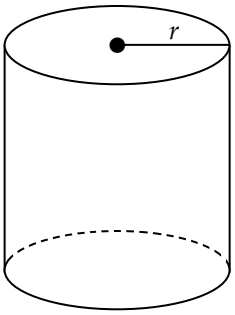
   b) State the uncertainty of the measurement.

   c) State the measurement Thomas should report (including the uncertainty).

7. The accepted weight of a small gold bar is 35.58 grams. Sam weighed the gold and his reading was 35.62±0.05 grams. Is Sam's reading accurate? Explain. *(2 marks)* (Module 8, Lesson 2)

Name: _____

8. A metal cylinder has a radius of 11.3 ± 0.2 cm and a height of 14.6 ± 0.3 cm. The volume formula for a cylinder is $V = \pi r^2 h$. (Module 8, Lesson 4)



$r = 11.3 \pm 0.2$ cm

$h = 14.6 \pm 0.3$ cm

Calculate the following: *(4 marks)*

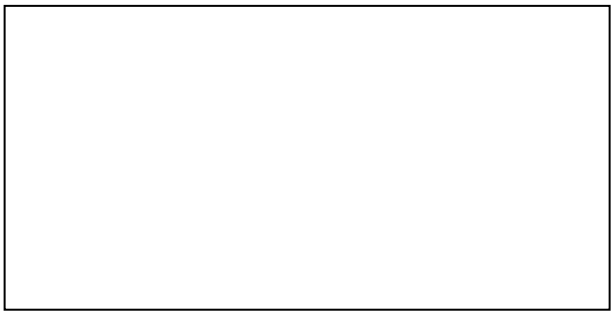
a) nominal volume

b) maximum volume

c) minimum volume

d) tolerance in the volume measurement

9. A thin rectangular metal plate has dimensions as shown on the diagram. (Module 8, Lesson 4)



$w = 8.5^{\ 0}_{-0.3}$ cm

$l = 15.5 \pm 0.1$ cm

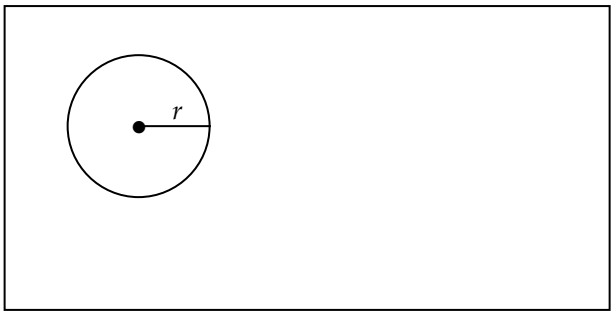
For the top surface of the metal plate, calculate *(2 marks)*

a) the maximum (upper limit) area

b) the minimum (lower limit) area

Name: _____

A round hole is drilled through the plate. The radius of the hole is 2.2 ± 0.1 cm.



$r = 2.2 \pm 0.1$ cm

$w = 8.5^{\ 0}_{-0.3}$ cm

$l = 15.5 \pm 0.1$ cm

For the circle, calculate *(2 marks)*

c) the maximum (upper limit) area

d) the minimum (lower limit) area

Calculate the area of the top surface of the metal plate remaining after the hole is drilled: *(2 marks)*

e) the maximum (upper limit) area

f) the minimum (lower limit) area

Driver Safety Rating Chart	
Merits for Safe Driving	**Autopac Discount**
+15	33%
+14	30%
+13	29%
+12	28%
+11	27%
+10	26%
+9	25%
+8	25%
+7	25%
+6	20%
+5	15%
+4	15%
+3	10%
+2	10%
+1	5%
0 (base)	0%
–1	0%
–2	0%
–3	0%
–4	0%
–5	0%
–6	0%
–7	0%
–8	0%
–9	0%
–10	0%
–11	0%
–12	0%
–13	0%
–14	0%
–15	0%
–16	0%
–17	0%
–18	0%
–19	0%
–20	0%

Table 5.1 Amortization Table					
Amortization Period Monthly Payment Per $1000 Loan Proceeds					
Annual Rate	1 Year Monthly	2 Years Monthly	3 Years Monthly	4 Years Monthly	5 Years Monthly
6.00%	$86.07	$44.33	$30.43	$23.49	$19.34
6.25%	$86.18	$44.44	$30.54	$23.61	$19.46
6.50%	$86.30	$44.56	$30.66	$23.72	$19.57
6.75%	$86.41	$44.67	$30.77	$23.84	$19.69
7.00%	$86.53	$44.78	$30.88	$23.95	$19.81
7.25%	$86.64	$44.89	$31.00	$24.07	$19.93
7.50%	$86.76	$45.01	$31.11	$24.19	$20.05
7.75%	$86.87	$45.12	$31.23	$24.30	$20.16
8.00%	$86.99	$45.24	$31.34	$24.42	$20.28
8.25%	$87.10	$45.34	$31.45	$24.53	$20.40
8.50%	$87.22	$45.46	$31.57	$24.65	$20.52
8.75%	$87.34	$45.57	$31.68	$24.71	$20.64
9.00%	$87.45	$45.68	$31.80	$24.89	$20.76
9.25%	$87.57	$45.80	$31.92	$25.00	$20.88
9.50%	$87.68	$45.91	$32.03	$25.12	$21.00
9.75%	$87.80	$46.03	$32.15	$25.24	$21.12
10.00%	$87.92	$46.14	$32.27	$25.36	$21.25
10.25%	$88.03	$46.26	$32.38	$25.48	$21.37
10.50%	$88.15	$46.38	$32.50	$25.60	$21.49
10.75%	$88.27	$46.49	$32.62	$25.72	$21.62
11.00%	$88.38	$46.61	$32.74	$25.85	$21.74
11.25%	$88.50	$46.72	$32.86	$25.97	$21.87
11.50%	$88.62	$46.84	$32.98	$26.09	$21.99
11.75%	$88.73	$46.96	$33.10	$26.21	$22.12
12.00%	$88.85	$47.07	$33.21	$26.33	$22.24
12.25%	$88.97	$47.19	$33.33	$26.46	$22.37
12.50%	$89.08	$47.31	$33.45	$26.58	$22.50
12.75%	$89.20	$47.42	$33.57	$26.70	$22.63
13.00%	$89.32	$47.54	$33.69	$26.83	$22.75
13.25%	$89.43	$47.66	$33.81	$26.95	$22.88
13.50%	$89.55	$47.78	$33.94	$27.08	$23.01
13.75%	$89.67	$47.89	$34.06	$27.20	$23.14
14.00%	$89.79	$48.01	$34.18	$27.33	$23.27

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
CHRYSLER	PT CRUISER LX	4 Door Hatchback	4	Gas	2	2757	Regular	1730025374			29	28												
CHRYSLER	PT CRUISER TOURING	Convertible	4	Gas	2	2765	Regular	1730006011					22	21	19									
CHRYSLER	PT CRUISER TOURING EDITION	4 Door	4	Gas	2	2757	Regular	1730004108							25	23	21	19						
CHRYSLER	PT CRUISER TOURING EDITION	4 Door Hatchback	4	Gas	2	2757	Regular	1730009863			29	28	27	26	25	23	21	19						
CHRYSLER	PT CRUISER TURBO	4 Door	4	Gas	2	2767	Regular	1730006582							30									
CHRYSLER	PT CRUISER TURBO	4 Door Hatchback	4	Gas	2	2767	Regular	1730009864						31	30									
CHRYSLER	SEBRING	2 Door	4	Gas	2	1456	Regular	1730015185							31	30								
CHRYSLER	SEBRING	4 Door	4	Gas	2	1189	Regular	1730005334					26	25	25	23								
CHRYSLER	SEBRING	4 Door	6	Gas	2	1189	Regular	1730005335					26	25	25	23								
CHRYSLER	SEBRING	Convertible	4	Gas	2	1114	Regular	1730012862						31	30									
CHRYSLER	SEBRING	Convertible	6	Gas	2	1114	Regular	1730005750						31	30	28								
CHRYSLER	SEBRING GTC	Convertible	6	Gas	2	1171	Regular	1730004109				27		30	29	27	26	24						
CHRYSLER	SEBRING JX	Convertible	4	Gas	2	1171	Regular	1730000332													17	14	12	11
CHRYSLER	SEBRING JX	Convertible	6	Gas	2	1171	Regular	224982												20	17	14	12	11
CHRYSLER	SEBRING JXI	Convertible	6	Gas	2	1172	Regular	224995												19	19	16	14	10
CHRYSLER	SEBRING JXI LIMITED	Convertible	6	Gas	2	1172	Regular	1730022191												19				
CHRYSLER	SEBRING LIMITED	2 Door	6	Gas	2	1169	Regular	1730021930							31	31								
CHRYSLER	SEBRING LIMITED	4 Door	4	Gas	2	1190	Regular	1730022761				28												
CHRYSLER	SEBRING LIMITED	4 Door	6	Gas	2	1190	Regular	1730005336		28	28	28	27	27	26	24								
CHRYSLER	SEBRING LIMITED	4 Door	6	Gas	4	1471	Regular	1730022762				29												
CHRYSLER	SEBRING LIMITED	Convertible	6	Gas	2	1172	Regular	1730001543		30	30	30		27	27	26	25	22	21					
CHRYSLER	SEBRING LIMITED	Retractable Hard Top	6	Gas	2	1172	Regular	1730024813		30	30	30												
CHRYSLER	SEBRING LX	2 Door	4	Gas	2	1168	Regular	27051											29				15	13
CHRYSLER	SEBRING LX	2 Door	6	Gas	2	1168	Regular	27052									32	31	29	28	22	19	15	13
CHRYSLER	SEBRING LX	4 Door	4	Gas	2	1175	Regular	1730002102		28	28	27				23	22	20	21					
CHRYSLER	SEBRING LX	4 Door	6	Gas	2	1175	Regular	1730002103								23	22	20	21					
CHRYSLER	SEBRING LX	Convertible	4	Gas	2	1171	Regular	1730015186		27	28	27				27								
CHRYSLER	SEBRING LX	Convertible	6	Gas	2	1171	Regular	1730001541		27	28	27			29	27	26	24	22					
CHRYSLER	SEBRING LXI	2 Door	6	Gas	2	1169	Regular	27053									32	32	31	27	24	21	17	15
CHRYSLER	SEBRING LXI	4 Door	6	Gas	2	1176	Regular	1730002104								24	23	22	23					
CHRYSLER	SEBRING LXI	Convertible	6	Gas	2	1172	Regular	1730001542						27	27	26	25	22	21					
CHRYSLER	SEBRING TOURING	4 Door	4	Gas	2	1190	Regular	1730022763				28												
CHRYSLER	SEBRING TOURING	4 Door	6	Gas	2	1190	Regular	1730005337		28	28	28	27	27	26	24								
CHRYSLER	SEBRING TOURING	Convertible	6	Gas	2	1172	Regular	1730006583		30	30	30		27	27	26								

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
DODGE	NEON EX	2 Door	4	Gas	2	2262	Regular	226736													18	16	14	10
DODGE	NEON EX	4 Door	4	Gas	2	2261	Regular	1730000404													18			
DODGE	NEON HIGHLINE	2 Door	4	Gas	2	2262	Regular	2210													18	16	14	10
DODGE	NEON HIGHLINE	4 Door	4	Gas	2	2261	Regular	2211													18	16	14	12
DODGE	NEON R/T	4 Door	4	Gas	2	2261	Regular	1730002671							30	29	28	25	24					
DODGE	NEON SE	4 Door	4	Gas	2	2261	Regular	1730004113							30	29	28							
DODGE	NEON SPORT	2 Door	4	Gas	2	2262	Regular	2215													18	16	14	10
DODGE	NEON SPORT	4 Door	4	Gas	2	2261	Regular	2216													18	16	14	12
DODGE	NEON SXT	4 Door	4	Gas	2	2261	Regular	1730004114							30	29	28							
DODGE	NITRO RT	Sport Utility 4 Door	6	Gas	4	2812	Regular	1730014870			30	29	27											
DODGE	NITRO SE	Sport Utility 4 Door	6	Gas	2	2810	Regular	1730014871			26	24	22											
DODGE	NITRO SE	Sport Utility 4 Door	6	Gas	4	2811	Regular	1730014872		30	29	29	28											
DODGE	NITRO SLT	Sport Utility 4 Door	6	Gas	2	2810	Regular	1730015191					22											
DODGE	NITRO SLT	Sport Utility 4 Door	6	Gas	4	2811	Regular	1730014873			29	29	28											
DODGE	NITRO SXT	Sport Utility 4 Door	6	Gas	2	2810	Regular	1730014874			26	24	22											
DODGE	NITRO SXT	Sport Utility 4 Door	6	Gas	4	2811	Regular	1730014875		30	29	29	28											
DODGE	OMNI	2 Door	4	Gas	2	2339	Regular	1341																
DODGE	OMNI	2 Door Hatchback	4	Gas	2	2339	Regular	1730005755																
DODGE	OMNI	4 Door	4	Gas	2	2341	Regular	1342																
DODGE	OMNI	4 Door Hatchback	4	Gas	2	2341	Regular	1730005431																
DODGE	OMNI 024	2 Door Hatchback	4	Gas	2	2328	Regular	1730005432																
DODGE	OMNI CUSTOM	4 Door	4	Gas	2	2341	Regular	1551																
DODGE	OMNI CUSTOM	4 Door Hatchback	4	Gas	2	2341	Regular	1730005433																
DODGE	OMNI GLH	4 Door	4	Gas	2	2341	Regular	2783																
DODGE	OMNI SE	4 Door	4	Gas	2	2341	Regular	1658																
DODGE	OMNI SE	4 Door Hatchback	4	Gas	2	2341	Regular	1730006773																
DODGE	POLARA	2 Door	6	Gas	2	2228	Regular	1730022192																
DODGE	POLARA	2 Door	8	Gas	2	2228	Regular	1730001345																
DODGE	POLARA	4 Door	8	Gas	2	2230	Regular	1730001346																
DODGE	POLARA	Convertible	8	Gas	2	2228	Regular	1730001347																
DODGE	POLARA	Station Wagon	8	Gas	2	2229	Regular	1730001348																
DODGE	RAIDER	Sport Utility 2 Door	4	Gas	4	2651	Regular	2921																
DODGE	RAIDER	Sport Utility 2 Door	6	Gas	4	2651	Regular	2922																
DODGE	RAM VAN 1500	Passenger Van	6	Gas	2	2746	Regular	224959											10	9	7	6	5	3

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
FORD	FIESTA	2 Door Hatchback	4	Gas	2	3709	Regular	1730006791																
FORD	FIESTA	4 Door	4	Gas	2	3709	Regular	723																
FORD	FIESTA S	4 Door	4	Gas	2	3792	Regular	1762106921	26															
FORD	FIESTA SE	4 Door	4	Gas	2	3793	Regular	1762106922	30															
FORD	FIESTA SE	4 Door Hatchback	4	Gas	2	3794	Regular	1762106923	31															
FORD	FIESTA SEL	4 Door	4	Gas	2	3793	Regular	1762106924	30															
FORD	FIESTA SES	4 Door Hatchback	4	Gas	2	3794	Regular	1762106925	31															
FORD	FIVE HUNDRED LIMITED	4 Door	6	Gas	2	9011	Regular	1730007192					24	23	22									
FORD	FIVE HUNDRED LIMITED	4 Door	6	Gas	4	9013	Regular	1730007193					27	27	26									
FORD	FIVE HUNDRED SE	4 Door	6	Gas	2	9010	Regular	1730007194					22	21	20									
FORD	FIVE HUNDRED SE	4 Door	6	Gas	4	9012	Regular	1730007195					27	26	24									
FORD	FIVE HUNDRED SEL	4 Door	6	Gas	2	9010	Regular	1730007196					22	21	20									
FORD	FIVE HUNDRED SEL	4 Door	6	Gas	4	9012	Regular	1730007197					27	26	24									
FORD	FLEX LIMITED	Sport Utility 4 Door	6	Gas	2	3583	Regular	1730025037		24	23													
FORD	FLEX LIMITED	Sport Utility 4 Door	6	Gas	4	3581	Regular	1730025038		27	27													
FORD	FLEX SE	Sport Utility 4 Door	6	Gas	2	3584	Regular	1730025039		24	23													
FORD	FLEX SEL	Sport Utility 4 Door	6	Gas	2	3584	Regular	1730025040		24	23													
FORD	FLEX SEL	Sport Utility 4 Door	6	Gas	4	3582	Regular	1730025041		27	27													
FORD	FOCUS LX	4 Door	4	Gas	2	9020	Regular	1730000960								24	22	20	19	15				
FORD	FOCUS S	4 Door	4	Gas	2	9020	Regular	1730025489		30	29	28												
FORD	FOCUS SE	2 Door	4	Gas	2	3448	Regular	1730022972		32	32	31												
FORD	FOCUS SE	2 Door Hatchback	4	Gas	2	9021	Regular	1730026561					31											
FORD	FOCUS SE	4 Door	4	Gas	2	9020	Regular	1730000961		30	29	28				24	22	20	19	15				
FORD	FOCUS SE	Station Wagon	4	Gas	2	9022	Regular	1730000962								20	19	17	14	13				
FORD	FOCUS SEL	4 Door	4	Gas	2	9020	Regular	1730025490		30	29													
FORD	FOCUS SES	2 Door	4	Gas	2	3448	Regular	1730022973		32	32	31												
FORD	FOCUS SES	4 Door	4	Gas	2	9020	Regular	1730022974		30	29	28												
FORD	FOCUS SVT	2 Door	4	Gas	2	9026	Regular	1730003890								31	29	28						
FORD	FOCUS SVT	2 Door Hatchback	4	Gas	2	9026	Regular	1730006792									29	28						
FORD	FOCUS SVT	4 Door	4	Gas	2	9027	Regular	1730004928								28	26							
FORD	FOCUS ZTS	4 Door	4	Gas	2	9023	Regular	1730000963								26	23	23	21	18				
FORD	FOCUS ZTW	Station Wagon	4	Gas	2	9024	Regular	1730002673								24	22	20						
FORD	FOCUS ZX3	2 Door	4	Gas	2	9021	Regular	1730000964							29	28	27	24	22	19				
FORD	FOCUS ZX3	2 Door Hatchback	4	Gas	2	9021	Regular	1730006793					31	30	29	28	27	24	22	19				

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
HONDA	CIVIC CX	2 Door	4	Gas	2	0245	Regular	3146												21	18	16	14	11
HONDA	CIVIC CX	2 Door Hatchback	4	Gas	2	0245	Regular	1730006823												21	18	16	14	11
HONDA	CIVIC CX-G	2 Door	4	Gas	2	0245	Regular	225492												21	18	16	14	
HONDA	CIVIC DEL SOL S	2 Door	4	Gas	2	0256	Regular	1659															18	16
HONDA	CIVIC DEL SOL SI	2 Door	4	Gas	2	0257	Regular	1674															21	19
HONDA	CIVIC DEL SOL SIR	2 Door	4	Gas	2	0250	Regular	1730026836																
HONDA	CIVIC DEL SOL VTEC	2 Door	4	Gas	2	0262	Regular	2325															24	21
HONDA	CIVIC DX	2 Door	4	Gas	2	0258	Regular	1999		32	32	31	32	32	29	27	25	24	22	23	20	17	14	13
HONDA	CIVIC DX	2 Door Hatchback	4	Gas	2	0246	Regular	1730006824												21	18	15	13	
HONDA	CIVIC DX	4 Door	4	Gas	2	0210	Regular	2000		31	32	31	31	29	23	23	22	21	19	19	17	14	13	11
HONDA	CIVIC DX-A	2 Door	4	Gas	2	0258	Regular	1730022975			32	31												
HONDA	CIVIC DX-A	4 Door	4	Gas	2	0210	Regular	1730022976		31	32	31												
HONDA	CIVIC DX-G	2 Door	4	Gas	2	0258	Regular	226821		32	32	31	32	32						23	20	17		
HONDA	CIVIC DX-G	4 Door	4	Gas	2	0210	Regular	1730002112		31	32	31	31	29	23	23	22	21	19					
HONDA	CIVIC DX-SE	2 Door	4	Gas	2	0258	Regular	224453							29									
HONDA	CIVIC EX	2 Door	4	Gas	2	0258	Regular	1730000160			32	31	32	32							20	17	14	13
HONDA	CIVIC EX	4 Door	4	Gas	2	0210	Regular	822		31	32	31	31	29	23	23	22	21	19	19	17	14	13	11
HONDA	CIVIC EX (US MDL)	2 Door	4	Gas	2	0259	Regular	1730007416		32					31			26		25	22	19	17	15
HONDA	CIVIC EX-G	4 Door	4	Gas	2	0210	Regular	226827												19	17	14		
HONDA	CIVIC EX-L	2 Door	4	Gas	2	0258	Regular	1730022977		32	32	31												
HONDA	CIVIC EX-L	4 Door	4	Gas	2	0210	Regular	1730022978		31	32	31												
HONDA	CIVIC EX-V	4 Door	4	Gas	2	0210	Regular	823																
HONDA	CIVIC GL	4 Door	4	Gas	2	0210	Regular	2002																
HONDA	CIVIC GX	4 Door	4	Gas	2	0210	Regular	1730022979			32	31												
HONDA	CIVIC HX	2 Door	4	Gas	2	0258	Regular	1730009617													20	17		
HONDA	CIVIC HYBRID	4 Door	4	Gas/Elec.	2	0221	Regular	1730004930		31	31	30	30	29	29	29	28							
HONDA	CIVIC LX	2 Door	4	Gas	2	0258	Regular	1730002261		32	32	31	32	32	29	27	25	24	22					
HONDA	CIVIC LX	4 Door	4	Gas	2	0251	Regular	2995		31	32	31	31	29	26	26	25	23	21	18	16	13	11	10
HONDA	CIVIC LX SPORT	4 Door	4	Gas	2	0251	Regular	1730004931									25							
HONDA	CIVIC LX-G	4 Door	4	Gas	2	0251	Regular	226887						29	26	26	25	23	21	18	16	13		
HONDA	CIVIC LX-SE	4 Door	4	Gas	2	0251	Regular	25331							26	26	25			18	16			
HONDA	CIVIC LX-SR	2 Door	4	Gas	2	0258	Regular	1730022980		32	32	31												
HONDA	CIVIC LX-SR	4 Door	4	Gas	2	0251	Regular	1730022981				31												
HONDA	CIVIC REVERB	2 Door	4	Gas	2	0258	Regular	1730007318							29									

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
JEEP	COMPASS LIMITED	Sport Utility 4 Door	4	Gas	2	7240	Regular	1730014891		24	24	24	23											
JEEP	COMPASS LIMITED	Sport Utility 4 Door	4	Gas	4	7238	Regular	1730013523		29	29	29	27											
JEEP	COMPASS NORTH	Sport Utility 4 Door	4	Gas	2	7239	Regular	1730022769		24	24	23	22											
JEEP	COMPASS NORTH	Sport Utility 4 Door	4	Gas	4	7237	Regular	1730022770		29	29	29	27											
JEEP	COMPASS SPORT	Sport Utility 4 Door	4	Gas	2	7239	Regular	1730014892		24	24	23	22											
JEEP	COMPASS SPORT	Sport Utility 4 Door	4	Gas	4	7237	Regular	1730013524		29	29	29	27											
JEEP	GRAND CHEROKEE	Sport Utility 4 Door	6	Gas	2	7183	Regular	1698																13
JEEP	GRAND CHEROKEE	Sport Utility 4 Door	6	Gas	4	7181	Regular	225109																13
JEEP	GRAND CHEROKEE	Sport Utility 4 Door	8	Gas	2	7183	Regular	1699																13
JEEP	GRAND CHEROKEE	Sport Utility 4 Door	8	Gas	4	7181	Regular	225110																13
JEEP	GRAND CHEROKEE 5.9 LIMITED	Sport Utility 4 Door	8	Gas	4	7182	Regular	1730013740														21		
JEEP	GRAND CHEROKEE FREEDOM	Sport Utility 4 Door	6	Gas	2	7183	Regular	1730013525							25									
JEEP	GRAND CHEROKEE FREEDOM	Sport Utility 4 Door	8	Gas	2	7183	Regular	1730013526							25									
JEEP	GRAND CHEROKEE LAREDO	Ambulance	6	Gas	4	7181	Regular	1730002392																
JEEP	GRAND CHEROKEE LAREDO	Sport Utility 4 Door	6	Diesel	4	7241	Regular	1730022201			30	29	29											
JEEP	GRAND CHEROKEE LAREDO	Sport Utility 4 Door	6	Gas	2	7183	Regular	225256		30	30	29	29	26	25	26	26	23		20	21	18	15	13
JEEP	GRAND CHEROKEE LAREDO	Sport Utility 4 Door	6	Gas	4	7181	Regular	225258		30	30	30	29	28	27	27	27	25	24	21	19	17	15	13
JEEP	GRAND CHEROKEE LAREDO	Sport Utility 4 Door	8	Gas	2	7183	Regular	225257			30	29	29	26	25	26	26	23		20	21	18	15	13
JEEP	GRAND CHEROKEE LAREDO	Sport Utility 4 Door	8	Gas	4	7181	Regular	225259		30	30	30	29	28	27	27	27	25	24	21	19	17	15	13
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	6	Diesel	2	7248	Regular	1730025308				31	31											
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	6	Diesel	4	7242	Regular	1730022287			31	29	29											
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	6	Gas	2	7184	Regular	225177		32	32						25		24	23	23	21	18	15
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	6	Gas	4	7182	Regular	225179							28	28	27	27	26	24	23	21	20	16
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	8	Diesel	4	7242	Regular	1730022202					29											
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	8	Gas	2	7184	Regular	225178			32	31	31	28	27	25	25	24	24	23	23	21	18	
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	8	Gas	4	7182	Regular	225180		32	32	30	29	29	28	28	27	27	26	24	23	21	20	16
JEEP	GRAND CHEROKEE ORVIS	Sport Utility 4 Door	6	Gas	2	7184	Regular	225181														21	18	
JEEP	GRAND CHEROKEE ORVIS	Sport Utility 4 Door	6	Gas	4	7182	Regular	225183														21	20	16
JEEP	GRAND CHEROKEE ORVIS	Sport Utility 4 Door	8	Gas	2	7184	Regular	225182														21	18	
JEEP	GRAND CHEROKEE ORVIS	Sport Utility 4 Door	8	Gas	4	7182	Regular	225184														21	20	
JEEP	GRAND CHEROKEE OVERLAND	Sport Utility 4 Door	6	Diesel	2	7248	Regular	1730025309				31	31											
JEEP	GRAND CHEROKEE OVERLAND	Sport Utility 4 Door	6	Diesel	4	7242	Regular	1730022632			31	29	29											
JEEP	GRAND CHEROKEE OVERLAND	Sport Utility 4 Door	8	Diesel	4	7242	Regular	1730022203					29											
JEEP	GRAND CHEROKEE OVERLAND	Sport Utility 4 Door	8	Gas	2	7184	Regular	1730014893			32	31	31											

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
MAZDA	CX-9 GS	Sport Utility 4 Door	6	Gas	4	7761	Regular	1730015233		28	28	27	27											
MAZDA	CX-9 GT	Sport Utility 4 Door	6	Gas	2	7760	Regular	1730015234				24	24											
MAZDA	CX-9 GT	Sport Utility 4 Door	6	Gas	4	7761	Regular	1730015235		28	28	27	27											
MAZDA	EUNOS	Roadster	4	Gas	2	0359	Regular	1730014114																
MAZDA	GLC	2 Door	4	Gas	2	0304	Regular	2408																
MAZDA	GLC	2 Door Hatchback	4	Gas	2	0304	Regular	1730006861																
MAZDA	GLC	4 Door	4	Gas	2	0337	Regular	2410																
MAZDA	GLC	Station Wagon	4	Gas	2	0316	Regular	2409																
MAZDA	GLC DECOR	4 Door Hatchback	4	Gas	2	0329	Regular	1730006862																
MAZDA	GLC LX	4 Door	4	Gas	2	0338	Regular	2486																
MAZDA	MAZDA3 GS	4 Door	4	Gas	2	7724	Regular	1730005662		31	29	29	28	25	23	21								
MAZDA	MAZDA3 GT	4 Door	4	Gas	2	7725	Regular	1730005663		32	31	31	31	30	29	27								
MAZDA	MAZDA3 GX	4 Door	4	Gas	2	7724	Regular	1730005664		31	29	29	28	25	23	21								
MAZDA	MAZDA3 I	4 Door	4	Gas	2	7724	Regular	1730009506					28	25	23	21								
MAZDA	MAZDA3 S	4 Door	4	Gas	2	7724	Regular	1730009507					28	25	23	21								
MAZDA	MAZDA3 S	4 Door Hatchback	4	Gas	2	7726	Regular	1730009508					29	28	26	24								
MAZDA	MAZDA3 SP23	4 Door	4	Gas	2	7725	Regular	1730009509							29									
MAZDA	MAZDA3 SP23	4 Door Hatchback	4	Gas	2	7726	Regular	1730009510							26									
MAZDA	MAZDA3 SPORT GS	4 Door Hatchback	4	Gas	2	7726	Regular	1730005665		31	30	30	29	28	26	24								
MAZDA	MAZDA3 SPORT GT	4 Door Hatchback	4	Gas	2	7726	Regular	1730005666		31	30	30	29	28	26	24								
MAZDA	MAZDA3 SPORT GX	4 Door Hatchback	4	Gas	2	7774	Regular	1730024897		29	27	27												
MAZDA	MAZDA3 TOURING EDITION	4 Door	4	Gas	2	7725	Regular	1730024738					31											
MAZDA	MAZDA5 GS	Station Wagon	4	Gas	2	7741	Regular	1730008814		28	28	28	28	25										
MAZDA	MAZDA5 GT	Station Wagon	4	Gas	2	7741	Regular	1730008815		28	28	28	28	25										
MAZDA	MAZDA6 GS-I4	4 Door	4	Gas	2	7719	Regular	1730004212		28	29	30	28	27	25	25	24							
MAZDA	MAZDA6 GS-V6	4 Door	6	Gas	2	7720	Regular	1730004213		29	30	30	30	28	27	25	24							
MAZDA	MAZDA6 GT-I4	4 Door	4	Gas	2	7719	Regular	1730004214		28	29	30	28	27	25	25	24							
MAZDA	MAZDA6 GT-V6	4 Door	6	Gas	2	7720	Regular	1730004215		29	30	30	30	28	27	25	24							
MAZDA	MAZDA6 I	4 Door	4	Gas	2	7719	Regular	1730009618				30	28	27		25								
MAZDA	MAZDA6 I SPORT	4 Door	4	Gas	2	7719	Regular	1730009619			29	30	28	27	25									
MAZDA	MAZDA6 I SPORT	4 Door Hatchback	4	Gas	2	7727	Regular	1730009620						27	25	24								
MAZDA	MAZDA6 S	4 Door	6	Gas	2	7720	Regular	1730009621					30	28	27									
MAZDA	MAZDA6 S GRAND TOURING	4 Door	6	Gas	2	7720	Regular	1730009622			30		30	28	27									
MAZDA	MAZDA6 S SPORT	4 Door	6	Gas	2	7720	Regular	1730009623			30		30	28	27									

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
TOYOTA	CAMRY	4 Door	6	Gas	2	7615	Regular	1603														15	13	12
TOYOTA	CAMRY	Station Wagon	4	Gas	2	0560	Regular	1601																8
TOYOTA	CAMRY CE	4 Door	4	Gas	2	0450	Regular	225632			25	24	24	23	23	21		20	19	18	16	14	11	
TOYOTA	CAMRY CE V6	4 Door	6	Gas	2	7615	Regular	225633					27	25	24	22		19	19	19	17	15	13	
TOYOTA	CAMRY DLX	4 Door	4	Gas	2	0450	Regular	2732																
TOYOTA	CAMRY DLX	Station Wagon	4	Gas	2	0560	Regular	2731																
TOYOTA	CAMRY DX	4 Door	4	Gas	2	0450	Regular	1730008825																10
TOYOTA	CAMRY DX V6	4 Door	6	Gas	2	7615	Regular	1730012808																12
TOYOTA	CAMRY HYBRID	4 Door	4	Gas/Elec.	2	7747	Regular	1730013072	24	24	24	24	23											
TOYOTA	CAMRY LE	2 Door	4	Gas	2	7622	Regular	2733																10
TOYOTA	CAMRY LE	4 Door	4	Gas	2	0450	Regular	2735	25	25	25	24	24	23	23	21	20	20	19	18	16	14	11	10
TOYOTA	CAMRY LE	4 Door	4	Gas	4	0567	Regular	1730000108																
TOYOTA	CAMRY LE	4 Door Hatchback	4	Gas	2	0466	Regular	1730006979																
TOYOTA	CAMRY LE	Station Wagon	4	Gas	2	0560	Regular	2734																8
TOYOTA	CAMRY LE	Station Wagon	6	Gas	2	0560	Regular	2736																
TOYOTA	CAMRY LE V6	2 Door	6	Gas	2	7623	Regular	2076																12
TOYOTA	CAMRY LE V6	4 Door	6	Gas	2	7615	Regular	2078	27	27	27	26	27	25	24	22	20	19	19	19	17	15	13	12
TOYOTA	CAMRY LE V6	Station Wagon	6	Gas	2	7621	Regular	2077																9
TOYOTA	CAMRY SE	4 Door	4	Gas	2	0450	Regular	1730004161	25	25	25	24	24	23	23	21	20							
TOYOTA	CAMRY SE V6	4 Door	6	Gas	2	7615	Regular	2189	27	27	27	26	27	25	24	22	20	19						
TOYOTA	CAMRY SOLARA SE	2 Door	4	Gas	2	7644	Regular	1730000445				26	25	24	24	23	22	21	19	17	16			
TOYOTA	CAMRY SOLARA SE	Convertible	4	Gas	2	7674	Regular	1730004244									18	16	14	13				
TOYOTA	CAMRY SOLARA SE V6	2 Door	6	Gas	2	7645	Regular	1730000446					26	25	24	23	23	22	22	21	18			
TOYOTA	CAMRY SOLARA SE V6	Convertible	6	Gas	2	7653	Regular	1730006229					24	22	22	21	21							
TOYOTA	CAMRY SOLARA SLE	2 Door	4	Gas	2	7644	Regular	1730013545				26	25											
TOYOTA	CAMRY SOLARA SLE V6	2 Door	6	Gas	2	7645	Regular	1730000447				26	26	25	24	23	23	22	22	21	18			
TOYOTA	CAMRY SOLARA SLE V6	Convertible	6	Gas	2	7653	Regular	1730001369				23	24	22	22	21	21	18	17	17				
TOYOTA	CAMRY SOLARA SPORT V6	2 Door	6	Gas	2	7645	Regular	1730013546					26											
TOYOTA	CAMRY SOLARA SPORT V6	Convertible	6	Gas	2	7653	Regular	1730013547					24											
TOYOTA	CAMRY XLE	4 Door	4	Gas	2	0450	Regular	1730002702	25	25	25	24	24	23	23	21	20	20						
TOYOTA	CAMRY XLE V6	4 Door	6	Gas	2	7615	Regular	225634	27	27	27	26	27	25	24	22	20	19	19	19	17	15	13	
TOYOTA	CANADIAN	2 Door	4	Gas	2	0404	Regular	2203																
TOYOTA	CARINA	2 Door	4	Gas	2		Regular	2225																
TOYOTA	CARINA	4 Door	4	Gas	2		Regular	2226																

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
1	20	All Purpose Motorhome	481	549	615	687	761	822	902	985	1054	1101	1192		
1	25	All Purpose Motorhome	451	514	577	644	713	771	845	923	988	1032	1117		
1	26	All Purpose Motorhome	445	508	569	636	704	761	834	911	975	1018	1103		
1	27	All Purpose Motorhome	439	501	561	627	694	750	823	899	961	1004	1088		
1	28	All Purpose Motorhome	433	494	554	618	685	740	811	886	948	991	1073		
1	29	All Purpose Motorhome	427	487	546	610	675	730	800	874	935	977	1058		
1	30	All Purpose Motorhome	421	480	538	601	666	720	789	862	922	963	1043		
1	0	All Purpose Passenger Vehicle	601	662	760	807	855	905	949	993	1041	1078	1093	1111	1134
1	5	All Purpose Passenger Vehicle	571	629	722	767	812	860	902	943	989	1024	1038	1055	1077
1	10	All Purpose Passenger Vehicle	541	596	684	726	769	814	854	894	937	970	984	1000	1021
1	15	All Purpose Passenger Vehicle	511	563	646	686	727	769	807	844	885	916	929	944	964
1	20	All Purpose Passenger Vehicle	481	530	608	646	684	724	759	794	833	862	874	889	907
1	25	All Purpose Passenger Vehicle	451	496	570	605	641	679	712	745	781	808	820	833	850
1	26	All Purpose Passenger Vehicle	445	490	562	597	633	670	702	735	770	798	809	822	839
1	27	All Purpose Passenger Vehicle	439	483	555	589	624	661	693	725	760	787	798	811	828
1	28	All Purpose Passenger Vehicle	433	477	547	581	616	652	683	715	750	776	787	800	816
1	29	All Purpose Passenger Vehicle	427	470	540	573	607	643	674	705	739	765	776	789	805
1	30	All Purpose Passenger Vehicle	421	463	532	565	598	633	664	695	729	755	765	778	794
1	0	All Purpose Snow Vehicle (HTA)	439												
1	0	All Purpose Trailer $2500 or less	10												
1	0	All Purpose Trailer $2501 or more		48	82	128	169	233	268	294	328	343	358	374	391
1	0	All Purpose Truck 4,540 kg or less GVW	447	523	550	581	604	634	659	682	717	746	776	821	846
1	5	All Purpose Truck 4,540 kg or less GVW	425	497	522	552	574	602	626	648	681	709	737	780	804
1	10	All Purpose Truck 4,540 kg or less GVW	402	471	495	523	544	571	593	614	645	671	698	739	761
1	15	All Purpose Truck 4,540 kg or less GVW	380	445	467	494	513	539	560	580	609	634	660	698	719
1	20	All Purpose Truck 4,540 kg or less GVW	358	418	440	465	483	507	527	546	574	597	621	657	677
1	25	All Purpose Truck 4,540 kg or less GVW	335	392	412	436	453	475	494	511	538	559	582	616	634
1	26	All Purpose Truck 4,540 kg or less GVW	331	387	407	430	447	469	488	505	531	552	574	608	626
1	27	All Purpose Truck 4,540 kg or less GVW	326	382	401	424	441	463	481	498	523	545	566	599	618
1	28	All Purpose Truck 4,540 kg or less GVW	322	377	396	418	435	456	474	491	516	537	559	591	609
1	29	All Purpose Truck 4,540 kg or less GVW	317	371	390	413	429	450	468	484	509	530	551	583	601
1	30	All Purpose Truck 4,540 kg or less GVW	313	366	385	407	423	444	461	477	502	522	543	575	592
1	0	Antique Vehicle - Bus	106												
1	0	Antique Vehicle - Motorcycle	106												
1	0	Antique Vehicle - Passenger Vehicle	106												
1	0	Antique Vehicle - Truck	106												
1	0	Artisan Truck 4,540 kg or less GVW	592	693	728	770	800	840	873	903	950	988	1028	1087	1121
1	5	Artisan Truck 4,540 kg or less GVW	562	658	692	731	760	798	829	858	902	939	977	1033	1065
1	10	Artisan Truck 4,540 kg or less GVW	533	624	655	693	720	756	786	813	855	889	925	978	1009
1	15	Artisan Truck 4,540 kg or less GVW	503	589	619	654	680	714	742	768	807	840	874	924	953
1	20	Artisan Truck 4,540 kg or less GVW	474	554	582	616	640	672	698	722	760	790	822	870	897
1	25	Artisan Truck 4,540 kg or less GVW	444	520	546	577	600	630	655	677	712	741	771	815	841
1	26	Artisan Truck 4,540 kg or less GVW	438	513	539	570	592	622	646	668	703	731	761	804	830
1	27	Artisan Truck 4,540 kg or less GVW	432	506	531	562	584	613	637	659	693	721	750	794	818
1	28	Artisan Truck 4,540 kg or less GVW	426	499	524	554	576	605	629	650	684	711	740	783	807
1	29	Artisan Truck 4,540 kg or less GVW	420	492	517	547	568	596	620	641	674	701	730	772	796
1	30	Artisan Truck 4,540 kg or less GVW	414	485	510	539	560	588	611	632	665	692	720	761	785
1	0	Artisan Truck 4,541 to 16,330 kg GVW		664	758	820	895	959	1032	1100	1168	1236	1305	1372	1441
1	5	Artisan Truck 4,541 to 16,330 kg GVW		631	720	779	850	911	980	1045	1110	1174	1240	1303	1369

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1156	1179	1204	1226	1249	1271	1294	1319	1343	1367	1391	1420	1448	1476	1494	1531	1564	1603	1647	1653	1659	1665	1671
1098	1120	1144	1165	1187	1207	1229	1253	1276	1299	1321	1349	1376	1402	1419	1454	1486	1523	1565	1570	1576	1582	1587
1040	1061	1084	1103	1124	1144	1165	1187	1209	1230	1252	1278	1303	1328	1345	1378	1408	1443	1482	1488	1493	1498	1504
983	1002	1023	1042	1062	1080	1100	1121	1142	1162	1182	1207	1231	1255	1270	1301	1329	1363	1400	1405	1410	1415	1420
925	943	963	981	999	1017	1035	1055	1074	1094	1113	1136	1158	1181	1195	1225	1251	1282	1318	1322	1327	1332	1337
867	884	903	919	937	953	970	989	1007	1025	1043	1065	1086	1107	1120	1148	1173	1202	1235	1240	1244	1249	1253
855	872	891	907	924	941	958	976	994	1012	1029	1051	1072	1092	1106	1133	1157	1186	1219	1223	1228	1232	1237
844	861	879	895	912	928	945	963	980	998	1015	1037	1057	1077	1091	1118	1142	1170	1202	1207	1211	1215	1220
832	849	867	883	899	915	932	950	967	984	1002	1022	1043	1063	1076	1102	1126	1154	1186	1190	1194	1199	1203
821	837	855	870	887	902	919	936	954	971	988	1008	1028	1048	1061	1087	1110	1138	1169	1174	1178	1182	1186
809	825	843	858	874	890	906	923	940	957	974	994	1014	1033	1046	1072	1095	1122	1153	1157	1161	1165	1170
406																						
858	894	958	969	1009	1043	1088	1100	1118	1155	1206	1231	1269	1317	1329	1347	1377	1399	1445	1452	1458	1465	1471
815	849	910	921	959	991	1034	1045	1062	1097	1146	1169	1206	1251	1263	1280	1308	1329	1373	1379	1385	1392	1397
772	805	862	872	908	939	979	990	1006	1039	1085	1108	1142	1185	1196	1212	1239	1259	1300	1307	1312	1318	1324
729	760	814	824	858	887	925	935	950	982	1025	1046	1079	1119	1130	1145	1170	1189	1228	1234	1239	1245	1250
686	715	766	775	807	834	870	880	894	924	965	985	1015	1054	1063	1078	1102	1119	1156	1162	1166	1172	1177
643	670	718	727	757	782	816	825	838	866	904	923	952	988	997	1010	1033	1049	1084	1089	1093	1099	1103
635	662	709	717	747	772	805	814	827	855	892	911	939	975	983	997	1019	1035	1069	1074	1079	1084	1089
626	653	699	707	737	761	794	803	816	843	880	899	926	961	970	983	1005	1021	1055	1060	1064	1069	1074
618	644	690	698	726	751	783	792	805	832	868	886	914	948	957	970	991	1007	1040	1045	1050	1055	1059
609	635	680	688	716	741	772	781	794	820	856	874	901	935	944	956	978	993	1026	1031	1035	1040	1044
601	626	671	678	706	730	762	770	783	808	844	862	888	922	930	943	964	979	1011	1016	1021	1025	1030
1137	1184	1269	1284	1336	1381	1441	1457	1480	1530	1598	1631	1681	1744	1761	1784	1824	1854	1915	1923	1932	1940	1949
1080	1125	1206	1220	1269	1312	1369	1384	1406	1453	1518	1549	1597	1657	1673	1695	1733	1761	1819	1827	1835	1843	1852
1023	1066	1142	1156	1202	1243	1297	1311	1332	1377	1438	1468	1513	1570	1585	1606	1642	1669	1723	1731	1739	1746	1754
966	1006	1079	1091	1136	1174	1225	1238	1258	1300	1358	1386	1429	1482	1497	1516	1550	1576	1628	1635	1642	1649	1657
910	947	1015	1027	1069	1105	1153	1166	1184	1224	1278	1305	1345	1395	1409	1427	1459	1483	1532	1538	1546	1552	1559
853	888	952	963	1002	1036	1081	1093	1110	1147	1198	1223	1261	1308	1321	1338	1368	1390	1436	1442	1449	1455	1462
841	876	939	950	989	1022	1066	1078	1095	1132	1183	1207	1244	1291	1303	1320	1350	1372	1417	1423	1430	1436	1442
830	864	926	937	975	1008	1052	1064	1080	1117	1167	1191	1227	1273	1286	1302	1332	1353	1398	1404	1410	1416	1423
819	852	914	924	962	994	1038	1049	1066	1102	1151	1174	1210	1256	1268	1284	1313	1335	1379	1385	1391	1397	1403
807	841	901	912	949	981	1023	1034	1051	1086	1135	1158	1194	1238	1250	1267	1295	1316	1360	1365	1372	1377	1384
796	829	888	899	935	967	1009	1020	1036	1071	1119	1142	1177	1221	1233	1249	1277	1298	1340	1346	1352	1358	1364
1510	1605	1702	1754	1780																		
1434	1525	1617	1666	1691																		

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
1	25	Pleasure Motorcycle-Touring 501 to 1000 cc	994	1088	1114	1183	1217	1279	1339	1410	1492	1513			
1	26	Pleasure Motorcycle-Touring 501 to 1000 cc	981	1074	1099	1168	1201	1262	1321	1391	1473	1493			
1	27	Pleasure Motorcycle-Touring 501 to 1000 cc	968	1059	1084	1152	1185	1245	1303	1372	1453	1472			
1	28	Pleasure Motorcycle-Touring 501 to 1000 cc	955	1045	1069	1136	1169	1228	1285	1354	1433	1452			
1	29	Pleasure Motorcycle-Touring 501 to 1000 cc	941	1030	1054	1120	1152	1211	1267	1335	1413	1432			
1	30	Pleasure Motorcycle-Touring 501 to 1000 cc	928	1016	1039	1105	1136	1194	1249	1316	1393	1412			
1	0	Pleasure Motorcycle-Touring 1001 cc or more	1424	1559	1594	1695	1742	1832	1916	2019	2137	2166			
1	5	Pleasure Motorcycle-Touring 1001 cc or more	1353	1481	1514	1610	1655	1740	1820	1918	2030	2058			
1	10	Pleasure Motorcycle-Touring 1001 cc or more	1282	1403	1435	1525	1568	1649	1724	1817	1923	1949			
1	15	Pleasure Motorcycle-Touring 1001 cc or more	1210	1325	1355	1441	1481	1557	1629	1716	1816	1841			
1	20	Pleasure Motorcycle-Touring 1001 cc or more	1139	1247	1275	1356	1394	1466	1533	1615	1710	1733			
1	25	Pleasure Motorcycle-Touring 1001 cc or more	1068	1169	1195	1271	1306	1374	1437	1514	1603	1624			
1	26	Pleasure Motorcycle-Touring 1001 cc or more	1054	1154	1180	1254	1289	1356	1418	1494	1581	1603			
1	27	Pleasure Motorcycle-Touring 1001 cc or more	1040	1138	1164	1237	1272	1337	1399	1474	1560	1581			
1	28	Pleasure Motorcycle-Touring 1001 cc or more	1025	1122	1148	1220	1254	1319	1380	1454	1539	1560			
1	29	Pleasure Motorcycle-Touring 1001 cc or more	1011	1107	1132	1203	1237	1301	1360	1433	1517	1538			
1	30	Pleasure Motorcycle-Touring 1001 cc or more	997	1091	1116	1186	1219	1282	1341	1413	1496	1516			
1	0	Pleasure Motorhome	362	414	463	517	573	619	679	742	793	829	898		
1	5	Pleasure Motorhome	344	393	440	491	544	588	645	705	753	788	853		
1	10	Pleasure Motorhome	326	373	417	465	516	557	611	668	714	746	808		
1	15	Pleasure Motorhome	308	352	394	439	487	526	577	631	674	705	763		
1	20	Pleasure Motorhome	290	331	370	414	458	495	543	594	634	663	718		
1	25	Pleasure Motorhome	271	310	347	388	430	464	509	556	595	622	673		
1	26	Pleasure Motorhome	268	306	343	383	424	458	502	549	587	613	665		
1	27	Pleasure Motorhome	264	302	338	377	418	452	496	542	579	605	656		
1	28	Pleasure Motorhome	261	298	333	372	413	446	489	534	571	597	647		
1	29	Pleasure Motorhome	257	294	329	367	407	439	482	527	563	589	638		
1	30	Pleasure Motorhome	253	290	324	362	401	433	475	519	555	580	629		
1	0	Pleasure Passenger Vehicle	479	528	606	643	682	721	756	791	830	859	871	885	904
1	5	Pleasure Passenger Vehicle	455	502	576	611	648	685	718	751	788	816	827	841	859
1	10	Pleasure Passenger Vehicle	431	475	545	579	614	649	680	712	747	773	784	796	814
1	15	Pleasure Passenger Vehicle	407	449	515	547	580	613	643	672	705	730	740	752	768
1	20	Pleasure Passenger Vehicle	383	422	485	514	546	577	605	633	664	687	697	708	723
1	25	Pleasure Passenger Vehicle	359	396	454	482	511	541	567	593	622	644	653	664	678
1	26	Pleasure Passenger Vehicle	354	391	448	476	505	534	559	585	614	636	645	655	669
1	27	Pleasure Passenger Vehicle	350	385	442	469	498	526	552	577	606	627	636	646	660
1	28	Pleasure Passenger Vehicle	345	380	436	463	491	519	544	570	598	618	627	637	651
1	29	Pleasure Passenger Vehicle	340	375	430	457	484	512	537	562	589	610	618	628	642
1	30	Pleasure Passenger Vehicle	335	370	424	450	477	505	529	554	581	601	610	619	633
1	0	Pleasure Truck 4,540 kg or less GVW	352	412	433	457	476	499	519	537	565	587	611	646	666
1	5	Pleasure Truck 4,540 kg or less GVW	334	391	411	434	452	474	493	510	537	558	580	614	633
1	10	Pleasure Truck 4,540 kg or less GVW	317	371	390	411	428	449	467	483	508	528	550	581	599
1	15	Pleasure Truck 4,540 kg or less GVW	299	350	368	388	405	424	441	456	480	499	519	549	566
1	20	Pleasure Truck 4,540 kg or less GVW	282	330	346	366	381	399	415	430	452	470	489	517	533
1	25	Pleasure Truck 4,540 kg or less GVW	264	309	325	343	357	374	389	403	424	440	458	484	499
1	26	Pleasure Truck 4,540 kg or less GVW	260	305	320	338	352	369	384	397	418	434	452	478	493
1	27	Pleasure Truck 4,540 kg or less GVW	257	301	316	334	347	364	379	392	412	429	446	472	486
1	28	Pleasure Truck 4,540 kg or less GVW	253	297	312	329	343	359	374	387	407	423	440	465	480
1	29	Pleasure Truck 4,540 kg or less GVW	250	293	307	324	338	354	368	381	401	417	434	459	473

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
921	940	959	977	996	1013	1031	1051	1071	1090	1109	1132	1154	1177	1191	1220	1246	1277	1313	1317	1322	1327	1332
875	893	911	928	946	962	979	998	1017	1035	1054	1075	1096	1118	1131	1159	1184	1213	1247	1251	1256	1261	1265
829	846	863	879	896	912	928	946	964	981	998	1019	1039	1059	1072	1098	1121	1149	1182	1185	1190	1194	1199
783	799	815	830	847	861	876	893	910	926	943	962	981	1000	1012	1037	1059	1085	1116	1119	1124	1128	1132
737	752	767	782	797	810	825	841	857	872	887	906	923	942	953	976	997	1022	1050	1054	1058	1062	1066
691	705	719	733	747	760	773	788	803	817	832	849	865	883	893	915	934	958	985	988	991	995	999
682	696	710	723	737	750	763	778	793	807	821	838	854	871	881	903	922	945	972	975	978	982	986
672	686	700	713	727	739	753	767	782	796	810	826	842	859	869	891	910	932	958	961	965	969	972
663	677	690	703	717	729	742	757	771	785	798	815	831	847	858	878	897	919	945	948	952	955	959
654	667	681	694	707	719	732	746	760	774	787	804	819	836	846	866	885	907	932	935	939	942	946
645	658	671	684	697	709	722	736	750	763	776	792	808	824	834	854	872	894	919	922	925	929	932
675	704	754	763	794	821	857	866	880	910	950	969	999	1036	1046	1060	1084	1102	1138	1143	1148	1153	1158
641	669	716	725	754	780	814	823	836	864	902	921	949	984	994	1007	1030	1047	1081	1086	1091	1095	1100
607	634	679	687	715	739	771	779	792	819	855	872	899	932	941	954	976	992	1024	1029	1033	1038	1042
574	598	641	649	675	698	728	736	748	773	807	824	849	881	889	901	921	937	967	972	976	980	984
540	563	603	610	635	657	686	693	704	728	760	775	799	829	837	848	867	882	910	914	918	922	926
506	528	565	572	595	616	643	649	660	682	712	727	749	777	784	795	813	826	853	857	861	865	868
499	521	558	565	588	608	634	641	651	673	703	717	739	767	774	784	802	815	842	846	850	853	857
493	514	550	557	580	599	626	632	642	664	693	707	729	756	764	774	791	804	831	834	838	842	845
486	507	543	549	572	591	617	624	634	655	684	698	719	746	753	763	780	793	819	823	827	830	834
479	500	535	542	564	583	608	615	625	646	674	688	709	736	743	753	770	782	808	812	815	819	822

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
2	15	All Purpose Motorcycle-Touring 501 to 1000 cc	1176	1288	1317	1400	1440	1514	1584	1669	1765	1790			
2	20	All Purpose Motorcycle-Touring 501 to 1000 cc	1107	1212	1240	1318	1355	1425	1490	1570	1662	1685			
2	25	All Purpose Motorcycle-Touring 501 to 1000 cc	1038	1136	1162	1235	1270	1336	1397	1472	1558	1579			
2	26	All Purpose Motorcycle-Touring 501 to 1000 cc	1024	1121	1147	1219	1254	1318	1379	1453	1537	1558			
2	27	All Purpose Motorcycle-Touring 501 to 1000 cc	1010	1106	1131	1202	1237	1300	1360	1433	1516	1537			
2	28	All Purpose Motorcycle-Touring 501 to 1000 cc	996	1091	1116	1186	1220	1282	1341	1413	1495	1516			
2	29	All Purpose Motorcycle-Touring 501 to 1000 cc	983	1076	1100	1169	1203	1265	1323	1394	1475	1495			
2	30	All Purpose Motorcycle-Touring 501 to 1000 cc	969	1060	1085	1153	1186	1247	1304	1374	1454	1474			
2	0	All Purpose Motorcycle-Touring 1001 cc or more	1529	1674	1712	1820	1871	1967	2058	2168	2295	2327			
2	5	All Purpose Motorcycle-Touring 1001 cc or more	1453	1590	1626	1729	1777	1869	1955	2060	2180	2211			
2	10	All Purpose Motorcycle-Touring 1001 cc or more	1376	1507	1541	1638	1684	1770	1852	1951	2065	2094			
2	15	All Purpose Motorcycle-Touring 1001 cc or more	1300	1423	1455	1547	1590	1672	1749	1843	1951	1978			
2	20	All Purpose Motorcycle-Touring 1001 cc or more	1223	1339	1370	1456	1497	1574	1646	1734	1836	1862			
2	25	All Purpose Motorcycle-Touring 1001 cc or more	1147	1255	1284	1365	1403	1475	1543	1626	1721	1745			
2	26	All Purpose Motorcycle-Touring 1001 cc or more	1131	1239	1267	1347	1385	1456	1523	1604	1698	1722			
2	27	All Purpose Motorcycle-Touring 1001 cc or more	1116	1222	1250	1329	1366	1436	1502	1583	1675	1699			
2	28	All Purpose Motorcycle-Touring 1001 cc or more	1101	1205	1233	1310	1347	1416	1482	1561	1652	1675			
2	29	All Purpose Motorcycle-Touring 1001 cc or more	1086	1189	1216	1292	1328	1397	1461	1539	1629	1652			
2	30	All Purpose Motorcycle-Touring 1001 cc or more	1070	1172	1198	1274	1310	1377	1441	1518	1606	1629			
2	0	All Purpose Motorhome	490	560	627	700	775	838	919	1004	1074	1122	1215		
2	5	All Purpose Motorhome	465	532	596	665	736	796	873	954	1020	1066	1154		
2	10	All Purpose Motorhome	441	504	564	630	697	754	827	904	967	1010	1093		
2	15	All Purpose Motorhome	416	476	533	595	659	712	781	853	913	954	1033		
2	20	All Purpose Motorhome	392	448	502	560	620	670	735	803	859	898	972		
2	25	All Purpose Motorhome	367	420	470	525	581	628	689	753	805	841	911		
2	26	All Purpose Motorhome	363	414	464	518	573	620	680	743	795	830	899		
2	27	All Purpose Motorhome	358	409	458	511	566	612	671	733	784	819	887		
2	28	All Purpose Motorhome	353	403	451	504	558	603	662	723	773	808	875		
2	29	All Purpose Motorhome	348	398	445	497	550	595	652	713	763	797	863		
2	30	All Purpose Motorhome	343	392	439	490	542	587	643	703	752	785	850		
2	0	All Purpose Passenger Vehicle	564	621	713	757	802	849	890	932	977	1011	1025	1042	1064
2	5	All Purpose Passenger Vehicle	536	590	677	719	762	807	845	885	928	960	974	990	1011
2	10	All Purpose Passenger Vehicle	508	559	642	681	722	764	801	839	879	910	922	938	958
2	15	All Purpose Passenger Vehicle	479	528	606	643	682	722	756	792	830	859	871	886	904
2	20	All Purpose Passenger Vehicle	451	497	570	606	642	679	712	746	782	809	820	834	851
2	25	All Purpose Passenger Vehicle	423	466	535	568	601	637	667	699	733	758	769	781	798
2	26	All Purpose Passenger Vehicle	417	460	528	560	593	628	659	690	723	748	758	771	787
2	27	All Purpose Passenger Vehicle	412	453	520	553	585	620	650	680	713	738	748	761	777
2	28	All Purpose Passenger Vehicle	406	447	513	545	577	611	641	671	703	728	738	750	766
2	29	All Purpose Passenger Vehicle	400	441	506	537	569	603	632	662	694	718	728	740	755
2	30	All Purpose Passenger Vehicle	395	435	499	530	561	594	623	652	684	708	717	729	745
2	0	All Purpose Snow Vehicle (HTA)	342												
2	0	All Purpose Trailer $2500 or less	7												
2	0	All Purpose Trailer $2501 or more		37	63	99	130	179	207	227	253	265	277	289	302
2	0	All Purpose Truck 4,540 kg or less GVW	436	511	537	567	590	619	644	666	701	728	758	802	827
2	5	All Purpose Truck 4,540 kg or less GVW	414	485	510	539	560	588	612	633	666	692	720	762	786
2	10	All Purpose Truck 4,540 kg or less GVW	392	460	483	510	531	557	580	599	631	655	682	722	744
2	15	All Purpose Truck 4,540 kg or less GVW	371	434	456	482	501	526	547	566	596	619	644	682	703
2	20	All Purpose Truck 4,540 kg or less GVW	349	409	430	454	472	495	515	533	561	582	606	642	662

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1084	1106	1129	1150	1172	1192	1214	1237	1260	1283	1305	1332	1358	1385	1402	1436	1467	1504	1545	1551	1556	1562	1568
1030	1051	1073	1092	1113	1132	1153	1175	1197	1219	1240	1265	1290	1316	1332	1364	1394	1429	1468	1473	1478	1484	1490
976	995	1016	1035	1055	1073	1093	1113	1134	1155	1174	1199	1222	1246	1262	1292	1320	1354	1390	1396	1400	1406	1411
921	940	960	977	996	1013	1032	1051	1071	1091	1109	1132	1154	1177	1192	1221	1247	1278	1313	1318	1323	1328	1333
867	885	903	920	938	954	971	990	1008	1026	1044	1066	1086	1108	1122	1149	1174	1203	1236	1241	1245	1250	1254
813	829	847	862	879	894	910	928	945	962	979	999	1018	1039	1051	1077	1100	1128	1159	1163	1167	1171	1176
802	818	835	851	867	882	898	915	932	949	966	986	1005	1025	1037	1063	1086	1113	1143	1148	1151	1156	1160
791	807	824	839	856	870	886	903	920	937	953	972	991	1011	1023	1048	1071	1098	1128	1132	1136	1140	1145
780	796	813	828	844	858	874	891	907	924	940	959	978	997	1009	1034	1056	1083	1112	1117	1120	1125	1129
770	785	802	816	832	846	862	878	895	911	927	946	964	983	995	1020	1042	1068	1097	1101	1105	1109	1113
759	774	790	805	820	834	850	866	882	898	913	932	951	969	981	1005	1027	1053	1081	1086	1089	1093	1098
313																						
838	873	936	946	985	1018	1063	1074	1092	1129	1178	1203	1239	1286	1298	1315	1345	1367	1412	1418	1424	1431	1437
796	829	889	899	936	967	1010	1020	1037	1073	1119	1143	1177	1222	1233	1249	1278	1299	1341	1347	1353	1359	1365
754	786	842	851	886	916	957	967	983	1016	1060	1083	1115	1157	1168	1183	1210	1230	1271	1276	1282	1288	1293
712	742	796	804	837	865	904	913	928	960	1001	1023	1053	1093	1103	1118	1143	1162	1200	1205	1210	1216	1221
670	698	749	757	788	814	850	859	874	903	942	962	991	1029	1038	1052	1076	1094	1130	1134	1139	1145	1150

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
2	29	Pleasure Motorhome	253	290	324	362	401	433	475	519	555	580	628		
2	30	Pleasure Motorhome	250	286	319	357	395	427	468	512	547	572	619		
2	0	Pleasure Passenger Vehicle	452	498	572	607	643	681	714	747	783	811	822	835	853
2	5	Pleasure Passenger Vehicle	429	473	543	577	611	647	678	710	744	770	781	793	810
2	10	Pleasure Passenger Vehicle	407	448	515	546	579	613	643	672	705	730	740	751	768
2	15	Pleasure Passenger Vehicle	384	423	486	516	547	579	607	635	666	689	699	710	725
2	20	Pleasure Passenger Vehicle	362	398	458	486	514	545	571	598	626	649	658	668	682
2	25	Pleasure Passenger Vehicle	339	373	429	455	482	511	535	560	587	608	616	626	640
2	26	Pleasure Passenger Vehicle	334	369	423	449	476	504	528	553	579	600	608	618	631
2	27	Pleasure Passenger Vehicle	330	364	418	443	469	497	521	545	572	592	600	610	623
2	28	Pleasure Passenger Vehicle	325	359	412	437	463	490	514	538	564	584	592	601	614
2	29	Pleasure Passenger Vehicle	321	354	406	431	457	484	507	530	556	576	584	593	606
2	30	Pleasure Passenger Vehicle	316	349	400	425	450	477	500	523	548	568	575	584	597
2	0	Pleasure Truck 4,540 kg or less GVW	340	398	418	442	460	483	502	519	546	568	591	625	644
2	5	Pleasure Truck 4,540 kg or less GVW	323	378	397	420	437	459	477	493	519	540	561	594	612
2	10	Pleasure Truck 4,540 kg or less GVW	306	358	376	398	414	435	452	467	491	511	532	562	580
2	15	Pleasure Truck 4,540 kg or less GVW	289	338	355	376	391	411	427	441	464	483	502	531	547
2	20	Pleasure Truck 4,540 kg or less GVW	272	318	334	354	368	386	402	415	437	454	473	500	515
2	25	Pleasure Truck 4,540 kg or less GVW	255	298	313	331	345	362	376	389	409	426	443	469	483
2	26	Pleasure Truck 4,540 kg or less GVW	252	295	309	327	340	357	371	384	404	420	437	462	477
2	27	Pleasure Truck 4,540 kg or less GVW	248	291	305	323	336	353	366	379	399	415	431	456	470
2	28	Pleasure Truck 4,540 kg or less GVW	245	287	301	318	331	348	361	374	393	409	426	450	464
2	29	Pleasure Truck 4,540 kg or less GVW	241	283	297	314	327	343	356	368	388	403	420	444	457
2	30	Pleasure Truck 4,540 kg or less GVW	238	279	293	309	322	338	351	363	382	398	414	437	451
2	0	Police/Emergency Passenger Vehicle	487	537	616	654	693	733	769	805	844	873	886	900	919
2	0	Police/Emergency Truck 4,540 kg or less GVW	614	614	614	614	614	614	614	614	614	614	614	614	614
2	0	Police/Emergency Truck 4,541 to 16,330 kg GVW		567	567	567	567	567	567	567	567	567	567	567	567
2	0	Police/Emergency Truck 16,331 kg or more GVW		493	493	493	493	493	493	493	493	493	493	493	493
2	0	Repairer	249												
2	0	Sand/Gravel Truck 10,891 to 16,330 kg GVW		514	587	636	694	743	800	852	905	958	1011	1063	1117
2	0	Sand/Gravel Truck 16,331 kg or more GVW		712	712	712	712	712	712	712	712	712	712	712	712
2	0	School Bus 20 seats or less	139	153	167	172	185	195	209	217	241	250	261	271	283
2	0	School Bus 21 to 35 seats	153	172	185	195	209	217	228	241	269	281	292	305	316
2	0	School Bus 36 to 50 seats	172	195	209	217	228	241	263	269	289	302	314	324	339
2	0	School Bus 51 seats or more	195	217	228	241	263	269	276	289	328	345	356	371	384
2	0	Taxi/Livery Passenger Vehicle	3291												
2	0	Tow Truck 4,540 kg or less GVW	401	470	494	522	543	570	592	613	645	670	697	738	760
2	0	Tow Truck 4,541 to 16,330 kg GVW		585	667	722	789	845	910	969	1029	1089	1149	1209	1269
2	0	Tow Truck 16,331 kg or more GVW		450	450	450	450	450	450	450	450	450	450	450	450
2	0	Transit Bus 20 seats or less	406	434	472	561	661	763	798	833	868	902	938	974	1013
2	0	Transit Bus 21 to 35 seats	434	472	561	661	763	820	855	891	925	960	1001	1040	1081
2	0	Transit Bus 36 to 50 seats	472	561	661	763	820	882	915	953	985	1026	1066	1109	1154
2	0	Transit Bus 51 seats or more	573	677	780	839	902	969	1004	1040	1077	1122	1164	1212	1260
2	0	U Drive Bus	950												
2	0	U Drive Moped	159	236	281	331	359	370	387	405	423	440			
2	0	U Drive Motorhome	749												
2	0	U Drive Passenger Vehicle	420	463	531	563	597	632	663	694	727	753	763	776	792
2	0	U Drive Truck 4,540 kg or less GVW	379	443	466	492	512	537	559	578	608	632	657	696	717
2	0	U Drive Truck 4,541 to 16,330 kg GVW		266	304	329	359	384	414	441	468	495	523	550	577

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
869	887	906	922	940	956	973	992	1011	1028	1046	1068	1089	1111	1124	1151	1176	1206	1239	1243	1248	1252	1257
826	843	861	876	893	908	924	942	960	977	994	1015	1035	1055	1068	1093	1117	1146	1177	1181	1186	1189	1194
782	798	815	830	846	860	876	893	910	925	941	961	980	1000	1012	1036	1058	1085	1115	1119	1123	1127	1131
739	754	770	784	799	813	827	843	859	874	889	908	926	944	955	978	1000	1025	1053	1057	1061	1064	1068
695	710	725	738	752	765	778	794	809	822	837	854	871	889	899	921	941	965	991	994	998	1002	1006
652	665	679	691	705	717	730	744	758	771	784	801	817	833	843	863	882	904	929	932	936	939	943
643	656	670	682	696	707	720	734	748	761	774	790	806	822	832	852	870	892	917	920	924	926	930
634	648	661	673	686	698	710	724	738	750	764	780	795	811	821	840	858	880	904	907	911	914	918
626	639	652	664	677	688	701	714	728	740	753	769	784	800	809	829	847	868	892	895	899	901	905
617	630	643	655	667	679	691	704	718	730	743	758	773	789	798	817	835	856	880	883	886	889	892
608	621	634	645	658	669	681	694	708	720	732	748	762	778	787	806	823	844	867	870	874	876	880
653	681	730	738	768	794	829	838	851	880	919	938	966	1002	1012	1025	1048	1065	1101	1105	1110	1115	1120
620	647	693	701	730	754	788	796	808	836	873	891	918	952	961	974	996	1012	1046	1050	1054	1059	1064
588	613	657	664	691	715	746	754	766	792	827	844	869	902	911	922	943	958	991	994	999	1003	1008
555	579	620	627	653	675	705	712	723	748	781	797	821	852	860	871	891	905	936	939	943	948	952
522	545	584	590	614	635	663	670	681	704	735	750	773	802	810	820	838	852	881	884	888	892	896
490	511	547	553	576	595	622	628	638	660	689	703	724	751	759	769	786	799	826	829	832	836	840
483	504	540	546	568	588	613	620	630	651	680	694	715	741	749	758	776	788	815	818	821	825	829
477	497	533	539	561	580	605	612	621	642	671	685	705	731	739	748	765	777	804	807	810	814	818
470	490	526	531	553	572	597	603	613	634	662	675	696	721	729	738	755	767	793	796	799	803	806
464	484	518	524	545	564	589	595	604	625	652	666	686	711	719	728	744	756	782	785	788	792	795
457	477	511	517	538	556	580	587	596	616	643	657	676	701	708	717	734	745	771	773	777	780	784
936	956	975	993	1012	1030	1048	1069	1089	1108	1127	1150	1173	1196	1211	1240	1267	1299	1335	1339	1344	1349	1354
614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614
567	567	567	567	567																		
493	493	493	493	493																		
1170	1244	1319	1359	1380																		
712	712	712	712	712																		
294																						
328																						
352																						
400																						
771	803	861	871	906	937	978	988	1004	1038	1084	1106	1140	1183	1194	1210	1237	1257	1299	1304	1310	1316	1322
1330	1414	1499	1545	1568																		
450	450	450	450	450																		
1053																						
1123																						
1200																						
1308																						
807	824	841	856	873	888	904	921	938	955	971	992	1011	1031	1043	1069	1092	1119	1150	1154	1159	1163	1167
727	758	812	821	855	884	922	932	947	979	1022	1044	1075	1116	1127	1141	1167	1186	1225	1230	1236	1241	1247
605	643	682	705	716																		

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
3	28	All Purpose Motorhome	431	492	552	616	683	737	809	883	945	988	1070		
3	29	All Purpose Motorhome	425	486	544	608	673	727	798	871	932	974	1055		
3	30	All Purpose Motorhome	419	479	536	599	664	717	787	859	919	960	1040		
3	0	All Purpose Passenger Vehicle	707	779	893	948	1005	1064	1115	1167	1224	1267	1285	1305	1333
3	5	All Purpose Passenger Vehicle	672	740	848	901	955	1011	1059	1109	1163	1204	1221	1240	1266
3	10	All Purpose Passenger Vehicle	636	701	804	853	904	958	1003	1050	1102	1140	1156	1174	1200
3	15	All Purpose Passenger Vehicle	601	662	759	806	854	904	948	992	1040	1077	1092	1109	1133
3	20	All Purpose Passenger Vehicle	566	623	714	758	804	851	892	934	979	1014	1028	1044	1066
3	25	All Purpose Passenger Vehicle	530	584	670	711	754	798	836	875	918	950	964	979	1000
3	26	All Purpose Passenger Vehicle	523	576	661	702	744	787	825	864	906	938	951	966	986
3	27	All Purpose Passenger Vehicle	516	569	652	692	734	777	814	852	894	925	938	953	973
3	28	All Purpose Passenger Vehicle	509	561	643	683	724	766	803	840	881	912	925	940	960
3	29	All Purpose Passenger Vehicle	502	553	634	673	714	755	792	829	869	900	912	927	946
3	30	All Purpose Passenger Vehicle	495	545	625	664	703	745	780	817	857	887	899	913	933
3	0	All Purpose Snow Vehicle (HTA)	402												
3	0	All Purpose Trailer $2500 or less	6												
3	0	All Purpose Trailer $2501 or more		27	46	72	95	131	151	165	185	193	202	211	220
3	0	All Purpose Truck 4,540 kg or less GVW	500	586	615	650	676	710	738	764	803	835	868	919	948
3	5	All Purpose Truck 4,540 kg or less GVW	475	557	584	617	642	674	701	726	763	793	825	873	901
3	10	All Purpose Truck 4,540 kg or less GVW	450	527	553	585	608	639	664	688	723	751	781	827	853
3	15	All Purpose Truck 4,540 kg or less GVW	425	498	523	552	575	603	627	649	683	710	738	781	806
3	20	All Purpose Truck 4,540 kg or less GVW	400	469	492	520	541	568	590	611	642	668	694	735	758
3	25	All Purpose Truck 4,540 kg or less GVW	375	439	461	487	507	532	553	573	602	626	651	689	711
3	26	All Purpose Truck 4,540 kg or less GVW	370	434	455	481	500	525	546	565	594	618	642	680	702
3	27	All Purpose Truck 4,540 kg or less GVW	365	428	449	474	493	518	539	558	586	610	634	671	692
3	28	All Purpose Truck 4,540 kg or less GVW	360	422	443	468	487	511	531	550	578	601	625	662	683
3	29	All Purpose Truck 4,540 kg or less GVW	355	416	437	461	480	504	524	542	570	593	616	652	673
3	30	All Purpose Truck 4,540 kg or less GVW	350	410	430	455	473	497	517	535	562	584	608	643	664
3	0	Antique Vehicle - Bus	106												
3	0	Antique Vehicle - Motorcycle	106												
3	0	Antique Vehicle - Passenger Vehicle	106												
3	0	Antique Vehicle - Truck	106												
3	0	Artisan Truck 4,540 kg or less GVW	413	483	508	537	558	586	609	630	663	689	717	758	782
3	5	Artisan Truck 4,540 kg or less GVW	392	459	483	510	530	557	579	598	630	655	681	720	743
3	10	Artisan Truck 4,540 kg or less GVW	372	435	457	483	502	527	548	567	597	620	645	682	704
3	15	Artisan Truck 4,540 kg or less GVW	351	411	432	456	474	498	518	535	564	586	609	644	665
3	20	Artisan Truck 4,540 kg or less GVW	330	386	406	430	446	469	487	504	530	551	574	606	626
3	25	Artisan Truck 4,540 kg or less GVW	310	362	381	403	418	439	457	472	497	517	538	568	586
3	26	Artisan Truck 4,540 kg or less GVW	306	357	376	397	413	434	451	466	491	510	531	561	579
3	27	Artisan Truck 4,540 kg or less GVW	301	353	371	392	407	428	445	460	484	503	523	553	571
3	28	Artisan Truck 4,540 kg or less GVW	297	348	366	387	402	422	438	454	477	496	516	546	563
3	29	Artisan Truck 4,540 kg or less GVW	293	343	361	381	396	416	432	447	471	489	509	538	555
3	30	Artisan Truck 4,540 kg or less GVW	289	338	356	376	391	410	426	441	464	482	502	531	547
3	0	Artisan Truck 4,541 to 16,330 kg GVW		522	594	642	701	752	809	862	915	970	1026	1081	1137
3	5	Artisan Truck 4,541 to 16,330 kg GVW		496	564	610	666	714	769	819	869	921	975	1027	1080
3	10	Artisan Truck 4,541 to 16,330 kg GVW		470	535	578	631	677	728	776	823	873	923	973	1023
3	15	Artisan Truck 4,541 to 16,330 kg GVW		444	505	546	596	639	688	733	778	824	872	919	966
3	20	Artisan Truck 4,541 to 16,330 kg GVW		418	475	514	561	602	647	690	732	776	821	865	910
3	25	Artisan Truck 4,541 to 16,330 kg GVW		391	445	481	526	564	607	646	686	727	769	811	853

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1358	1386	1415	1441	1469	1494	1521	1550	1579	1607	1635	1669	1702	1735	1756	1799	1838	1884	1936	1943	1950	1957	1964
1290	1317	1344	1369	1396	1419	1445	1472	1500	1527	1553	1586	1617	1648	1668	1709	1746	1790	1839	1846	1852	1859	1866
1222	1247	1273	1297	1322	1345	1369	1395	1421	1446	1471	1502	1532	1561	1580	1619	1654	1696	1742	1749	1755	1761	1768
1154	1178	1203	1225	1249	1270	1293	1317	1342	1366	1390	1419	1447	1475	1493	1529	1562	1601	1646	1652	1657	1663	1669
1086	1109	1132	1153	1175	1195	1217	1240	1263	1286	1308	1335	1362	1388	1405	1439	1470	1507	1549	1554	1560	1566	1571
1018	1039	1061	1081	1102	1120	1141	1162	1184	1205	1226	1252	1276	1301	1317	1349	1378	1413	1452	1457	1462	1468	1473
1005	1026	1047	1066	1087	1106	1126	1147	1168	1189	1210	1235	1259	1284	1299	1331	1360	1394	1433	1438	1443	1448	1453
991	1012	1033	1052	1072	1091	1110	1131	1153	1173	1194	1218	1242	1267	1282	1313	1342	1375	1413	1418	1423	1429	1434
978	998	1019	1038	1058	1076	1095	1116	1137	1157	1177	1202	1225	1249	1264	1295	1323	1356	1394	1399	1404	1409	1414
964	984	1005	1023	1043	1061	1080	1100	1121	1141	1161	1185	1208	1232	1247	1277	1305	1338	1375	1380	1384	1389	1394
951	970	990	1009	1028	1046	1065	1085	1105	1125	1144	1168	1191	1214	1229	1259	1287	1319	1355	1360	1365	1370	1375
228																						
961	1001	1073	1085	1130	1167	1218	1231	1251	1294	1350	1379	1420	1474	1488	1508	1541	1567	1618	1625	1632	1640	1647
913	951	1019	1031	1073	1109	1157	1169	1188	1229	1282	1310	1349	1400	1414	1433	1464	1489	1537	1544	1550	1558	1565
865	901	966	976	1017	1050	1096	1108	1126	1165	1215	1241	1278	1327	1339	1357	1387	1410	1456	1462	1469	1476	1482
817	851	912	922	960	992	1035	1046	1063	1100	1147	1172	1207	1253	1265	1282	1310	1332	1375	1381	1387	1394	1400
769	801	858	868	904	934	974	985	1001	1035	1080	1103	1136	1179	1190	1206	1233	1254	1294	1300	1306	1312	1318
721	751	805	814	847	875	913	923	938	970	1012	1034	1065	1105	1116	1131	1156	1175	1213	1219	1224	1230	1235
711	741	794	803	836	864	901	911	926	958	999	1020	1051	1091	1101	1116	1140	1160	1197	1202	1208	1214	1219
702	731	783	792	825	852	889	899	913	945	985	1007	1037	1076	1086	1101	1125	1144	1181	1186	1191	1197	1202
692	721	773	781	814	840	877	886	901	932	972	993	1022	1061	1071	1086	1110	1128	1165	1170	1175	1181	1186
682	711	762	770	802	829	865	874	888	919	958	979	1008	1047	1056	1071	1094	1113	1149	1154	1159	1164	1169
673	701	751	759	791	817	853	862	876	906	945	965	994	1032	1042	1056	1079	1097	1133	1137	1142	1148	1153
793	826	885	895	932	966	1005	1016	1032	1067	1114	1138	1187	1216	1228	1256	1278	1317	1343	1341	1347	1353	1359
753	785	841	850	885	918	955	965	980	1014	1058	1081	1128	1155	1167	1193	1214	1251	1276	1274	1280	1285	1291
714	743	796	805	839	869	904	914	929	960	1003	1024	1068	1094	1105	1130	1150	1185	1209	1207	1212	1218	1223
674	702	752	761	792	821	854	864	877	907	947	967	1009	1034	1044	1068	1086	1119	1142	1140	1145	1150	1155
634	661	708	716	746	773	804	813	826	854	891	910	950	973	982	1005	1022	1054	1074	1073	1078	1082	1087
595	619	664	671	699	724	754	762	774	800	835	853	890	912	921	942	958	988	1007	1006	1010	1015	1019
587	611	655	662	690	715	744	752	764	790	824	842	878	900	909	929	946	975	994	992	997	1001	1006
579	603	646	653	680	705	734	742	753	779	813	831	867	888	896	917	933	961	980	979	983	988	992
571	595	637	644	671	696	724	732	743	768	802	819	855	876	884	904	920	948	967	966	970	974	978
563	586	628	635	662	686	714	721	733	758	791	808	843	863	872	892	907	935	954	952	956	961	965
555	578	619	626	652	676	703	711	722	747	780	797	831	851	860	879	895	922	940	939	943	947	951
1194	1271	1349	1392	1415																		
1134	1207	1282	1322	1344																		
1075	1144	1214	1253	1273																		
1015	1080	1147	1183	1203																		
955	1017	1079	1114	1132																		
895	953	1012	1044	1061																		

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
3	5	Pleasure Motorcycle-Touring 1001 cc or more	1073	1173	1201	1276	1312	1379	1443	1520	1609	1631			
3	10	Pleasure Motorcycle-Touring 1001 cc or more	1016	1111	1138	1209	1243	1307	1367	1440	1525	1545			
3	15	Pleasure Motorcycle-Touring 1001 cc or more	960	1050	1074	1142	1174	1234	1291	1360	1440	1459			
3	20	Pleasure Motorcycle-Touring 1001 cc or more	903	988	1011	1074	1105	1162	1215	1280	1355	1374			
3	25	Pleasure Motorcycle-Touring 1001 cc or more	847	926	948	1007	1036	1089	1139	1200	1270	1288			
3	26	Pleasure Motorcycle-Touring 1001 cc or more	835	914	935	994	1022	1074	1124	1184	1254	1271			
3	27	Pleasure Motorcycle-Touring 1001 cc or more	824	902	923	980	1008	1060	1109	1168	1237	1253			
3	28	Pleasure Motorcycle-Touring 1001 cc or more	813	889	910	967	994	1045	1094	1152	1220	1236			
3	29	Pleasure Motorcycle-Touring 1001 cc or more	802	877	897	954	981	1031	1078	1136	1203	1219			
3	30	Pleasure Motorcycle-Touring 1001 cc or more	790	864	885	940	967	1016	1063	1120	1186	1202			
3	0	Pleasure Motorhome	466	532	596	666	737	796	873	954	1021	1066	1155		
3	5	Pleasure Motorhome	443	505	566	633	700	756	829	906	970	1013	1097		
3	10	Pleasure Motorhome	419	479	536	599	663	716	786	859	919	959	1039		
3	15	Pleasure Motorhome	396	452	507	566	626	677	742	811	868	906	982		
3	20	Pleasure Motorhome	373	426	477	533	590	637	698	763	817	853	924		
3	25	Pleasure Motorhome	349	399	447	499	553	597	655	715	766	799	866		
3	26	Pleasure Motorhome	345	394	441	493	545	589	646	706	756	789	855		
3	27	Pleasure Motorhome	340	388	435	486	538	581	637	696	745	778	843		
3	28	Pleasure Motorhome	336	383	429	480	531	573	629	687	735	768	832		
3	29	Pleasure Motorhome	331	378	423	473	523	565	620	677	725	757	820		
3	30	Pleasure Motorhome	326	372	417	466	516	557	611	668	715	746	808		
3	0	Pleasure Passenger Vehicle	565	622	714	757	803	850	891	932	977	1012	1026	1043	1065
3	5	Pleasure Passenger Vehicle	537	591	678	719	763	807	846	885	928	961	975	991	1012
3	10	Pleasure Passenger Vehicle	508	560	643	681	723	765	802	839	879	911	923	939	958
3	15	Pleasure Passenger Vehicle	480	529	607	643	683	722	757	792	830	860	872	887	905
3	20	Pleasure Passenger Vehicle	452	498	571	606	642	680	713	746	782	810	821	834	852
3	25	Pleasure Passenger Vehicle	424	466	535	568	602	637	668	699	733	759	769	782	799
3	26	Pleasure Passenger Vehicle	418	460	528	560	594	629	659	690	723	749	759	772	788
3	27	Pleasure Passenger Vehicle	412	454	521	553	586	620	650	680	713	739	749	761	777
3	28	Pleasure Passenger Vehicle	407	448	514	545	578	612	642	671	703	729	739	751	767
3	29	Pleasure Passenger Vehicle	401	442	507	537	570	603	633	662	694	719	728	741	756
3	30	Pleasure Passenger Vehicle	395	435	500	530	562	595	624	652	684	708	718	730	745
3	0	Pleasure Truck 4,540 kg or less GVW	365	428	449	475	494	518	539	558	587	610	634	671	692
3	5	Pleasure Truck 4,540 kg or less GVW	347	407	427	451	469	492	512	530	558	579	602	637	657
3	10	Pleasure Truck 4,540 kg or less GVW	328	385	404	427	445	466	485	502	528	549	571	604	623
3	15	Pleasure Truck 4,540 kg or less GVW	310	364	382	404	420	440	458	474	499	518	539	570	588
3	20	Pleasure Truck 4,540 kg or less GVW	292	342	359	380	395	414	431	446	470	488	507	537	554
3	25	Pleasure Truck 4,540 kg or less GVW	274	321	337	356	370	388	404	418	440	457	475	503	519
3	26	Pleasure Truck 4,540 kg or less GVW	270	317	332	351	366	383	399	413	434	451	469	497	512
3	27	Pleasure Truck 4,540 kg or less GVW	266	312	328	347	361	378	393	407	429	445	463	490	505
3	28	Pleasure Truck 4,540 kg or less GVW	263	308	323	342	356	373	388	402	423	439	456	483	498
3	29	Pleasure Truck 4,540 kg or less GVW	259	304	319	337	351	368	383	396	417	433	450	476	491
3	30	Pleasure Truck 4,540 kg or less GVW	255	300	314	332	346	363	377	391	411	427	444	470	484
3	0	Police/Emergency Passenger Vehicle	744	819	940	997	1058	1119	1173	1228	1287	1332	1351	1373	1402
3	0	Police/Emergency Truck 4,540 kg or less GVW	844	844	844	844	844	844	844	844	844	844	844	844	844
3	0	Police/Emergency Truck 4,541 to 16,330 kg GVW		779	779	779	779	779	779	779	779	779	779	779	779
3	0	Police/Emergency Truck 16,331 kg or more GVW		756	756	756	756	756	756	756	756	756	756	756	756
3	0	Repairer	288												
3	0	Sand/Gravel Truck 10,891 to 16,330 kg GVW		580	662	716	782	838	902	961	1020	1079	1139	1198	1258
3	0	Sand/Gravel Truck 16,331 kg or more GVW		865	865	865	865	865	865	865	865	865	865	865	865
3	0	School Bus 20 seats or less	199	225	236	253	269	282	282	313	347	363	376	392	408
3	0	School Bus 21 to 35 seats	225	253	269	278	282	313	331	347	394	409	424	443	459
3	0	School Bus 36 to 50 seats	253	282	282	313	331	347	368	394	400	415	432	449	467
3	0	School Bus 51 seats or more	282	313	331	347	368	394	397	404	408	424	442	458	478
3	0	Taxi/Livery Passenger Vehicle	4652												
3	0	Tow Truck 4,540 kg or less GVW	463	542	570	602	626	657	684	707	744	773	804	851	878
3	0	Tow Truck 4,541 to 16,330 kg GVW		603	688	745	813	871	938	999	1061	1123	1185	1246	1309
3	0	Tow Truck 16,331 kg or more GVW		579	579	579	579	579	579	579	579	579	579	579	579
3	0	Transit Bus 20 seats or less	556	599	644	771	906	1047	1096	1144	1193	1241	1290	1342	1395
3	0	Transit Bus 21 to 35 seats	599	644	771	906	1047	1127	1174	1223	1272	1320	1376	1430	1487

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1085	1107	1130	1151	1173	1193	1215	1238	1261	1284	1306	1333	1359	1386	1403	1437	1468	1505	1546	1552	1557	1563	1569
1031	1052	1073	1093	1114	1133	1154	1176	1198	1220	1241	1266	1291	1317	1333	1365	1395	1430	1469	1474	1479	1485	1491
976	996	1017	1036	1056	1074	1093	1114	1135	1156	1175	1200	1223	1247	1263	1293	1321	1354	1391	1397	1401	1407	1412
922	941	960	978	997	1014	1033	1052	1072	1091	1110	1133	1155	1178	1193	1221	1248	1279	1314	1319	1323	1329	1334
868	886	904	921	938	954	972	990	1009	1027	1045	1066	1087	1109	1122	1150	1174	1204	1237	1242	1246	1250	1255
814	830	847	863	880	895	911	928	946	963	979	1000	1019	1039	1052	1078	1101	1129	1159	1164	1168	1172	1177
803	819	836	852	868	883	899	916	933	950	966	986	1006	1026	1038	1063	1086	1114	1144	1148	1152	1157	1161
792	808	825	840	856	871	887	904	921	937	953	973	992	1012	1024	1049	1072	1099	1129	1133	1137	1141	1145
781	797	814	829	845	859	875	891	908	924	940	960	978	998	1010	1035	1057	1084	1113	1117	1121	1125	1130
770	786	802	817	833	847	863	879	895	912	927	946	965	984	996	1020	1042	1069	1098	1102	1105	1110	1114
759	775	791	806	821	835	850	867	883	899	914	933	951	970	982	1006	1028	1053	1082	1086	1090	1094	1098
702	731	784	793	825	853	890	900	914	945	987	1007	1038	1077	1087	1101	1126	1144	1182	1187	1193	1198	1203
667	694	745	753	784	810	845	855	868	898	938	957	986	1023	1033	1046	1070	1087	1123	1128	1133	1138	1143
632	658	706	714	742	768	801	810	823	850	888	906	934	969	978	991	1013	1030	1064	1068	1074	1078	1083
597	621	666	674	701	725	756	765	777	803	839	856	882	915	924	936	957	972	1005	1009	1014	1018	1023
562	585	627	634	660	682	712	720	731	756	790	806	830	862	870	881	901	915	946	950	954	958	962
526	548	588	595	619	640	667	675	685	709	740	755	778	808	815	826	844	858	886	890	895	898	902
519	541	580	587	610	631	659	666	676	699	730	745	768	797	804	815	833	847	875	878	883	887	890
512	534	572	579	602	623	650	657	667	690	721	735	758	786	794	804	822	835	863	867	871	875	878
505	526	564	571	594	614	641	648	658	680	711	725	747	775	783	793	811	824	851	855	859	863	866
498	519	557	563	586	606	632	639	649	671	701	715	737	765	772	782	799	812	839	843	847	851	854
491	512	549	555	577	597	623	630	640	661	691	705	727	754	761	771	788	801	827	831	835	839	842
1429	1458	1489	1516	1545	1571	1600	1631	1661	1691	1720	1756	1790	1826	1847	1893	1934	1982	2037	2044	2051	2059	2066
844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844
779	779	779	779	779																		
756	756	756	756	756																		
1319	1402	1486	1531	1554																		
865	865	865	865	865																		
424																						
478																						
487																						
496																						
890	927	993	1005	1046	1081	1128	1141	1159	1198	1251	1277	1316	1365	1378	1396	1428	1451	1499	1505	1512	1519	1525
1372	1458	1546	1593	1617																		
579	579	579	579	579																		
1451																						
1548																						

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
4	26	All Purpose Motorcycle-Touring 501 to 1000 cc	1063	1163	1190	1265	1300	1367	1430	1507	1595	1617			
4	27	All Purpose Motorcycle-Touring 501 to 1000 cc	1048	1148	1174	1248	1283	1348	1411	1486	1573	1595			
4	28	All Purpose Motorcycle-Touring 501 to 1000 cc	1034	1132	1158	1230	1265	1330	1392	1466	1552	1573			
4	29	All Purpose Motorcycle-Touring 501 to 1000 cc	1020	1116	1142	1213	1247	1311	1372	1446	1530	1551			
4	30	All Purpose Motorcycle-Touring 501 to 1000 cc	1005	1100	1126	1196	1230	1293	1353	1425	1508	1529			
4	0	All Purpose Motorcycle-Touring 1001 cc or more	1436	1572	1608	1709	1757	1847	1933	2036	2155	2185			
4	5	All Purpose Motorcycle-Touring 1001 cc or more	1364	1493	1528	1624	1669	1755	1836	1934	2047	2076			
4	10	All Purpose Motorcycle-Touring 1001 cc or more	1292	1415	1447	1538	1581	1662	1740	1832	1939	1966			
4	15	All Purpose Motorcycle-Touring 1001 cc or more	1221	1336	1367	1453	1493	1570	1643	1731	1832	1857			
4	20	All Purpose Motorcycle-Touring 1001 cc or more	1149	1258	1286	1367	1406	1478	1546	1629	1724	1748			
4	25	All Purpose Motorcycle-Touring 1001 cc or more	1077	1179	1206	1282	1318	1385	1450	1527	1616	1639			
4	26	All Purpose Motorcycle-Touring 1001 cc or more	1063	1163	1190	1265	1300	1367	1430	1507	1595	1617			
4	27	All Purpose Motorcycle-Touring 1001 cc or more	1048	1148	1174	1248	1283	1348	1411	1486	1573	1595			
4	28	All Purpose Motorcycle-Touring 1001 cc or more	1034	1132	1158	1230	1265	1330	1392	1466	1552	1573			
4	29	All Purpose Motorcycle-Touring 1001 cc or more	1020	1116	1142	1213	1247	1311	1372	1446	1530	1551			
4	30	All Purpose Motorcycle-Touring 1001 cc or more	1005	1100	1126	1196	1230	1293	1353	1425	1508	1529			
4	0	All Purpose Motorhome	810	926	1037	1159	1283	1386	1520	1661	1777	1856	2011		
4	5	All Purpose Motorhome	769	880	985	1101	1219	1317	1444	1578	1688	1763	1910		
4	10	All Purpose Motorhome	729	833	933	1043	1155	1247	1368	1495	1599	1670	1810		
4	15	All Purpose Motorhome	688	787	881	985	1091	1178	1292	1412	1510	1578	1709		
4	20	All Purpose Motorhome	648	741	830	927	1026	1109	1216	1329	1422	1485	1609		
4	25	All Purpose Motorhome	607	694	778	869	962	1039	1140	1246	1333	1392	1508		
4	26	All Purpose Motorhome	599	685	767	858	949	1026	1125	1229	1315	1373	1488		
4	27	All Purpose Motorhome	591	676	757	846	937	1012	1110	1213	1297	1355	1468		
4	28	All Purpose Motorhome	583	667	747	834	924	998	1094	1196	1279	1336	1448		
4	29	All Purpose Motorhome	575	657	736	823	911	984	1079	1179	1262	1318	1428		
4	30	All Purpose Motorhome	567	648	726	811	898	970	1064	1163	1244	1299	1408		
4	0	All Purpose Passenger Vehicle	726	800	918	974	1033	1093	1145	1199	1257	1301	1319	1341	1369
4	5	All Purpose Passenger Vehicle	690	760	872	925	981	1038	1088	1139	1194	1236	1253	1274	1301
4	10	All Purpose Passenger Vehicle	653	720	826	877	930	984	1030	1079	1131	1171	1187	1207	1232
4	15	All Purpose Passenger Vehicle	617	680	780	828	878	929	973	1019	1068	1106	1121	1140	1164
4	20	All Purpose Passenger Vehicle	581	640	734	779	826	874	916	959	1006	1041	1055	1073	1095
4	25	All Purpose Passenger Vehicle	544	600	688	730	775	820	859	899	943	976	989	1006	1027
4	26	All Purpose Passenger Vehicle	537	592	679	721	764	809	847	887	930	963	976	992	1013
4	27	All Purpose Passenger Vehicle	530	584	670	711	754	798	836	875	918	950	963	979	999
4	28	All Purpose Passenger Vehicle	523	576	661	701	744	787	824	863	905	937	950	966	986
4	29	All Purpose Passenger Vehicle	515	568	652	692	733	776	813	851	892	924	936	952	972
4	30	All Purpose Passenger Vehicle	508	560	643	682	723	765	801	839	880	911	923	939	958
4	0	All Purpose Snow Vehicle (HTA)	369												
4	0	All Purpose Trailer $2500 or less	5												
4	0	All Purpose Trailer $2501 or more		25	42	66	87	120	138	151	169	176	184	193	201
4	0	All Purpose Truck 4,540 kg or less GVW	540	632	664	702	730	766	797	825	867	902	938	992	1023
4	5	All Purpose Truck 4,540 kg or less GVW	513	600	631	667	693	728	757	784	824	857	891	942	972
4	10	All Purpose Truck 4,540 kg or less GVW	486	569	598	632	657	689	717	742	780	812	844	893	921
4	15	All Purpose Truck 4,540 kg or less GVW	459	537	564	597	620	651	677	701	737	767	797	843	870
4	20	All Purpose Truck 4,540 kg or less GVW	432	506	531	562	584	613	638	660	694	722	750	794	818
4	25	All Purpose Truck 4,540 kg or less GVW	405	474	498	526	547	574	598	619	650	676	703	744	767
4	26	All Purpose Truck 4,540 kg or less GVW	400	468	491	519	540	567	590	610	642	667	694	734	757
4	27	All Purpose Truck 4,540 kg or less GVW	394	461	485	512	533	559	582	602	633	658	685	724	747
4	28	All Purpose Truck 4,540 kg or less GVW	389	455	478	505	526	552	574	594	624	649	675	714	737
4	29	All Purpose Truck 4,540 kg or less GVW	383	449	471	498	518	544	566	586	616	640	666	704	726
4	30	All Purpose Truck 4,540 kg or less GVW	378	442	465	491	511	536	558	577	607	631	657	694	716
4	0	Antique Vehicle - Bus	106												
4	0	Antique Vehicle - Motorcycle	106												
4	0	Antique Vehicle - Passenger Vehicle	106												
4	0	Antique Vehicle - Truck	106												
4	0	Artisan Truck 4,540 kg or less GVW	409	479	503	532	553	580	603	624	657	683	710	751	775
4	5	Artisan Truck 4,540 kg or less GVW	389	455	478	505	525	551	573	593	624	649	674	713	736
4	10	Artisan Truck 4,540 kg or less GVW	368	431	453	479	498	522	543	562	591	615	639	676	697
4	15	Artisan Truck 4,540 kg or less GVW	348	407	428	452	470	493	513	530	558	581	603	638	659

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1395	1424	1453	1480	1508	1534	1562	1592	1622	1650	1679	1714	1748	1782	1804	1848	1888	1935	1988	1996	2003	2010	2017
1325	1353	1380	1406	1433	1457	1484	1512	1541	1567	1595	1628	1661	1693	1714	1756	1794	1838	1889	1896	1903	1909	1916
1255	1282	1308	1332	1357	1381	1406	1433	1460	1485	1511	1543	1573	1604	1624	1663	1699	1741	1789	1796	1803	1809	1815
1186	1210	1235	1258	1282	1304	1328	1353	1379	1402	1427	1457	1486	1515	1533	1571	1605	1645	1690	1697	1703	1708	1714
1116	1139	1162	1184	1206	1227	1250	1274	1298	1320	1343	1371	1398	1426	1443	1478	1510	1548	1590	1597	1602	1608	1614
1046	1068	1090	1110	1131	1150	1171	1194	1216	1237	1259	1285	1311	1336	1353	1386	1416	1451	1491	1497	1502	1507	1513
1032	1054	1075	1095	1116	1135	1156	1178	1200	1221	1242	1268	1294	1319	1335	1368	1397	1432	1471	1477	1482	1487	1493
1018	1040	1061	1080	1101	1120	1140	1162	1184	1204	1226	1251	1276	1301	1317	1349	1378	1413	1451	1457	1462	1467	1472
1004	1025	1046	1066	1086	1104	1125	1146	1168	1188	1209	1234	1259	1283	1299	1331	1359	1393	1431	1437	1442	1447	1452
990	1011	1032	1051	1071	1089	1109	1130	1152	1171	1192	1217	1241	1265	1281	1312	1340	1374	1411	1417	1422	1427	1432
976	997	1017	1036	1056	1074	1093	1114	1135	1155	1175	1200	1224	1247	1263	1294	1322	1354	1392	1397	1402	1407	1412
209																						
1037	1081	1158	1172	1220	1260	1316	1330	1351	1397	1458	1489	1534	1592	1607	1628	1664	1692	1748	1755	1763	1771	1779
985	1027	1100	1113	1159	1197	1250	1263	1283	1327	1385	1415	1457	1512	1527	1547	1581	1607	1661	1667	1675	1682	1690
933	973	1042	1055	1098	1134	1184	1197	1216	1257	1312	1340	1381	1433	1446	1465	1498	1523	1573	1579	1587	1594	1601
881	919	984	996	1037	1071	1119	1130	1148	1187	1239	1266	1304	1353	1366	1384	1414	1438	1486	1492	1499	1505	1512
830	865	926	938	976	1008	1053	1064	1081	1118	1166	1191	1227	1274	1286	1302	1331	1354	1398	1404	1410	1417	1423
778	811	868	879	915	945	987	997	1013	1048	1093	1117	1150	1194	1205	1221	1248	1269	1311	1316	1322	1328	1334
767	800	857	867	903	932	974	984	1000	1034	1079	1102	1135	1178	1189	1205	1231	1252	1294	1299	1305	1311	1316
757	789	845	856	891	920	961	971	986	1020	1064	1087	1120	1162	1173	1188	1215	1235	1276	1281	1287	1293	1299
747	778	834	844	878	907	948	958	973	1006	1050	1072	1104	1146	1157	1172	1198	1218	1259	1264	1269	1275	1281
736	768	822	832	866	895	934	944	959	992	1035	1057	1089	1130	1141	1156	1181	1201	1241	1246	1252	1257	1263
726	757	811	820	854	882	921	931	946	978	1021	1042	1074	1114	1125	1140	1165	1184	1224	1228	1234	1240	1245
785	818	877	887	923	954	996	1007	1023	1057	1104	1127	1161	1205	1216	1232	1260	1281	1323	1329	1334	1340	1346
746	777	833	843	877	906	946	957	972	1004	1049	1071	1103	1145	1155	1170	1197	1217	1257	1263	1267	1273	1279
706	736	789	798	831	859	896	906	921	951	994	1014	1045	1084	1094	1109	1134	1153	1191	1196	1201	1206	1211
667	695	745	754	785	811	847	856	870	898	938	958	987	1024	1034	1047	1071	1089	1125	1130	1134	1139	1144

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
4	10	Pleasure Motorcycle-Touring 1001 cc or more	994	1089	1114	1184	1218	1280	1339	1411	1493	1514			
4	15	Pleasure Motorcycle-Touring 1001 cc or more	939	1028	1052	1119	1150	1209	1265	1333	1410	1430			
4	20	Pleasure Motorcycle-Touring 1001 cc or more	884	968	990	1053	1082	1138	1190	1254	1327	1346			
4	25	Pleasure Motorcycle-Touring 1001 cc or more	829	907	928	987	1015	1066	1116	1176	1244	1261			
4	26	Pleasure Motorcycle-Touring 1001 cc or more	818	895	916	974	1001	1052	1101	1160	1228	1245			
4	27	Pleasure Motorcycle-Touring 1001 cc or more	807	883	904	961	988	1038	1086	1145	1211	1228			
4	28	Pleasure Motorcycle-Touring 1001 cc or more	796	871	891	948	974	1024	1071	1129	1194	1211			
4	29	Pleasure Motorcycle-Touring 1001 cc or more	785	859	879	934	961	1010	1056	1113	1178	1194			
4	30	Pleasure Motorcycle-Touring 1001 cc or more	773	847	867	921	947	995	1042	1098	1161	1177			
4	0	Pleasure Motorhome	489	558	625	699	774	836	917	1002	1072	1119	1213		
4	5	Pleasure Motorhome	465	530	594	664	735	794	871	952	1018	1063	1152		
4	10	Pleasure Motorhome	440	502	562	629	697	752	825	902	965	1007	1092		
4	15	Pleasure Motorhome	416	474	531	594	658	711	779	852	911	951	1031		
4	20	Pleasure Motorhome	391	446	500	559	619	669	734	802	858	895	970		
4	25	Pleasure Motorhome	367	418	469	524	580	627	688	751	804	839	910		
4	26	Pleasure Motorhome	362	413	462	517	573	619	679	741	793	828	898		
4	27	Pleasure Motorhome	357	407	456	510	565	610	669	731	783	817	885		
4	28	Pleasure Motorhome	352	402	450	503	557	602	660	721	772	806	873		
4	29	Pleasure Motorhome	347	396	444	496	550	594	651	711	761	794	861		
4	30	Pleasure Motorhome	342	391	437	489	542	585	642	701	750	783	849		
4	0	Pleasure Passenger Vehicle	576	635	729	773	820	867	909	952	998	1033	1048	1064	1087
4	5	Pleasure Passenger Vehicle	547	603	693	734	779	824	864	904	948	981	996	1011	1033
4	10	Pleasure Passenger Vehicle	518	571	656	696	738	780	818	857	898	930	943	958	978
4	15	Pleasure Passenger Vehicle	490	540	620	657	697	737	773	809	848	878	891	904	924
4	20	Pleasure Passenger Vehicle	461	508	583	618	656	694	727	762	798	826	838	851	870
4	25	Pleasure Passenger Vehicle	432	476	547	580	615	650	682	714	748	775	786	798	815
4	26	Pleasure Passenger Vehicle	426	470	539	572	607	642	673	704	739	764	776	787	804
4	27	Pleasure Passenger Vehicle	420	464	532	564	599	633	664	695	729	754	765	777	794
4	28	Pleasure Passenger Vehicle	415	457	525	557	590	624	654	685	719	744	755	766	783
4	29	Pleasure Passenger Vehicle	409	451	518	549	582	616	645	676	709	733	744	755	772
4	30	Pleasure Passenger Vehicle	403	444	510	541	574	607	636	666	699	723	734	745	761
4	0	Pleasure Truck 4,540 kg or less GVW	396	464	487	515	535	562	584	604	636	661	688	728	750
4	5	Pleasure Truck 4,540 kg or less GVW	376	441	463	489	508	534	555	574	604	628	654	692	712
4	10	Pleasure Truck 4,540 kg or less GVW	356	418	438	463	481	506	526	544	572	595	619	655	675
4	15	Pleasure Truck 4,540 kg or less GVW	337	394	414	438	455	478	496	513	541	562	585	619	637
4	20	Pleasure Truck 4,540 kg or less GVW	317	371	390	412	428	450	467	483	509	529	550	582	600
4	25	Pleasure Truck 4,540 kg or less GVW	297	348	365	386	401	421	438	453	477	496	516	546	562
4	26	Pleasure Truck 4,540 kg or less GVW	293	343	360	381	396	416	432	447	471	489	509	539	555
4	27	Pleasure Truck 4,540 kg or less GVW	289	339	356	376	391	410	426	441	464	483	502	531	547
4	28	Pleasure Truck 4,540 kg or less GVW	285	334	351	371	385	405	420	435	458	476	495	524	540
4	29	Pleasure Truck 4,540 kg or less GVW	281	329	346	366	380	399	415	429	452	469	488	517	532
4	30	Pleasure Truck 4,540 kg or less GVW	277	325	341	360	374	393	409	423	445	463	482	510	525
4	0	Police/Emergency Passenger Vehicle	697	767	880	934	991	1048	1099	1150	1206	1248	1266	1286	1313
4	0	Police/Emergency Truck 4,540 kg or less GVW	747	747	747	747	747	747	747	747	747	747	747	747	747
4	0	Police/Emergency Truck 4,541 to 16,330 kg GVW		624	624	624	624	624	624	624	624	624	624	624	624
4	0	Police/Emergency Truck 16,331 kg or more GVW		478	478	478	478	478	478	478	478	478	478	478	478
4	0	Repairer	267												
4	0	Sand/Gravel Truck 10,891 to 16,330 kg GVW		509	581	629	687	736	792	844	896	948	1001	1052	1105
4	0	Sand/Gravel Truck 16,331 kg or more GVW		766	766	766	766	766	766	766	766	766	766	766	766
4	0	School Bus 20 seats or less	181	204	217	230	245	256	272	288	316	332	343	356	371
4	0	School Bus 21 to 35 seats	204	230	245	256	272	288	303	316	359	374	388	406	422
4	0	School Bus 36 to 50 seats	230	256	272	288	303	316	346	359	363	377	395	410	425
4	0	School Bus 51 seats or more	256	288	303	316	346	359	362	368	374	388	406	422	440
4	0	Taxi/Livery Passenger Vehicle	4133												
4	0	Tow Truck 4,540 kg or less GVW	352	412	433	457	476	499	519	537	565	587	611	646	667
4	0	Tow Truck 4,541 to 16,330 kg GVW		504	575	623	680	728	784	835	887	938	990	1041	1094
4	0	Tow Truck 16,331 kg or more GVW		452	452	452	452	452	452	452	452	452	452	452	452
4	0	Transit Bus 20 seats or less	440	472	505	606	713	823	862	900	939	975	1016	1058	1099
4	0	Transit Bus 21 to 35 seats	496	533	642	750	868	934	973	1016	1058	1100	1143	1189	1235
4	0	Transit Bus 36 to 50 seats	505	606	713	823	885	954	995	1031	1068	1112	1155	1201	1249

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1107	1130	1154	1175	1197	1218	1240	1264	1288	1310	1333	1361	1388	1415	1432	1467	1499	1536	1579	1584	1590	1596	1602
1052	1073	1096	1116	1137	1157	1178	1201	1224	1244	1266	1293	1319	1344	1360	1394	1424	1459	1500	1505	1510	1516	1522
996	1017	1039	1057	1077	1096	1116	1138	1159	1179	1200	1225	1249	1273	1289	1320	1349	1382	1421	1426	1431	1436	1442
941	960	981	999	1017	1035	1054	1074	1095	1113	1133	1157	1180	1203	1217	1247	1274	1306	1342	1346	1351	1357	1362
886	904	923	940	958	974	992	1011	1030	1048	1066	1089	1110	1132	1146	1174	1199	1229	1263	1267	1272	1277	1282
830	847	865	881	898	913	930	948	966	982	1000	1021	1041	1061	1074	1100	1124	1152	1184	1188	1192	1197	1201
819	836	854	869	886	901	918	935	953	969	986	1007	1027	1047	1060	1086	1109	1137	1168	1172	1177	1181	1185
808	825	842	858	874	889	905	923	940	956	973	994	1013	1033	1045	1071	1094	1121	1153	1156	1161	1165	1169
797	814	831	846	862	877	893	910	927	943	960	980	999	1019	1031	1056	1079	1106	1137	1140	1145	1149	1153
786	802	819	834	850	865	880	897	914	930	946	966	985	1005	1017	1042	1064	1091	1121	1125	1129	1133	1137
775	791	808	822	838	853	868	885	902	917	933	953	972	990	1002	1027	1049	1075	1105	1109	1113	1117	1121
760	792	849	859	894	924	964	975	991	1024	1069	1091	1124	1167	1178	1194	1220	1240	1281	1287	1292	1298	1304
722	752	807	816	849	878	916	926	941	973	1016	1036	1068	1109	1119	1134	1159	1178	1217	1223	1227	1233	1239
684	713	764	773	805	832	868	877	892	922	962	982	1012	1050	1060	1075	1098	1116	1153	1158	1163	1168	1174
646	673	722	730	760	785	819	829	842	870	909	927	955	992	1001	1015	1037	1054	1089	1094	1098	1103	1108
608	634	679	687	715	739	771	780	793	819	855	873	899	934	942	955	976	992	1025	1030	1034	1038	1043
570	594	637	644	670	693	723	731	743	768	802	818	843	875	883	895	915	930	961	965	969	973	978
562	586	628	636	662	684	713	721	733	758	791	807	832	864	872	884	903	918	948	952	956	961	965
555	578	620	627	653	675	704	712	723	748	780	796	821	852	860	872	891	905	935	940	943	948	952
547	570	611	618	644	665	694	702	714	737	770	786	809	840	848	860	878	893	922	927	930	935	939
540	562	603	610	635	656	684	692	704	727	759	775	798	829	836	848	866	880	910	914	917	922	926
532	554	594	601	626	647	675	682	694	717	748	764	787	817	825	836	854	868	897	901	904	909	913
1338	1366	1394	1420	1447	1472	1499	1527	1556	1583	1611	1644	1677	1710	1730	1773	1811	1856	1908	1914	1921	1928	1935
747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747
624	624	624	624	624																		
478	478	478	478	478																		
1158	1231	1305	1345	1365																		
766	766	766	766	766																		
387																						
440																						
443																						
457																						
676	704	755	763	795	821	857	866	880	910	950	970	999	1037	1047	1061	1084	1102	1138	1143	1148	1153	1159
1146	1219	1292	1331	1351																		
452	452	452	452	452																		
1142																						
1285																						
1298																						

GRADE 12 ESSENTIAL MATHEMATICS (40S)

Final Practice Exam
Answer Key

GRADE 12 ESSENTIAL MATHEMATICS

Final Practice Exam
Answer Key

Name: _____

Student Number: _____

Attending ❑ Non-Attending ❑

Phone Number: _____

Address: _____

_____

_____

For Marker's Use Only

Date: _____

Final Mark: _____ / 100 = _____ %

Comments:

Instructions

The final examination is based on Modules 5 to 8 of the Grade 12 Essential Mathematics course. It is worth 12.5% of your final mark in this course.

Time

You will have a maximum of **3.0 hours** to complete the final examination.

Format

The format of the examination will be as follows:

Module 5: Vehicle Finance	30 marks
Module 6: Career Life	9 marks
Module 7: Statistics	31 marks
Module 8: Precision Measurement	30 marks
Total	100 marks

(see over)

Instructions (continued)

Resources Provided

The following tables are provided at the end of this examination

- Driver Safety Rating Chart
- Amortization Table
- Manitoba Public Insurance Passenger Vehicles—2011 Rate Groups Table
- Manitoba Public Insurance 2011 Basic Rate Table

Resources Required (Not Provided)

To complete this examination, you will need:

- pens/pencils (2 or 3 or each)
- blank paper
- scientific or graphing calculator
- Final Exam Resource Sheet (The Final Exam Resource Sheet must be handed in with the exam.)

Notes

- show all calculations and formulas
- include units where appropriate
- use decimal places in your calculations and round the final answers to the correct number of decimal places
- clearly state your final answer
- diagrams may not be drawn to scale

Name: _____

Answer all questions to the best of your ability. Show all your work.

Module 5: Vehicle Finance *(30 marks)*

1. Earna Wheeler is able to make a down payment of $4000 on a two-door sedan she purchases for $23,457, including tax. In order to finance the remaining portion, she takes out a three-year car loan at a fixed interest rate of 8.5%. (Module 5, Lesson 1)

   a) Calculate her monthly payment for the two-door sedan. *(3 marks)*

   Answer:

   Amount of the loan = $23,457 – $4000 = $19,457.

   Monthly payment/$1000 loan at 8.5% amortized over three years is $31.57 (from Table 5.1).

   Monthly payment = $\frac{\$19,457}{1000} \times 31.57 = \$614.26$

   b) Calculate her deferred payment for the two-door sedan. *(2 marks)*

   Answer:

   The total of monthly payments = 36 × $614.26 = $22,113.36

   The deferred payment = (36 × $614.26) + $4000 = $26,113.36

   c) Calculate her finance charge for the automobile. *(1 mark)*

   Answer:

   The finance charge = $26,113.36 – $23,457 = $2656.36

2. A four-wheel-drive vehicle sells for $28,750, plus tax, and leases for $378 per month plus tax for a lease term of 24 months. A down payment of $5000 is required. The guaranteed residual value of the vehicle is 60% of the sales price.
(Module 5, Lesson 2 and Lesson 4)

   a) Calculate the total monthly leasing payment. *(1 mark)*

      Answer:

      Total monthly leasing payment = $378 × 1.12 = $423.36

   b) Calculate the total amount paid by the end of the lease. *(2 marks)*

      Answer:

      Total amount paid by the end of the lease = ($423.36 × 24) + $5000 = $15,160.64

   c) Calculate the total residual value of the four-wheel-drive vehicle, including taxes. *(2 marks)*

      Answer:

      Residual value = 60% × $28,750 = $17,250

      Total residual value = $17,250 × 1.12 = $19,320

   d) Calculate the total cost of the vehicle if it is purchased outright at the end of the lease. *(1 mark)*

      Answer:

      Total cost of the vehicle if it is purchased outright at the end of the lease
      = $15,160.64 + $19,320 = $34,480.64

   e) Calculate how much the vehicle depreciates in two years. *(2 marks)*

      Answer:

      Depreciation in the first year = 20% × $28,750 = $5750

      Value of the vehicle after the first year = $28,750 – $5750 = $23,000

      Depreciation in the second year = 20% × $23,000 = $4600

      Total depreciation after two years = $5750 + $4600 = $10,350

Name: _____

3. Rosa wants to purchase a used car sold privately. The price the vendor is asking is $5500. A lien search costs $4, and a diagnostic test costs $35. The technician reports that the car needs the following repairs: suspension, $350; and tires, $680. A safety check costs $45. (Module 5, Lesson 3)

   Calculate the total purchase price of this car if the book value is $5475. *(5 marks)*

   Answer:

Asking price of the car	$5500
PST on the book value of the car	7% × $5500 = $385.00
Lien search	$4
Safety inspection	1.05 × $45 = $47.25
Diagnostic test	1.12 × $35 = $39.20
Repairs	($350 + $680) × 1.12 = $1153.60
Total	$5500 + $385 + $39.20 + $4 + $47.25 + $1153.60 = $7129.05

4. Before purchasing a used vehicle privately, name two searches, tests, or checks that you should do. Explain why each should be done. *(2 marks)* (Module 5, Lesson 3)

   Answer:

   Students must include two of the following, as well as the corresponding description.

   - Lien search: to check whether the seller of a vehicle owns it outright and there is no money owing against it.
   - Diagnostic test: to determine whether there are any mechanical problems with the vehicle.
   - Check by qualified mechanic: to give you an opinion as to the vehicle's condition and value.
   - Safety check: Mandatory in Manitoba, this check is done to ensure the safety of the vehicle.
   - Personal check: Check general condition of car, condition of interior, variations in colour of exterior (indication of accident).

5. A pick-up truck travels 72 km on 10 L of gasoline when driven on a smooth, paved road. The truck is only able to travel 48 km on the same amount of gasoline when driven on a gravel road. (Module 5, Lesson 4)

   a) Determine the fuel consumption rate of the truck on the paved road. *(1 mark)*

   Answer:

   $$\text{Fuel consumption rate} = \left(\frac{10}{72}\right) \times 100 = 13.9 \text{ L/100 km}$$

   b) Determine the fuel consumption rate of the truck on the gravel road. *(1 mark)*

   Answer:

   $$\text{Fuel consumption rate} = \left(\frac{10}{48}\right) \times 100 = 20.8 \text{ L/100 km}$$

   c) What is the percent increase in fuel consumption rates when driving on paved roads instead of gravel roads? *(1 mark)*

   Answer:

   The increase in fuel consumption = 20.8 – 13.9 = 6.9 L/100 km

   $$\text{Rate of percent} = \left(\frac{6.9}{13.9}\right) \times 100 = 49.6\%$$

   d) Calculate the cost of 3500 km of highway (smooth, paved road) if the cost of gasoline is \$1.23/L. *(1 mark)*

   Answer:

   $$\text{Cost} = \left(\frac{13.9 \text{ L}}{100 \text{ km}}\right) \times (3500 \text{ km}) \times \$1.23/\text{km} = \$598.40$$

Name: _____

6. Brett is a motorist living in Territory 3. He owns a 2011 Toyota Camry Hybrid. He uses the vehicle for personal use only. He currently has 0 merit points (Module 5, Lesson 5)

   a) Calculate his 2011 Autopac rate. *(2 marks)*

      Answer:

      The rating for a 2011 Toyota Camry Hybrid is 24.

      The 2011 Autopac rate for a Pleasure Passenger Vehicle in Territory 3 with a merit discount of 0% and a basic rate of 24 is $1333.

   b) If he obtains one more merit from safe driving this year, what will be his Autopac rate next year? Assume the rates stay the same and still use the 2011 Basic Rate Table. *(1 mark)*

      Answer:

      If he obtains one more merit, he will have one merit. One merit will give Brett a discount of 5%. The 2011 Autopac rate for a Pleasure Passenger Vehicle in Territory 3 with a merit discount of 5% and a basic rate of 24 is $1266.

7. Mercedes is debating whether to buy a new or used vehicle. She has recently acquired a full time job as a receptionist. However, she lives in Steinbach and has to commute one hour to Winnipeg for her new job every day. Discuss at least two factors that might influence Mercedes' decision on whether to buy a new or used vehicle. *(2 marks)* (Module 5, Lessons 1–5)

   Answer:

   Answers may vary. Students get full marks for arguing their case using the pros and cons of purchasing a new or used vehicle.

   The following is a sample answer:

   Mercedes might buy a new vehicle because:

   - She needs a reliable vehicle that will get her to and from her job every day. As used vehicles are generally less reliable than new vehicles, Mercedes might consider purchasing a new vehicle.
   - She has a full time job. Therefore, she should have enough money to pay for a new vehicle.
   - Newer vehicles generally get better gas mileage. Therefore, Mercedes may save money on gasoline if she purchases a new vehicle instead of a used vehicle.
   - New vehicles have a warranty, and used vehicles usually do not. She would not need to worry about major repair bills.

Module 6: Career Life *(9 marks)*

1. State the two careers you chose to research in the Career Life module. Specify which career was your career choice and which career was your alternate career choice. Answer *all* of the following questions in paragraph form.

   For this question, you will be marked using a rubric. As you answer this question, refer to the rubric below to make sure you are answering this question correctly and completely.

	3 marks	2 marks	1 mark	0 mark
Information	All of the necessary information is included.	One or two pieces of information are not included.	Three or more pieces of information are not included.	Insufficient information included.
Explanation	All information is justified or explanations are included for each point.	One or two pieces of information are not justified or do not include explanations.	Three or more pieces of information are not justified or do not include explanations.	No explanation included.
Writing Conventions (spelling, capitalization, grammar) and Organization	The paragraphs are organized and free of errors.	The paragraphs have a few errors or are not organized very well.	The paragraphs have many errors and/or are not organized well.	Not written in paragraph form.
				Total _____ 9 marks

Career Choice: _____

Alternate Career Choice: _____

a) What aspect of your chosen career appeals to you the most? Explain.

_____

_____

_____

_____

_____

_____

Name: _____

b) What aspect of your chosen career appeals to you the least? Explain.

c) After completing the Career Life module, do you still plan to pursue your career choice as your career? Are you planning to choose a different career? Explain.

d) What do you believe are the most important things you learned from the Career Life module?

Module 7: Statistics *(31 marks)*

1. Haley scores 47% on her law exam. A total of 382 students, including Haley, wrote the same exam. There were 36 other students received the same score that she did, but 244 received a lower score. (Module 7, Lesson 5)

   a) Find Haley's percentile rank. *(4 marks)*

   Answer:

   $B = 244$

   $E = 36 + 1 = 37$ (the number of people scoring 47% on the Law Exam)

   $n = 382$

   $$\text{Haley's percentile rank} = \frac{244 + (0.5 \times 37)}{382} \times 100 = 68.7 = 69\text{th percentile}$$

   b) Explain the difference between Haley's percentile rank and the percent mark she receives on the exam. *(2 marks)*

   Answer:

   The percent mark is a comparison of the score a student receives to the total possible score, expressed in percent form.

   The percentile rank is a comparison of the score a student receives to the scores of all the other students who have written the test.

2. State one advantage and one disadvantage of using the trimmed mean as a measure of central tendency. *(2 marks)* (Module 7, Lesson 4)

   Answer:

   Answers may vary.

   Advantages of using the trimmed mean:

   - The trimmed mean is usually resistant to outliers
   - It is useful for data with extremely skewed values
   - The trimmed mean gives a reasonable estimate of the centre of the data

   Disadvantages of using the trimmed mean:

   - If there are a significant number of outliers, such as more than 5% in a given direction, the calculation of the trimmed mean may still include outliers

Name: _____

3. Valerie scores 58% on a recent test. However, her percentile rank on the test was 92. (Module 7, Lesson 5)

   a) What can you conclude about the success rate of most of the other students who have written the test? *(1 mark)*

   Answer:

   92% of the students who wrote the test scored the same as or lower than Valerie.

   b) Explain why the test results might be like this. *(1 mark)*

   Answer:

   One reason could be that the test was very difficult.

   A second reason could be that the students were not prepared for the test.

4. A stats person for a professional football team decides to track the number of touchdown passes thrown by the quarterback during a period of 20 games. She records the following numbers of touchdown passes during each game.

1	3	2	1	2	2	1	4	3	2
7	3	4	0	5	3	4	1	2	3

a) Calculate the mean of the number of touchdown passes per game. *(1 mark)* (Module 7, Lesson 1)

Answer:

$$\text{Mean} = \frac{1+3+2+1+2+2+1+4+3+2+7+3+4+0+5+3+4+1+2+3}{20}$$

$$= 2.65$$

b) Calculate the 10% trimmed mean of the number of touchdown passes per game. *(1 mark)* (Module 7, Lesson 2)

Answer:

There are 20 values in this data set. 10% of 20 is 2. Therefore, you need to remove the highest and lowest value to calculate the 10% trimmed mean.

$$\text{10\% Trimmed Mean} = \frac{1+3+2+1+2+2+1+4+3+2+3+4+5+3+4+1+2+3}{18}$$

$$= 2.56$$

c) Identify the outlier(s) in this set of data. *(1 mark)* (Module 7, Lesson 2)

Answer:

Outliers: 0 and 7

d) Does the 10% trimmed mean get rid of the influence of outliers from this set of data? Explain. *(2 marks)* (Module 7, Lesson 2)

Answer:

Yes, the outliers are 0 and 7. The trimmed mean removes the highest 5% of all data values and the lowest 5% of all data values. In this situation, the values of 0 and 7 are removed when calculating the 10% trimmed mean.

Name: _____

5. For the following set of numbers:

   124, 210, 318, 124, 198, 342, 180

   a) Find the mean, median, and mode. *(3 marks)* (Module 7, Lesson 1)

   Answer:

   $$\text{Mean} = \frac{124 + 210 + 318 + 124 + 198 + 342 + 180}{7} = 213.7$$

   Ordered values: 124, 124, 180, 198, 210, 318, 342

   Median: 198

   Mode: 124

   b) Add the number 10 to the set. Find the mean, median, and mode of this new set of numbers. *(3 marks)* (Module 7, Lesson 1)

   Answer:

   $$\text{Mean} = \frac{124 + 210 + 318 + 124 + 198 + 342 + 180 + 10}{8} = 188.25$$

   Ordered values: 10, 124, 124, 180, 198, 210, 318, 342

   Median: $\frac{(180 + 198)}{2} = 189$

   Mode: 124

   c) How does adding a low outlier affect the mean, median, and mode of this data? *(3 marks)* (Module 7, Lesson 2)

   Answer:

   The mean is lowered after adding a low outlier.

   The median is also lowered after adding a low outlier.

   The mode stays the same.

   d) Which of the three measures of central tendency is most influenced by an extreme score? *(1 mark)* (Module 7, Lesson 2)

   Answer:

   The mean.

6. Cassidy is trying to figure out what her mean monthly phone bill was for the previous year. For four months, her phone bill was $52 a month. For the other eight months in the year, her phone bill was $63 a month. Since the mean of $52 and $63 is $57.50, Cassidy states that her mean phone bill for the previous year was $57.50. Is her reasoning correct? Explain. *(3 marks)* (Module 7, Lesson 3)

   Answer:

   No, her reasoning is incorrect. Cassidy did not realize that the values on her phone bills have different weightings because she was not charged the same amount of money for equal amounts of time. The actual mean (weighted mean) value of her phone bill would be: $\frac{(52 \times 4) + (63 \times 8)}{8 + 4} = \$59.33.$

7. Keegan is taking an Independent Study Grade 12 Physics course. He has received a mean mark of 86% on his assignments, 77% on his midterm exam, and 65% on his final exam. Assignments are worth 50% of his final mark, while the midterm exam is worth 20% and the final exam is worth 30%. Determine Keegan's final mark in this course. *(3 marks)* (Module 7, Lesson 3)

   Answer:

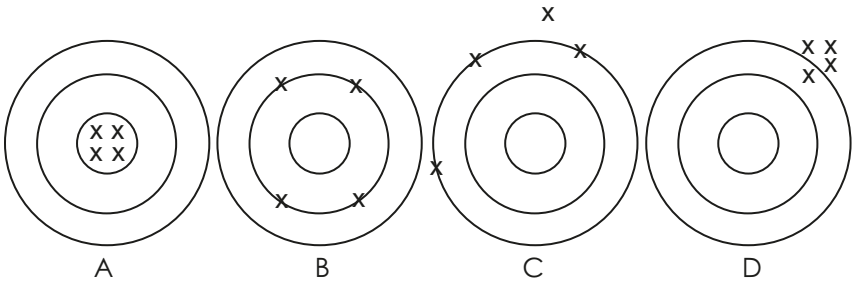
   Keegan's final mark = Weighted mean

   $$\text{Weighted Mean} = \frac{(86 \times 0.50) + (77 \times 0.20) + (65 \times 0.30)}{0.50 + 0.20 + 0.30} = \frac{77.9}{1} = 77.9\%$$

Name: _____

Module 8: Precision Measurement *(30 marks)*

1. State whether each of the following target patterns displays a high degree of accuracy, a high degree of precision, both precision and accuracy, or neither. *(4 marks)*
(Module 8, Lesson 1)



Answer:

A: Precision and Accuracy

B: Neither—cannot have accuracy without precision

C: Neither

D: Precision but not accuracy

2. State two examples from everyday life that demonstrate the importance of not only precision, but also the importance of accuracy in measurement. *(2 marks)*
(Module 8, Lesson 1)

Answer:

Sample answers:

- Medicine: Pills must not only be similar, but must have the correct amount of medication.
- Mechanics: Engine parts must not only be measured with very precise measuring devices, but must also have the correct measurements so that they fit together properly.
- Commerce: When buying gas, the pump indicates the amount to $\frac{1}{10}$ of a litre (precision), but it is important that you receive the amount indicated (accuracy).
- Sports: Timing devices must be precise to distinguish between very close finishes in races, and must be accurate so that record books represent the correct times.

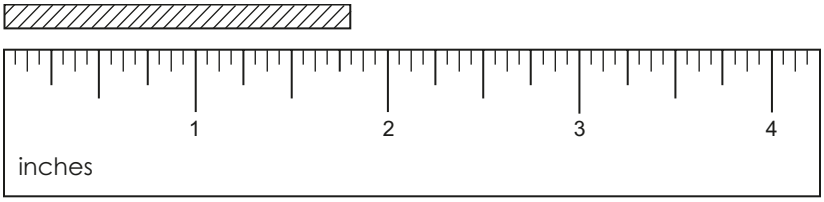
3. Measure the length of the following string, precise to the nearest indicated unit, using the given imperial ruler. *(4 marks)* (Module 8, Lesson 1)

a) $\frac{1}{8}''$ _____

b) one inch _____

c) $\frac{1}{2}''$ _____

d) $\frac{1}{4}''$ _____



Answer:

a) $1\frac{7}{8}$ inches or $1\frac{3}{4}$ inches

b) 2 inches

c) 2 inches

d) $1\frac{3}{4}$ inches

Name: _____

4. A farmer wants to build a fence around a rectangular field. He measures the field, and discovers that the dimensions are 200 m by 70 m. (Module 8, Lesson 1)

   a) How precise are each of the measurements? *(1 mark)*

   Answer:

   His measurements are precise to the nearest metre.

   b) What is the perimeter of the field? *(1 mark)*

   Answer:

   Perimeter = 200 + 200 + 70 + 70 = 540 m

   c) What is the area of the field? *(1 mark)*

   Answer:

   Area = $200 \times 70 = 14\,000$ m^2

5. Is it possible to have a measuring device that is precise but not accurate? Explain. Illustrate your explanation with an example. *(2 marks)* (Module 8, Lesson 2)

   Answer:

   Yes, it is possible.

   A bowed ruler would always provide the same reading when measuring objects that have the same length, but the measurements would all be wrong.

   An old bathroom scale may always show the same weight when you weigh yourself, but if it is not calibrated to start at zero, the weight shown may always be too high or too low.

6. Thomas measures the diameter of a toonie (a $2 coin). The diameter of the coin is 2.815 cm. *(3 marks)* (Module 8, Lesson 2)

   a) State the precision of the measuring device used.

      Answer:

      This device is precise to the nearest 0.001 cm.

   b) State the uncertainty of the measurement.

      Answer:

      The uncertainty of the measurement is ± 0.0005 cm.

   c) State the measurement Thomas should report (including the uncertainty).

      Answer:

      Thomas should report the diameter of the coin as: 2.815 cm ± 0.0005 cm.

7. The accepted weight of a small gold bar is 35.58 grams. Sam weighed the gold and his reading was 35.62±0.05 grams. Is Sam's reading accurate? Explain. *(2 marks)* (Module 8, Lesson 2)

   Answer:

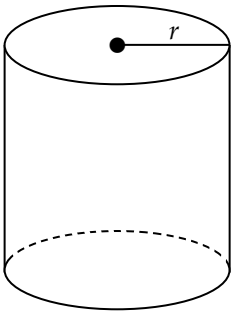
   Yes, his reading is accurate.

   The lower limit and upper limits for Sam's readings are:

   35.62 ± 0.05 = 35.57 – 35.67 grams, and the accepted weight of 35.58 grams is in this range.

Name: _____

8. A metal cylinder has a radius of 11.3 ± 0.2 cm and a height of 14.6 ± 0.3 cm. The volume formula for a cylinder is $V = \pi r^2 h$. (Module 8, Lesson 4)



$r = 11.3 \pm 0.2$ cm

$h = 14.6 \pm 0.3$ cm

Calculate the following: *(4 marks)*

a) nominal volume

b) maximum volume

c) minimum volume

d) tolerance in the volume measurement

Answers:

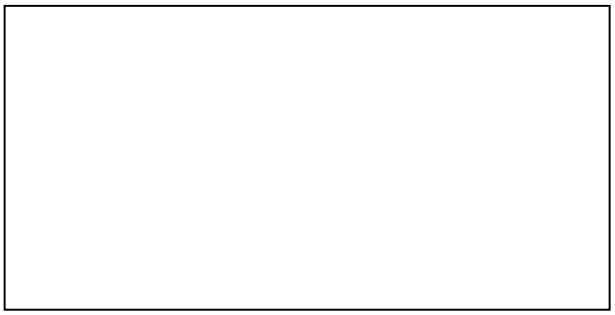
a) Nominal Volume = $\pi r^2 h = \pi(11.3^2)(14.6) = 5856.8$ cm^3

b) Maximum Volume = $\pi(11.5^2)(14.9) = 6190.6$ cm^3

c) Minimum Volume = $\pi(11.1^2)(14.3) = 5535.2$ cm^3

d) Volume Tolerance = 6190.6 – 5535.2 = 655.4 cm^3

9. A thin rectangular metal plate has dimensions as shown on the diagram. (Module 8, Lesson 4)



$w = 8.5^{\ 0}_{-0.3}$ cm

$l = 15.5 \pm 0.1$ cm

For the top surface of the metal plate, calculate *(2 marks)*

a) the maximum (upper limit) area

Answer:

A(max) = (15.6)(8.5) = 132.6 cm^2

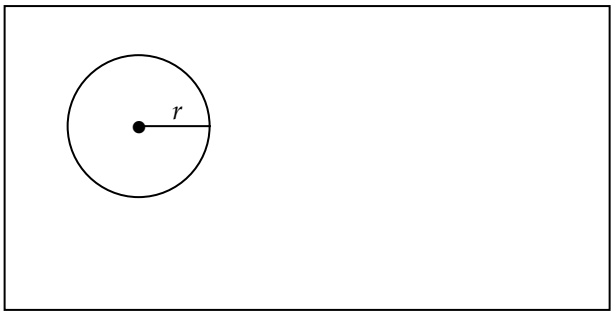
b) the minimum (lower limit) area

Answer:

A(min) = (15.4)(8.2) = 126.3 cm^2

Name: _____

A round hole is drilled through the plate. The radius of the hole is 2.2 ± 0.1 cm.



$r = 2.2 \pm 0.1$ cm

$w = 8.5^{\ 0}_{-0.3}$ cm

$l = 15.5 \pm 0.1$ cm

For the circle, calculate *(2 marks)*

c) the maximum (upper limit) area

Answer:

A(max) = $\pi r^2 = \pi(2.3^2) = 16.6$ cm^2

d) the minimum (lower limit) area

Answer:

A(min) = $\pi(2.1^2) = 13.9$ cm^2

Calculate the area of the top surface of the metal plate remaining after the hole is drilled: *(2 marks)*

e) the maximum (upper limit) area

Answer:

A(max) = (a) – (d) = 132.6 – 13.9 = 118.7 cm^2

f) the minimum (lower limit) area

Answer:

A(min) = (b) – (c)= 126.3 – 16.6 = 109.7 cm^2

Driver Safety Rating Chart	
Merits for Safe Driving	**Autopac Discount**
+15	33%
+14	30%
+13	29%
+12	28%
+11	27%
+10	26%
+9	25%
+8	25%
+7	25%
+6	20%
+5	15%
+4	15%
+3	10%
+2	10%
+1	5%
0 (base)	0%
–1	0%
–2	0%
–3	0%
–4	0%
–5	0%
–6	0%
–7	0%
–8	0%
–9	0%
–10	0%
–11	0%
–12	0%
–13	0%
–14	0%
–15	0%
–16	0%
–17	0%
–18	0%
–19	0%
–20	0%

Table 5.1 Amortization Table					
Amortization Period Monthly Payment Per $1000 Loan Proceeds					
Annual Rate	1 Year Monthly	2 Years Monthly	3 Years Monthly	4 Years Monthly	5 Years Monthly
6.00%	$86.07	$44.33	$30.43	$23.49	$19.34
6.25%	$86.18	$44.44	$30.54	$23.61	$19.46
6.50%	$86.30	$44.56	$30.66	$23.72	$19.57
6.75%	$86.41	$44.67	$30.77	$23.84	$19.69
7.00%	$86.53	$44.78	$30.88	$23.95	$19.81
7.25%	$86.64	$44.89	$31.00	$24.07	$19.93
7.50%	$86.76	$45.01	$31.11	$24.19	$20.05
7.75%	$86.87	$45.12	$31.23	$24.30	$20.16
8.00%	$86.99	$45.24	$31.34	$24.42	$20.28
8.25%	$87.10	$45.34	$31.45	$24.53	$20.40
8.50%	$87.22	$45.46	$31.57	$24.65	$20.52
8.75%	$87.34	$45.57	$31.68	$24.71	$20.64
9.00%	$87.45	$45.68	$31.80	$24.89	$20.76
9.25%	$87.57	$45.80	$31.92	$25.00	$20.88
9.50%	$87.68	$45.91	$32.03	$25.12	$21.00
9.75%	$87.80	$46.03	$32.15	$25.24	$21.12
10.00%	$87.92	$46.14	$32.27	$25.36	$21.25
10.25%	$88.03	$46.26	$32.38	$25.48	$21.37
10.50%	$88.15	$46.38	$32.50	$25.60	$21.49
10.75%	$88.27	$46.49	$32.62	$25.72	$21.62
11.00%	$88.38	$46.61	$32.74	$25.85	$21.74
11.25%	$88.50	$46.72	$32.86	$25.97	$21.87
11.50%	$88.62	$46.84	$32.98	$26.09	$21.99
11.75%	$88.73	$46.96	$33.10	$26.21	$22.12
12.00%	$88.85	$47.07	$33.21	$26.33	$22.24
12.25%	$88.97	$47.19	$33.33	$26.46	$22.37
12.50%	$89.08	$47.31	$33.45	$26.58	$22.50
12.75%	$89.20	$47.42	$33.57	$26.70	$22.63
13.00%	$89.32	$47.54	$33.69	$26.83	$22.75
13.25%	$89.43	$47.66	$33.81	$26.95	$22.88
13.50%	$89.55	$47.78	$33.94	$27.08	$23.01
13.75%	$89.67	$47.89	$34.06	$27.20	$23.14
14.00%	$89.79	$48.01	$34.18	$27.33	$23.27

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
CHRYSLER	PT CRUISER LX	4 Door Hatchback	4	Gas	2	2757	Regular	1730025374			29	28												
CHRYSLER	PT CRUISER TOURING	Convertible	4	Gas	2	2765	Regular	1730006011					22	21	19									
CHRYSLER	PT CRUISER TOURING EDITION	4 Door	4	Gas	2	2757	Regular	1730004108							25	23	21	19						
CHRYSLER	PT CRUISER TOURING EDITION	4 Door Hatchback	4	Gas	2	2757	Regular	1730009863			29	28	27	26	25	23	21	19						
CHRYSLER	PT CRUISER TURBO	4 Door	4	Gas	2	2767	Regular	1730006582							30									
CHRYSLER	PT CRUISER TURBO	4 Door Hatchback	4	Gas	2	2767	Regular	1730009864						31	30									
CHRYSLER	SEBRING	2 Door	4	Gas	2	1456	Regular	1730015185							31	30								
CHRYSLER	SEBRING	4 Door	4	Gas	2	1189	Regular	1730005334					26	25	25	23								
CHRYSLER	SEBRING	4 Door	6	Gas	2	1189	Regular	1730005335					26	25	25	23								
CHRYSLER	SEBRING	Convertible	4	Gas	2	1114	Regular	1730012862						31	30									
CHRYSLER	SEBRING	Convertible	6	Gas	2	1114	Regular	1730005750						31	30	28								
CHRYSLER	SEBRING GTC	Convertible	6	Gas	2	1171	Regular	1730004109				27		30	29	27	26	24						
CHRYSLER	SEBRING JX	Convertible	4	Gas	2	1171	Regular	1730000332													17	14	12	11
CHRYSLER	SEBRING JX	Convertible	6	Gas	2	1171	Regular	224982												20	17	14	12	11
CHRYSLER	SEBRING JXI	Convertible	6	Gas	2	1172	Regular	224995												19	19	16	14	10
CHRYSLER	SEBRING JXI LIMITED	Convertible	6	Gas	2	1172	Regular	1730022191												19				
CHRYSLER	SEBRING LIMITED	2 Door	6	Gas	2	1169	Regular	1730021930							31	31								
CHRYSLER	SEBRING LIMITED	4 Door	4	Gas	2	1190	Regular	1730022761				28												
CHRYSLER	SEBRING LIMITED	4 Door	6	Gas	2	1190	Regular	1730005336	28	28	28	27	27	26	24									
CHRYSLER	SEBRING LIMITED	4 Door	6	Gas	4	1471	Regular	1730022762				29												
CHRYSLER	SEBRING LIMITED	Convertible	6	Gas	2	1172	Regular	1730001543	30	30	30		27	27	26	25	22	21						
CHRYSLER	SEBRING LIMITED	Retractable Hard Top	6	Gas	2	1172	Regular	1730024813	30	30	30													
CHRYSLER	SEBRING LX	2 Door	4	Gas	2	1168	Regular	27051											29				15	13
CHRYSLER	SEBRING LX	2 Door	6	Gas	2	1168	Regular	27052									32	31	29	28	22	19	15	13
CHRYSLER	SEBRING LX	4 Door	4	Gas	2	1175	Regular	1730002102	28	28	27				23	22	20	21						
CHRYSLER	SEBRING LX	4 Door	6	Gas	2	1175	Regular	1730002103							23	22	20	21						
CHRYSLER	SEBRING LX	Convertible	4	Gas	2	1171	Regular	1730015186	27	28	27				27									
CHRYSLER	SEBRING LX	Convertible	6	Gas	2	1171	Regular	1730001541	27	28	27			29	27	26	24	22						
CHRYSLER	SEBRING LXI	2 Door	6	Gas	2	1169	Regular	27053								32	32	31	27	24	21	17	15	
CHRYSLER	SEBRING LXI	4 Door	6	Gas	2	1176	Regular	1730002104							24	23	22	23						
CHRYSLER	SEBRING LXI	Convertible	6	Gas	2	1172	Regular	1730001542						27	27	26	25	22	21					
CHRYSLER	SEBRING TOURING	4 Door	4	Gas	2	1190	Regular	1730022763				28												
CHRYSLER	SEBRING TOURING	4 Door	6	Gas	2	1190	Regular	1730005337	28	28	28	27	27	26	24									
CHRYSLER	SEBRING TOURING	Convertible	6	Gas	2	1172	Regular	1730006583	30	30	30		27	27	26									

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
DODGE	NEON EX	2 Door	4	Gas	2	2262	Regular	226736													18	16	14	10
DODGE	NEON EX	4 Door	4	Gas	2	2261	Regular	1730000404													18			
DODGE	NEON HIGHLINE	2 Door	4	Gas	2	2262	Regular	2210													18	16	14	10
DODGE	NEON HIGHLINE	4 Door	4	Gas	2	2261	Regular	2211													18	16	14	12
DODGE	NEON R/T	4 Door	4	Gas	2	2261	Regular	1730002671							30	29	28	25	24					
DODGE	NEON SE	4 Door	4	Gas	2	2261	Regular	1730004113							30	29	28							
DODGE	NEON SPORT	2 Door	4	Gas	2	2262	Regular	2215													18	16	14	10
DODGE	NEON SPORT	4 Door	4	Gas	2	2261	Regular	2216													18	16	14	12
DODGE	NEON SXT	4 Door	4	Gas	2	2261	Regular	1730004114							30	29	28							
DODGE	NITRO RT	Sport Utility 4 Door	6	Gas	4	2812	Regular	1730014870			30	29	27											
DODGE	NITRO SE	Sport Utility 4 Door	6	Gas	2	2810	Regular	1730014871			26	24	22											
DODGE	NITRO SE	Sport Utility 4 Door	6	Gas	4	2811	Regular	1730014872		30	29	29	28											
DODGE	NITRO SLT	Sport Utility 4 Door	6	Gas	2	2810	Regular	1730015191					22											
DODGE	NITRO SLT	Sport Utility 4 Door	6	Gas	4	2811	Regular	1730014873			29	29	28											
DODGE	NITRO SXT	Sport Utility 4 Door	6	Gas	2	2810	Regular	1730014874			26	24	22											
DODGE	NITRO SXT	Sport Utility 4 Door	6	Gas	4	2811	Regular	1730014875		30	29	29	28											
DODGE	OMNI	2 Door	4	Gas	2	2339	Regular	1341																
DODGE	OMNI	2 Door Hatchback	4	Gas	2	2339	Regular	1730005755																
DODGE	OMNI	4 Door	4	Gas	2	2341	Regular	1342																
DODGE	OMNI	4 Door Hatchback	4	Gas	2	2341	Regular	1730005431																
DODGE	OMNI 024	2 Door Hatchback	4	Gas	2	2328	Regular	1730005432																
DODGE	OMNI CUSTOM	4 Door	4	Gas	2	2341	Regular	1551																
DODGE	OMNI CUSTOM	4 Door Hatchback	4	Gas	2	2341	Regular	1730005433																
DODGE	OMNI GLH	4 Door	4	Gas	2	2341	Regular	2783																
DODGE	OMNI SE	4 Door	4	Gas	2	2341	Regular	1658																
DODGE	OMNI SE	4 Door Hatchback	4	Gas	2	2341	Regular	1730006773																
DODGE	POLARA	2 Door	6	Gas	2	2228	Regular	1730022192																
DODGE	POLARA	2 Door	8	Gas	2	2228	Regular	1730001345																
DODGE	POLARA	4 Door	8	Gas	2	2230	Regular	1730001346																
DODGE	POLARA	Convertible	8	Gas	2	2228	Regular	1730001347																
DODGE	POLARA	Station Wagon	8	Gas	2	2229	Regular	1730001348																
DODGE	RAIDER	Sport Utility 2 Door	4	Gas	4	2651	Regular	2921																
DODGE	RAIDER	Sport Utility 2 Door	6	Gas	4	2651	Regular	2922																
DODGE	RAM VAN 1500	Passenger Van	6	Gas	2	2746	Regular	224959											10	9	7	6	5	3

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
FORD	FIESTA	2 Door Hatchback	4	Gas	2	3709	Regular	1730006791																
FORD	FIESTA	4 Door	4	Gas	2	3709	Regular	723																
FORD	FIESTA S	4 Door	4	Gas	2	3792	Regular	1762106921	26															
FORD	FIESTA SE	4 Door	4	Gas	2	3793	Regular	1762106922	30															
FORD	FIESTA SE	4 Door Hatchback	4	Gas	2	3794	Regular	1762106923	31															
FORD	FIESTA SEL	4 Door	4	Gas	2	3793	Regular	1762106924	30															
FORD	FIESTA SES	4 Door Hatchback	4	Gas	2	3794	Regular	1762106925	31															
FORD	FIVE HUNDRED LIMITED	4 Door	6	Gas	2	9011	Regular	1730007192					24	23	22									
FORD	FIVE HUNDRED LIMITED	4 Door	6	Gas	4	9013	Regular	1730007193					27	27	26									
FORD	FIVE HUNDRED SE	4 Door	6	Gas	2	9010	Regular	1730007194					22	21	20									
FORD	FIVE HUNDRED SE	4 Door	6	Gas	4	9012	Regular	1730007195					27	26	24									
FORD	FIVE HUNDRED SEL	4 Door	6	Gas	2	9010	Regular	1730007196					22	21	20									
FORD	FIVE HUNDRED SEL	4 Door	6	Gas	4	9012	Regular	1730007197					27	26	24									
FORD	FLEX LIMITED	Sport Utility 4 Door	6	Gas	2	3583	Regular	1730025037		24	23													
FORD	FLEX LIMITED	Sport Utility 4 Door	6	Gas	4	3581	Regular	1730025038		27	27													
FORD	FLEX SE	Sport Utility 4 Door	6	Gas	2	3584	Regular	1730025039		24	23													
FORD	FLEX SEL	Sport Utility 4 Door	6	Gas	2	3584	Regular	1730025040		24	23													
FORD	FLEX SEL	Sport Utility 4 Door	6	Gas	4	3582	Regular	1730025041		27	27													
FORD	FOCUS LX	4 Door	4	Gas	2	9020	Regular	1730000960								24	22	20	19	15				
FORD	FOCUS S	4 Door	4	Gas	2	9020	Regular	1730025489		30	29	28												
FORD	FOCUS SE	2 Door	4	Gas	2	3448	Regular	1730022972		32	32	31												
FORD	FOCUS SE	2 Door Hatchback	4	Gas	2	9021	Regular	1730026561					31											
FORD	FOCUS SE	4 Door	4	Gas	2	9020	Regular	1730000961		30	29	28				24	22	20	19	15				
FORD	FOCUS SE	Station Wagon	4	Gas	2	9022	Regular	1730000962								20	19	17	14	13				
FORD	FOCUS SEL	4 Door	4	Gas	2	9020	Regular	1730025490		30	29													
FORD	FOCUS SES	2 Door	4	Gas	2	3448	Regular	1730022973		32	32	31												
FORD	FOCUS SES	4 Door	4	Gas	2	9020	Regular	1730022974		30	29	28												
FORD	FOCUS SVT	2 Door	4	Gas	2	9026	Regular	1730003890								31	29	28						
FORD	FOCUS SVT	2 Door Hatchback	4	Gas	2	9026	Regular	1730006792									29	28						
FORD	FOCUS SVT	4 Door	4	Gas	2	9027	Regular	1730004928								28	26							
FORD	FOCUS ZTS	4 Door	4	Gas	2	9023	Regular	1730000963								26	23	23	21	18				
FORD	FOCUS ZTW	Station Wagon	4	Gas	2	9024	Regular	1730002673								24	22	20						
FORD	FOCUS ZX3	2 Door	4	Gas	2	9021	Regular	1730000964							29	28	27	24	22	19				
FORD	FOCUS ZX3	2 Door Hatchback	4	Gas	2	9021	Regular	1730006793					31	30	29	28	27	24	22	19				

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
HONDA	CIVIC CX	2 Door	4	Gas	2	0245	Regular	3146												21	18	16	14	11
HONDA	CIVIC CX	2 Door Hatchback	4	Gas	2	0245	Regular	1730006823												21	18	16	14	11
HONDA	CIVIC CX-G	2 Door	4	Gas	2	0245	Regular	225492												21	18	16	14	
HONDA	CIVIC DEL SOL S	2 Door	4	Gas	2	0256	Regular	1659															18	16
HONDA	CIVIC DEL SOL SI	2 Door	4	Gas	2	0257	Regular	1674															21	19
HONDA	CIVIC DEL SOL SIR	2 Door	4	Gas	2	0250	Regular	1730026836																
HONDA	CIVIC DEL SOL VTEC	2 Door	4	Gas	2	0262	Regular	2325															24	21
HONDA	CIVIC DX	2 Door	4	Gas	2	0258	Regular	1999		32	32	31	32	32	29	27	25	24	22	23	20	17	14	13
HONDA	CIVIC DX	2 Door Hatchback	4	Gas	2	0246	Regular	1730006824												21	18	15	13	
HONDA	CIVIC DX	4 Door	4	Gas	2	0210	Regular	2000		31	32	31	31	29	23	23	22	21	19	19	17	14	13	11
HONDA	CIVIC DX-A	2 Door	4	Gas	2	0258	Regular	1730022975			32	31												
HONDA	CIVIC DX-A	4 Door	4	Gas	2	0210	Regular	1730022976		31	32	31												
HONDA	CIVIC DX-G	2 Door	4	Gas	2	0258	Regular	226821		32	32	31	32	32						23	20	17		
HONDA	CIVIC DX-G	4 Door	4	Gas	2	0210	Regular	1730002112		31	32	31	31	29	23	23	22	21	19					
HONDA	CIVIC DX-SE	2 Door	4	Gas	2	0258	Regular	224453							29									
HONDA	CIVIC EX	2 Door	4	Gas	2	0258	Regular	1730000160			32	31	32	32							20	17	14	13
HONDA	CIVIC EX	4 Door	4	Gas	2	0210	Regular	822		31	32	31	31	29	23	23	22	21	19	19	17	14	13	11
HONDA	CIVIC EX (US MDL)	2 Door	4	Gas	2	0259	Regular	1730007416		32					31			26		25	22	19	17	15
HONDA	CIVIC EX-G	4 Door	4	Gas	2	0210	Regular	226827												19	17	14		
HONDA	CIVIC EX-L	2 Door	4	Gas	2	0258	Regular	1730022977		32	32	31												
HONDA	CIVIC EX-L	4 Door	4	Gas	2	0210	Regular	1730022978		31	32	31												
HONDA	CIVIC EX-V	4 Door	4	Gas	2	0210	Regular	823																
HONDA	CIVIC GL	4 Door	4	Gas	2	0210	Regular	2002																
HONDA	CIVIC GX	4 Door	4	Gas	2	0210	Regular	1730022979			32	31												
HONDA	CIVIC HX	2 Door	4	Gas	2	0258	Regular	1730009617													20	17		
HONDA	CIVIC HYBRID	4 Door	4	Gas/Elec.	2	0221	Regular	1730004930		31	31	30	30	29	29	29	28							
HONDA	CIVIC LX	2 Door	4	Gas	2	0258	Regular	1730002261		32	32	31	32	32	29	27	25	24	22					
HONDA	CIVIC LX	4 Door	4	Gas	2	0251	Regular	2995		31	32	31	31	29	26	26	25	23	21	18	16	13	11	10
HONDA	CIVIC LX SPORT	4 Door	4	Gas	2	0251	Regular	1730004931									25							
HONDA	CIVIC LX-G	4 Door	4	Gas	2	0251	Regular	226887						29	26	26	25	23	21	18	16	13		
HONDA	CIVIC LX-SE	4 Door	4	Gas	2	0251	Regular	25331							26	26	25			18	16			
HONDA	CIVIC LX-SR	2 Door	4	Gas	2	0258	Regular	1730022980		32	32	31												
HONDA	CIVIC LX-SR	4 Door	4	Gas	2	0251	Regular	1730022981				31												
HONDA	CIVIC REVERB	2 Door	4	Gas	2	0258	Regular	1730007318							29									

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
JEEP	COMPASS LIMITED	Sport Utility 4 Door	4	Gas	2	7240	Regular	1730014891		24	24	24	23											
JEEP	COMPASS LIMITED	Sport Utility 4 Door	4	Gas	4	7238	Regular	1730013523		29	29	29	27											
JEEP	COMPASS NORTH	Sport Utility 4 Door	4	Gas	2	7239	Regular	1730022769		24	24	23	22											
JEEP	COMPASS NORTH	Sport Utility 4 Door	4	Gas	4	7237	Regular	1730022770		29	29	29	27											
JEEP	COMPASS SPORT	Sport Utility 4 Door	4	Gas	2	7239	Regular	1730014892		24	24	23	22											
JEEP	COMPASS SPORT	Sport Utility 4 Door	4	Gas	4	7237	Regular	1730013524		29	29	29	27											
JEEP	GRAND CHEROKEE	Sport Utility 4 Door	6	Gas	2	7183	Regular	1698																13
JEEP	GRAND CHEROKEE	Sport Utility 4 Door	6	Gas	4	7181	Regular	225109																13
JEEP	GRAND CHEROKEE	Sport Utility 4 Door	8	Gas	2	7183	Regular	1699																13
JEEP	GRAND CHEROKEE	Sport Utility 4 Door	8	Gas	4	7181	Regular	225110																13
JEEP	GRAND CHEROKEE 5.9 LIMITED	Sport Utility 4 Door	8	Gas	4	7182	Regular	1730013740														21		
JEEP	GRAND CHEROKEE FREEDOM	Sport Utility 4 Door	6	Gas	2	7183	Regular	1730013525							25									
JEEP	GRAND CHEROKEE FREEDOM	Sport Utility 4 Door	8	Gas	2	7183	Regular	1730013526							25									
JEEP	GRAND CHEROKEE LAREDO	Ambulance	6	Gas	4	7181	Regular	1730002392																
JEEP	GRAND CHEROKEE LAREDO	Sport Utility 4 Door	6	Diesel	4	7241	Regular	1730022201			30	29	29											
JEEP	GRAND CHEROKEE LAREDO	Sport Utility 4 Door	6	Gas	2	7183	Regular	225256		30	30	29	29	26	25	26	26	23		20	21	18	15	13
JEEP	GRAND CHEROKEE LAREDO	Sport Utility 4 Door	6	Gas	4	7181	Regular	225258		30	30	30	29	28	27	27	27	25	24	21	19	17	15	13
JEEP	GRAND CHEROKEE LAREDO	Sport Utility 4 Door	8	Gas	2	7183	Regular	225257			30	29	29	26	25	26	26	23		20	21	18	15	13
JEEP	GRAND CHEROKEE LAREDO	Sport Utility 4 Door	8	Gas	4	7181	Regular	225259		30	30	30	29	28	27	27	27	25	24	21	19	17	15	13
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	6	Diesel	2	7248	Regular	1730025308				31	31											
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	6	Diesel	4	7242	Regular	1730022287			31	29	29											
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	6	Gas	2	7184	Regular	225177		32	32						25		24	23	23	21	18	15
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	6	Gas	4	7182	Regular	225179							28	28	27	27	26	24	23	21	20	16
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	8	Diesel	4	7242	Regular	1730022202					29											
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	8	Gas	2	7184	Regular	225178			32	31	31	28	27	25	25	24	24	23	23	21	18	
JEEP	GRAND CHEROKEE LIMITED	Sport Utility 4 Door	8	Gas	4	7182	Regular	225180		32	32	30	29	29	28	28	27	27	26	24	23	21	20	16
JEEP	GRAND CHEROKEE ORVIS	Sport Utility 4 Door	6	Gas	2	7184	Regular	225181														21	18	
JEEP	GRAND CHEROKEE ORVIS	Sport Utility 4 Door	6	Gas	4	7182	Regular	225183														21	20	16
JEEP	GRAND CHEROKEE ORVIS	Sport Utility 4 Door	8	Gas	2	7184	Regular	225182														21	18	
JEEP	GRAND CHEROKEE ORVIS	Sport Utility 4 Door	8	Gas	4	7182	Regular	225184														21	20	
JEEP	GRAND CHEROKEE OVERLAND	Sport Utility 4 Door	6	Diesel	2	7248	Regular	1730025309				31	31											
JEEP	GRAND CHEROKEE OVERLAND	Sport Utility 4 Door	6	Diesel	4	7242	Regular	1730022632			31	29	29											
JEEP	GRAND CHEROKEE OVERLAND	Sport Utility 4 Door	8	Diesel	4	7242	Regular	1730022203					29											
JEEP	GRAND CHEROKEE OVERLAND	Sport Utility 4 Door	8	Gas	2	7184	Regular	1730014893			32	31	31											

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
MAZDA	CX-9 GS	Sport Utility 4 Door	6	Gas	4	7761	Regular	1730015233		28	28	27	27											
MAZDA	CX-9 GT	Sport Utility 4 Door	6	Gas	2	7760	Regular	1730015234				24	24											
MAZDA	CX-9 GT	Sport Utility 4 Door	6	Gas	4	7761	Regular	1730015235		28	28	27	27											
MAZDA	EUNOS	Roadster	4	Gas	2	0359	Regular	1730014114																
MAZDA	GLC	2 Door	4	Gas	2	0304	Regular	2408																
MAZDA	GLC	2 Door Hatchback	4	Gas	2	0304	Regular	1730006861																
MAZDA	GLC	4 Door	4	Gas	2	0337	Regular	2410																
MAZDA	GLC	Station Wagon	4	Gas	2	0316	Regular	2409																
MAZDA	GLC DECOR	4 Door Hatchback	4	Gas	2	0329	Regular	1730006862																
MAZDA	GLC LX	4 Door	4	Gas	2	0338	Regular	2486																
MAZDA	MAZDA3 GS	4 Door	4	Gas	2	7724	Regular	1730005662		31	29	29	28	25	23	21								
MAZDA	MAZDA3 GT	4 Door	4	Gas	2	7725	Regular	1730005663		32	31	31	31	30	29	27								
MAZDA	MAZDA3 GX	4 Door	4	Gas	2	7724	Regular	1730005664		31	29	29	28	25	23	21								
MAZDA	MAZDA3 I	4 Door	4	Gas	2	7724	Regular	1730009506					28	25	23	21								
MAZDA	MAZDA3 S	4 Door	4	Gas	2	7724	Regular	1730009507					28	25	23	21								
MAZDA	MAZDA3 S	4 Door Hatchback	4	Gas	2	7726	Regular	1730009508					29	28	26	24								
MAZDA	MAZDA3 SP23	4 Door	4	Gas	2	7725	Regular	1730009509							29									
MAZDA	MAZDA3 SP23	4 Door Hatchback	4	Gas	2	7726	Regular	1730009510							26									
MAZDA	MAZDA3 SPORT GS	4 Door Hatchback	4	Gas	2	7726	Regular	1730005665		31	30	30	29	28	26	24								
MAZDA	MAZDA3 SPORT GT	4 Door Hatchback	4	Gas	2	7726	Regular	1730005666		31	30	30	29	28	26	24								
MAZDA	MAZDA3 SPORT GX	4 Door Hatchback	4	Gas	2	7774	Regular	1730024897		29	27	27												
MAZDA	MAZDA3 TOURING EDITION	4 Door	4	Gas	2	7725	Regular	1730024738					31											
MAZDA	MAZDA5 GS	Station Wagon	4	Gas	2	7741	Regular	1730008814		28	28	28	28	25										
MAZDA	MAZDA5 GT	Station Wagon	4	Gas	2	7741	Regular	1730008815		28	28	28	28	25										
MAZDA	MAZDA6 GS-I4	4 Door	4	Gas	2	7719	Regular	1730004212		28	29	30	28	27	25	25	24							
MAZDA	MAZDA6 GS-V6	4 Door	6	Gas	2	7720	Regular	1730004213		29	30	30	30	28	27	25	24							
MAZDA	MAZDA6 GT-I4	4 Door	4	Gas	2	7719	Regular	1730004214		28	29	30	28	27	25	25	24							
MAZDA	MAZDA6 GT-V6	4 Door	6	Gas	2	7720	Regular	1730004215		29	30	30	30	28	27	25	24							
MAZDA	MAZDA6 I	4 Door	4	Gas	2	7719	Regular	1730009618				30	28	27		25								
MAZDA	MAZDA6 I SPORT	4 Door	4	Gas	2	7719	Regular	1730009619			29	30	28	27	25									
MAZDA	MAZDA6 I SPORT	4 Door Hatchback	4	Gas	2	7727	Regular	1730009620						27	25	24								
MAZDA	MAZDA6 S	4 Door	6	Gas	2	7720	Regular	1730009621					30	28	27									
MAZDA	MAZDA6 S GRAND TOURING	4 Door	6	Gas	2	7720	Regular	1730009622			30		30	28	27									
MAZDA	MAZDA6 S SPORT	4 Door	6	Gas	2	7720	Regular	1730009623			30		30	28	27									

Make	Model	Body Style	CYL	FUEL	WDR	VICC	SUBTYPE	VDESC	11	10	09	08	07	06	05	04	03	02	01	00	99	98	97	96
TOYOTA	CAMRY	4 Door	6	Gas	2	7615	Regular	1603														15	13	12
TOYOTA	CAMRY	Station Wagon	4	Gas	2	0560	Regular	1601																8
TOYOTA	CAMRY CE	4 Door	4	Gas	2	0450	Regular	225632			25	24	24	23	23	21		20	19	18	16	14	11	
TOYOTA	CAMRY CE V6	4 Door	6	Gas	2	7615	Regular	225633					27	25	24	22		19	19	19	17	15	13	
TOYOTA	CAMRY DLX	4 Door	4	Gas	2	0450	Regular	2732																
TOYOTA	CAMRY DLX	Station Wagon	4	Gas	2	0560	Regular	2731																
TOYOTA	CAMRY DX	4 Door	4	Gas	2	0450	Regular	1730008825																10
TOYOTA	CAMRY DX V6	4 Door	6	Gas	2	7615	Regular	1730012808																12
TOYOTA	CAMRY HYBRID	4 Door	4	Gas/Elec.	2	7747	Regular	1730013072	24	24	24	24	23											
TOYOTA	CAMRY LE	2 Door	4	Gas	2	7622	Regular	2733																10
TOYOTA	CAMRY LE	4 Door	4	Gas	2	0450	Regular	2735	25	25	25	24	24	23	23	21	20	20	19	18	16	14	11	10
TOYOTA	CAMRY LE	4 Door	4	Gas	4	0567	Regular	1730000108																
TOYOTA	CAMRY LE	4 Door Hatchback	4	Gas	2	0466	Regular	1730006979																
TOYOTA	CAMRY LE	Station Wagon	4	Gas	2	0560	Regular	2734																8
TOYOTA	CAMRY LE	Station Wagon	6	Gas	2	0560	Regular	2736																
TOYOTA	CAMRY LE V6	2 Door	6	Gas	2	7623	Regular	2076																12
TOYOTA	CAMRY LE V6	4 Door	6	Gas	2	7615	Regular	2078	27	27	27	26	27	25	24	22	20	19	19	19	17	15	13	12
TOYOTA	CAMRY LE V6	Station Wagon	6	Gas	2	7621	Regular	2077																9
TOYOTA	CAMRY SE	4 Door	4	Gas	2	0450	Regular	1730004161	25	25	25	24	24	23	23	21	20							
TOYOTA	CAMRY SE V6	4 Door	6	Gas	2	7615	Regular	2189	27	27	27	26	27	25	24	22	20	19						
TOYOTA	CAMRY SOLARA SE	2 Door	4	Gas	2	7644	Regular	1730000445				26	25	24	24	23	22	21	19	17	16			
TOYOTA	CAMRY SOLARA SE	Convertible	4	Gas	2	7674	Regular	1730004244									18	16	14	13				
TOYOTA	CAMRY SOLARA SE V6	2 Door	6	Gas	2	7645	Regular	1730000446					26	25	24	23	23	22	22	21	18			
TOYOTA	CAMRY SOLARA SE V6	Convertible	6	Gas	2	7653	Regular	1730006229					24	22	22	21	21							
TOYOTA	CAMRY SOLARA SLE	2 Door	4	Gas	2	7644	Regular	1730013545				26	25											
TOYOTA	CAMRY SOLARA SLE V6	2 Door	6	Gas	2	7645	Regular	1730000447				26	26	25	24	23	23	22	22	21	18			
TOYOTA	CAMRY SOLARA SLE V6	Convertible	6	Gas	2	7653	Regular	1730001369				23	24	22	22	21	21	18	17	17				
TOYOTA	CAMRY SOLARA SPORT V6	2 Door	6	Gas	2	7645	Regular	1730013546					26											
TOYOTA	CAMRY SOLARA SPORT V6	Convertible	6	Gas	2	7653	Regular	1730013547					24											
TOYOTA	CAMRY XLE	4 Door	4	Gas	2	0450	Regular	1730002702	25	25	25	24	24	23	23	21	20	20						
TOYOTA	CAMRY XLE V6	4 Door	6	Gas	2	7615	Regular	225634	27	27	27	26	27	25	24	22	20	19	19	19	17	15	13	
TOYOTA	CANADIAN	2 Door	4	Gas	2	0404	Regular	2203																
TOYOTA	CARINA	2 Door	4	Gas	2		Regular	2225																
TOYOTA	CARINA	4 Door	4	Gas	2		Regular	2226																

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
1	20	All Purpose Motorhome	481	549	615	687	761	822	902	985	1054	1101	1192		
1	25	All Purpose Motorhome	451	514	577	644	713	771	845	923	988	1032	1117		
1	26	All Purpose Motorhome	445	508	569	636	704	761	834	911	975	1018	1103		
1	27	All Purpose Motorhome	439	501	561	627	694	750	823	899	961	1004	1088		
1	28	All Purpose Motorhome	433	494	554	618	685	740	811	886	948	991	1073		
1	29	All Purpose Motorhome	427	487	546	610	675	730	800	874	935	977	1058		
1	30	All Purpose Motorhome	421	480	538	601	666	720	789	862	922	963	1043		
1	0	All Purpose Passenger Vehicle	601	662	760	807	855	905	949	993	1041	1078	1093	1111	1134
1	5	All Purpose Passenger Vehicle	571	629	722	767	812	860	902	943	989	1024	1038	1055	1077
1	10	All Purpose Passenger Vehicle	541	596	684	726	769	814	854	894	937	970	984	1000	1021
1	15	All Purpose Passenger Vehicle	511	563	646	686	727	769	807	844	885	916	929	944	964
1	20	All Purpose Passenger Vehicle	481	530	608	646	684	724	759	794	833	862	874	889	907
1	25	All Purpose Passenger Vehicle	451	496	570	605	641	679	712	745	781	808	820	833	850
1	26	All Purpose Passenger Vehicle	445	490	562	597	633	670	702	735	770	798	809	822	839
1	27	All Purpose Passenger Vehicle	439	483	555	589	624	661	693	725	760	787	798	811	828
1	28	All Purpose Passenger Vehicle	433	477	547	581	616	652	683	715	750	776	787	800	816
1	29	All Purpose Passenger Vehicle	427	470	540	573	607	643	674	705	739	765	776	789	805
1	30	All Purpose Passenger Vehicle	421	463	532	565	598	633	664	695	729	755	765	778	794
1	0	All Purpose Snow Vehicle (HTA)	439												
1	0	All Purpose Trailer $2500 or less	10												
1	0	All Purpose Trailer $2501 or more		48	82	128	169	233	268	294	328	343	358	374	391
1	0	All Purpose Truck 4,540 kg or less GVW	447	523	550	581	604	634	659	682	717	746	776	821	846
1	5	All Purpose Truck 4,540 kg or less GVW	425	497	522	552	574	602	626	648	681	709	737	780	804
1	10	All Purpose Truck 4,540 kg or less GVW	402	471	495	523	544	571	593	614	645	671	698	739	761
1	15	All Purpose Truck 4,540 kg or less GVW	380	445	467	494	513	539	560	580	609	634	660	698	719
1	20	All Purpose Truck 4,540 kg or less GVW	358	418	440	465	483	507	527	546	574	597	621	657	677
1	25	All Purpose Truck 4,540 kg or less GVW	335	392	412	436	453	475	494	511	538	559	582	616	634
1	26	All Purpose Truck 4,540 kg or less GVW	331	387	407	430	447	469	488	505	531	552	574	608	626
1	27	All Purpose Truck 4,540 kg or less GVW	326	382	401	424	441	463	481	498	523	545	566	599	618
1	28	All Purpose Truck 4,540 kg or less GVW	322	377	396	418	435	456	474	491	516	537	559	591	609
1	29	All Purpose Truck 4,540 kg or less GVW	317	371	390	413	429	450	468	484	509	530	551	583	601
1	30	All Purpose Truck 4,540 kg or less GVW	313	366	385	407	423	444	461	477	502	522	543	575	592
1	0	Antique Vehicle - Bus	106												
1	0	Antique Vehicle - Motorcycle	106												
1	0	Antique Vehicle - Passenger Vehicle	106												
1	0	Antique Vehicle - Truck	106												
1	0	Artisan Truck 4,540 kg or less GVW	592	693	728	770	800	840	873	903	950	988	1028	1087	1121
1	5	Artisan Truck 4,540 kg or less GVW	562	658	692	731	760	798	829	858	902	939	977	1033	1065
1	10	Artisan Truck 4,540 kg or less GVW	533	624	655	693	720	756	786	813	855	889	925	978	1009
1	15	Artisan Truck 4,540 kg or less GVW	503	589	619	654	680	714	742	768	807	840	874	924	953
1	20	Artisan Truck 4,540 kg or less GVW	474	554	582	616	640	672	698	722	760	790	822	870	897
1	25	Artisan Truck 4,540 kg or less GVW	444	520	546	577	600	630	655	677	712	741	771	815	841
1	26	Artisan Truck 4,540 kg or less GVW	438	513	539	570	592	622	646	668	703	731	761	804	830
1	27	Artisan Truck 4,540 kg or less GVW	432	506	531	562	584	613	637	659	693	721	750	794	818
1	28	Artisan Truck 4,540 kg or less GVW	426	499	524	554	576	605	629	650	684	711	740	783	807
1	29	Artisan Truck 4,540 kg or less GVW	420	492	517	547	568	596	620	641	674	701	730	772	796
1	30	Artisan Truck 4,540 kg or less GVW	414	485	510	539	560	588	611	632	665	692	720	761	785
1	0	Artisan Truck 4,541 to 16,330 kg GVW		664	758	820	895	959	1032	1100	1168	1236	1305	1372	1441
1	5	Artisan Truck 4,541 to 16,330 kg GVW		631	720	779	850	911	980	1045	1110	1174	1240	1303	1369

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1156	1179	1204	1226	1249	1271	1294	1319	1343	1367	1391	1420	1448	1476	1494	1531	1564	1603	1647	1653	1659	1665	1671
1098	1120	1144	1165	1187	1207	1229	1253	1276	1299	1321	1349	1376	1402	1419	1454	1486	1523	1565	1570	1576	1582	1587
1040	1061	1084	1103	1124	1144	1165	1187	1209	1230	1252	1278	1303	1328	1345	1378	1408	1443	1482	1488	1493	1498	1504
983	1002	1023	1042	1062	1080	1100	1121	1142	1162	1182	1207	1231	1255	1270	1301	1329	1363	1400	1405	1410	1415	1420
925	943	963	981	999	1017	1035	1055	1074	1094	1113	1136	1158	1181	1195	1225	1251	1282	1318	1322	1327	1332	1337
867	884	903	919	937	953	970	989	1007	1025	1043	1065	1086	1107	1120	1148	1173	1202	1235	1240	1244	1249	1253
855	872	891	907	924	941	958	976	994	1012	1029	1051	1072	1092	1106	1133	1157	1186	1219	1223	1228	1232	1237
844	861	879	895	912	928	945	963	980	998	1015	1037	1057	1077	1091	1118	1142	1170	1202	1207	1211	1215	1220
832	849	867	883	899	915	932	950	967	984	1002	1022	1043	1063	1076	1102	1126	1154	1186	1190	1194	1199	1203
821	837	855	870	887	902	919	936	954	971	988	1008	1028	1048	1061	1087	1110	1138	1169	1174	1178	1182	1186
809	825	843	858	874	890	906	923	940	957	974	994	1014	1033	1046	1072	1095	1122	1153	1157	1161	1165	1170
406																						
858	894	958	969	1009	1043	1088	1100	1118	1155	1206	1231	1269	1317	1329	1347	1377	1399	1445	1452	1458	1465	1471
815	849	910	921	959	991	1034	1045	1062	1097	1146	1169	1206	1251	1263	1280	1308	1329	1373	1379	1385	1392	1397
772	805	862	872	908	939	979	990	1006	1039	1085	1108	1142	1185	1196	1212	1239	1259	1300	1307	1312	1318	1324
729	760	814	824	858	887	925	935	950	982	1025	1046	1079	1119	1130	1145	1170	1189	1228	1234	1239	1245	1250
686	715	766	775	807	834	870	880	894	924	965	985	1015	1054	1063	1078	1102	1119	1156	1162	1166	1172	1177
643	670	718	727	757	782	816	825	838	866	904	923	952	988	997	1010	1033	1049	1084	1089	1093	1099	1103
635	662	709	717	747	772	805	814	827	855	892	911	939	975	983	997	1019	1035	1069	1074	1079	1084	1089
626	653	699	707	737	761	794	803	816	843	880	899	926	961	970	983	1005	1021	1055	1060	1064	1069	1074
618	644	690	698	726	751	783	792	805	832	868	886	914	948	957	970	991	1007	1040	1045	1050	1055	1059
609	635	680	688	716	741	772	781	794	820	856	874	901	935	944	956	978	993	1026	1031	1035	1040	1044
601	626	671	678	706	730	762	770	783	808	844	862	888	922	930	943	964	979	1011	1016	1021	1025	1030
1137	1184	1269	1284	1336	1381	1441	1457	1480	1530	1598	1631	1681	1744	1761	1784	1824	1854	1915	1923	1932	1940	1949
1080	1125	1206	1220	1269	1312	1369	1384	1406	1453	1518	1549	1597	1657	1673	1695	1733	1761	1819	1827	1835	1843	1852
1023	1066	1142	1156	1202	1243	1297	1311	1332	1377	1438	1468	1513	1570	1585	1606	1642	1669	1723	1731	1739	1746	1754
966	1006	1079	1091	1136	1174	1225	1238	1258	1300	1358	1386	1429	1482	1497	1516	1550	1576	1628	1635	1642	1649	1657
910	947	1015	1027	1069	1105	1153	1166	1184	1224	1278	1305	1345	1395	1409	1427	1459	1483	1532	1538	1546	1552	1559
853	888	952	963	1002	1036	1081	1093	1110	1147	1198	1223	1261	1308	1321	1338	1368	1390	1436	1442	1449	1455	1462
841	876	939	950	989	1022	1066	1078	1095	1132	1183	1207	1244	1291	1303	1320	1350	1372	1417	1423	1430	1436	1442
830	864	926	937	975	1008	1052	1064	1080	1117	1167	1191	1227	1273	1286	1302	1332	1353	1398	1404	1410	1416	1423
819	852	914	924	962	994	1038	1049	1066	1102	1151	1174	1210	1256	1268	1284	1313	1335	1379	1385	1391	1397	1403
807	841	901	912	949	981	1023	1034	1051	1086	1135	1158	1194	1238	1250	1267	1295	1316	1360	1365	1372	1377	1384
796	829	888	899	935	967	1009	1020	1036	1071	1119	1142	1177	1221	1233	1249	1277	1298	1340	1346	1352	1358	1364
1510	1605	1702	1754	1780																		
1434	1525	1617	1666	1691																		

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
1	25	Pleasure Motorcycle-Touring 501 to 1000 cc	994	1088	1114	1183	1217	1279	1339	1410	1492	1513			
1	26	Pleasure Motorcycle-Touring 501 to 1000 cc	981	1074	1099	1168	1201	1262	1321	1391	1473	1493			
1	27	Pleasure Motorcycle-Touring 501 to 1000 cc	968	1059	1084	1152	1185	1245	1303	1372	1453	1472			
1	28	Pleasure Motorcycle-Touring 501 to 1000 cc	955	1045	1069	1136	1169	1228	1285	1354	1433	1452			
1	29	Pleasure Motorcycle-Touring 501 to 1000 cc	941	1030	1054	1120	1152	1211	1267	1335	1413	1432			
1	30	Pleasure Motorcycle-Touring 501 to 1000 cc	928	1016	1039	1105	1136	1194	1249	1316	1393	1412			
1	0	Pleasure Motorcycle-Touring 1001 cc or more	1424	1559	1594	1695	1742	1832	1916	2019	2137	2166			
1	5	Pleasure Motorcycle-Touring 1001 cc or more	1353	1481	1514	1610	1655	1740	1820	1918	2030	2058			
1	10	Pleasure Motorcycle-Touring 1001 cc or more	1282	1403	1435	1525	1568	1649	1724	1817	1923	1949			
1	15	Pleasure Motorcycle-Touring 1001 cc or more	1210	1325	1355	1441	1481	1557	1629	1716	1816	1841			
1	20	Pleasure Motorcycle-Touring 1001 cc or more	1139	1247	1275	1356	1394	1466	1533	1615	1710	1733			
1	25	Pleasure Motorcycle-Touring 1001 cc or more	1068	1169	1195	1271	1306	1374	1437	1514	1603	1624			
1	26	Pleasure Motorcycle-Touring 1001 cc or more	1054	1154	1180	1254	1289	1356	1418	1494	1581	1603			
1	27	Pleasure Motorcycle-Touring 1001 cc or more	1040	1138	1164	1237	1272	1337	1399	1474	1560	1581			
1	28	Pleasure Motorcycle-Touring 1001 cc or more	1025	1122	1148	1220	1254	1319	1380	1454	1539	1560			
1	29	Pleasure Motorcycle-Touring 1001 cc or more	1011	1107	1132	1203	1237	1301	1360	1433	1517	1538			
1	30	Pleasure Motorcycle-Touring 1001 cc or more	997	1091	1116	1186	1219	1282	1341	1413	1496	1516			
1	0	Pleasure Motorhome	362	414	463	517	573	619	679	742	793	829	898		
1	5	Pleasure Motorhome	344	393	440	491	544	588	645	705	753	788	853		
1	10	Pleasure Motorhome	326	373	417	465	516	557	611	668	714	746	808		
1	15	Pleasure Motorhome	308	352	394	439	487	526	577	631	674	705	763		
1	20	Pleasure Motorhome	290	331	370	414	458	495	543	594	634	663	718		
1	25	Pleasure Motorhome	271	310	347	388	430	464	509	556	595	622	673		
1	26	Pleasure Motorhome	268	306	343	383	424	458	502	549	587	613	665		
1	27	Pleasure Motorhome	264	302	338	377	418	452	496	542	579	605	656		
1	28	Pleasure Motorhome	261	298	333	372	413	446	489	534	571	597	647		
1	29	Pleasure Motorhome	257	294	329	367	407	439	482	527	563	589	638		
1	30	Pleasure Motorhome	253	290	324	362	401	433	475	519	555	580	629		
1	0	Pleasure Passenger Vehicle	479	528	606	643	682	721	756	791	830	859	871	885	904
1	5	Pleasure Passenger Vehicle	455	502	576	611	648	685	718	751	788	816	827	841	859
1	10	Pleasure Passenger Vehicle	431	475	545	579	614	649	680	712	747	773	784	796	814
1	15	Pleasure Passenger Vehicle	407	449	515	547	580	613	643	672	705	730	740	752	768
1	20	Pleasure Passenger Vehicle	383	422	485	514	546	577	605	633	664	687	697	708	723
1	25	Pleasure Passenger Vehicle	359	396	454	482	511	541	567	593	622	644	653	664	678
1	26	Pleasure Passenger Vehicle	354	391	448	476	505	534	559	585	614	636	645	655	669
1	27	Pleasure Passenger Vehicle	350	385	442	469	498	526	552	577	606	627	636	646	660
1	28	Pleasure Passenger Vehicle	345	380	436	463	491	519	544	570	598	618	627	637	651
1	29	Pleasure Passenger Vehicle	340	375	430	457	484	512	537	562	589	610	618	628	642
1	30	Pleasure Passenger Vehicle	335	370	424	450	477	505	529	554	581	601	610	619	633
1	0	Pleasure Truck 4,540 kg or less GVW	352	412	433	457	476	499	519	537	565	587	611	646	666
1	5	Pleasure Truck 4,540 kg or less GVW	334	391	411	434	452	474	493	510	537	558	580	614	633
1	10	Pleasure Truck 4,540 kg or less GVW	317	371	390	411	428	449	467	483	508	528	550	581	599
1	15	Pleasure Truck 4,540 kg or less GVW	299	350	368	388	405	424	441	456	480	499	519	549	566
1	20	Pleasure Truck 4,540 kg or less GVW	282	330	346	366	381	399	415	430	452	470	489	517	533
1	25	Pleasure Truck 4,540 kg or less GVW	264	309	325	343	357	374	389	403	424	440	458	484	499
1	26	Pleasure Truck 4,540 kg or less GVW	260	305	320	338	352	369	384	397	418	434	452	478	493
1	27	Pleasure Truck 4,540 kg or less GVW	257	301	316	334	347	364	379	392	412	429	446	472	486
1	28	Pleasure Truck 4,540 kg or less GVW	253	297	312	329	343	359	374	387	407	423	440	465	480
1	29	Pleasure Truck 4,540 kg or less GVW	250	293	307	324	338	354	368	381	401	417	434	459	473

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
921	940	959	977	996	1013	1031	1051	1071	1090	1109	1132	1154	1177	1191	1220	1246	1277	1313	1317	1322	1327	1332
875	893	911	928	946	962	979	998	1017	1035	1054	1075	1096	1118	1131	1159	1184	1213	1247	1251	1256	1261	1265
829	846	863	879	896	912	928	946	964	981	998	1019	1039	1059	1072	1098	1121	1149	1182	1185	1190	1194	1199
783	799	815	830	847	861	876	893	910	926	943	962	981	1000	1012	1037	1059	1085	1116	1119	1124	1128	1132
737	752	767	782	797	810	825	841	857	872	887	906	923	942	953	976	997	1022	1050	1054	1058	1062	1066
691	705	719	733	747	760	773	788	803	817	832	849	865	883	893	915	934	958	985	988	991	995	999
682	696	710	723	737	750	763	778	793	807	821	838	854	871	881	903	922	945	972	975	978	982	986
672	686	700	713	727	739	753	767	782	796	810	826	842	859	869	891	910	932	958	961	965	969	972
663	677	690	703	717	729	742	757	771	785	798	815	831	847	858	878	897	919	945	948	952	955	959
654	667	681	694	707	719	732	746	760	774	787	804	819	836	846	866	885	907	932	935	939	942	946
645	658	671	684	697	709	722	736	750	763	776	792	808	824	834	854	872	894	919	922	925	929	932
675	704	754	763	794	821	857	866	880	910	950	969	999	1036	1046	1060	1084	1102	1138	1143	1148	1153	1158
641	669	716	725	754	780	814	823	836	864	902	921	949	984	994	1007	1030	1047	1081	1086	1091	1095	1100
607	634	679	687	715	739	771	779	792	819	855	872	899	932	941	954	976	992	1024	1029	1033	1038	1042
574	598	641	649	675	698	728	736	748	773	807	824	849	881	889	901	921	937	967	972	976	980	984
540	563	603	610	635	657	686	693	704	728	760	775	799	829	837	848	867	882	910	914	918	922	926
506	528	565	572	595	616	643	649	660	682	712	727	749	777	784	795	813	826	853	857	861	865	868
499	521	558	565	588	608	634	641	651	673	703	717	739	767	774	784	802	815	842	846	850	853	857
493	514	550	557	580	599	626	632	642	664	693	707	729	756	764	774	791	804	831	834	838	842	845
486	507	543	549	572	591	617	624	634	655	684	698	719	746	753	763	780	793	819	823	827	830	834
479	500	535	542	564	583	608	615	625	646	674	688	709	736	743	753	770	782	808	812	815	819	822

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
2	15	All Purpose Motorcycle-Touring 501 to 1000 cc	1176	1288	1317	1400	1440	1514	1584	1669	1765	1790			
2	20	All Purpose Motorcycle-Touring 501 to 1000 cc	1107	1212	1240	1318	1355	1425	1490	1570	1662	1685			
2	25	All Purpose Motorcycle-Touring 501 to 1000 cc	1038	1136	1162	1235	1270	1336	1397	1472	1558	1579			
2	26	All Purpose Motorcycle-Touring 501 to 1000 cc	1024	1121	1147	1219	1254	1318	1379	1453	1537	1558			
2	27	All Purpose Motorcycle-Touring 501 to 1000 cc	1010	1106	1131	1202	1237	1300	1360	1433	1516	1537			
2	28	All Purpose Motorcycle-Touring 501 to 1000 cc	996	1091	1116	1186	1220	1282	1341	1413	1495	1516			
2	29	All Purpose Motorcycle-Touring 501 to 1000 cc	983	1076	1100	1169	1203	1265	1323	1394	1475	1495			
2	30	All Purpose Motorcycle-Touring 501 to 1000 cc	969	1060	1085	1153	1186	1247	1304	1374	1454	1474			
2	0	All Purpose Motorcycle-Touring 1001 cc or more	1529	1674	1712	1820	1871	1967	2058	2168	2295	2327			
2	5	All Purpose Motorcycle-Touring 1001 cc or more	1453	1590	1626	1729	1777	1869	1955	2060	2180	2211			
2	10	All Purpose Motorcycle-Touring 1001 cc or more	1376	1507	1541	1638	1684	1770	1852	1951	2065	2094			
2	15	All Purpose Motorcycle-Touring 1001 cc or more	1300	1423	1455	1547	1590	1672	1749	1843	1951	1978			
2	20	All Purpose Motorcycle-Touring 1001 cc or more	1223	1339	1370	1456	1497	1574	1646	1734	1836	1862			
2	25	All Purpose Motorcycle-Touring 1001 cc or more	1147	1255	1284	1365	1403	1475	1543	1626	1721	1745			
2	26	All Purpose Motorcycle-Touring 1001 cc or more	1131	1239	1267	1347	1385	1456	1523	1604	1698	1722			
2	27	All Purpose Motorcycle-Touring 1001 cc or more	1116	1222	1250	1329	1366	1436	1502	1583	1675	1699			
2	28	All Purpose Motorcycle-Touring 1001 cc or more	1101	1205	1233	1310	1347	1416	1482	1561	1652	1675			
2	29	All Purpose Motorcycle-Touring 1001 cc or more	1086	1189	1216	1292	1328	1397	1461	1539	1629	1652			
2	30	All Purpose Motorcycle-Touring 1001 cc or more	1070	1172	1198	1274	1310	1377	1441	1518	1606	1629			
2	0	All Purpose Motorhome	490	560	627	700	775	838	919	1004	1074	1122	1215		
2	5	All Purpose Motorhome	465	532	596	665	736	796	873	954	1020	1066	1154		
2	10	All Purpose Motorhome	441	504	564	630	697	754	827	904	967	1010	1093		
2	15	All Purpose Motorhome	416	476	533	595	659	712	781	853	913	954	1033		
2	20	All Purpose Motorhome	392	448	502	560	620	670	735	803	859	898	972		
2	25	All Purpose Motorhome	367	420	470	525	581	628	689	753	805	841	911		
2	26	All Purpose Motorhome	363	414	464	518	573	620	680	743	795	830	899		
2	27	All Purpose Motorhome	358	409	458	511	566	612	671	733	784	819	887		
2	28	All Purpose Motorhome	353	403	451	504	558	603	662	723	773	808	875		
2	29	All Purpose Motorhome	348	398	445	497	550	595	652	713	763	797	863		
2	30	All Purpose Motorhome	343	392	439	490	542	587	643	703	752	785	850		
2	0	All Purpose Passenger Vehicle	564	621	713	757	802	849	890	932	977	1011	1025	1042	1064
2	5	All Purpose Passenger Vehicle	536	590	677	719	762	807	845	885	928	960	974	990	1011
2	10	All Purpose Passenger Vehicle	508	559	642	681	722	764	801	839	879	910	922	938	958
2	15	All Purpose Passenger Vehicle	479	528	606	643	682	722	756	792	830	859	871	886	904
2	20	All Purpose Passenger Vehicle	451	497	570	606	642	679	712	746	782	809	820	834	851
2	25	All Purpose Passenger Vehicle	423	466	535	568	601	637	667	699	733	758	769	781	798
2	26	All Purpose Passenger Vehicle	417	460	528	560	593	628	659	690	723	748	758	771	787
2	27	All Purpose Passenger Vehicle	412	453	520	553	585	620	650	680	713	738	748	761	777
2	28	All Purpose Passenger Vehicle	406	447	513	545	577	611	641	671	703	728	738	750	766
2	29	All Purpose Passenger Vehicle	400	441	506	537	569	603	632	662	694	718	728	740	755
2	30	All Purpose Passenger Vehicle	395	435	499	530	561	594	623	652	684	708	717	729	745
2	0	All Purpose Snow Vehicle (HTA)	342												
2	0	All Purpose Trailer $2500 or less	7												
2	0	All Purpose Trailer $2501 or more		37	63	99	130	179	207	227	253	265	277	289	302
2	0	All Purpose Truck 4,540 kg or less GVW	436	511	537	567	590	619	644	666	701	728	758	802	827
2	5	All Purpose Truck 4,540 kg or less GVW	414	485	510	539	560	588	612	633	666	692	720	762	786
2	10	All Purpose Truck 4,540 kg or less GVW	392	460	483	510	531	557	580	599	631	655	682	722	744
2	15	All Purpose Truck 4,540 kg or less GVW	371	434	456	482	501	526	547	566	596	619	644	682	703
2	20	All Purpose Truck 4,540 kg or less GVW	349	409	430	454	472	495	515	533	561	582	606	642	662

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1084	1106	1129	1150	1172	1192	1214	1237	1260	1283	1305	1332	1358	1385	1402	1436	1467	1504	1545	1551	1556	1562	1568
1030	1051	1073	1092	1113	1132	1153	1175	1197	1219	1240	1265	1290	1316	1332	1364	1394	1429	1468	1473	1478	1484	1490
976	995	1016	1035	1055	1073	1093	1113	1134	1155	1174	1199	1222	1246	1262	1292	1320	1354	1390	1396	1400	1406	1411
921	940	960	977	996	1013	1032	1051	1071	1091	1109	1132	1154	1177	1192	1221	1247	1278	1313	1318	1323	1328	1333
867	885	903	920	938	954	971	990	1008	1026	1044	1066	1086	1108	1122	1149	1174	1203	1236	1241	1245	1250	1254
813	829	847	862	879	894	910	928	945	962	979	999	1018	1039	1051	1077	1100	1128	1159	1163	1167	1171	1176
802	818	835	851	867	882	898	915	932	949	966	986	1005	1025	1037	1063	1086	1113	1143	1148	1151	1156	1160
791	807	824	839	856	870	886	903	920	937	953	972	991	1011	1023	1048	1071	1098	1128	1132	1136	1140	1145
780	796	813	828	844	858	874	891	907	924	940	959	978	997	1009	1034	1056	1083	1112	1117	1120	1125	1129
770	785	802	816	832	846	862	878	895	911	927	946	964	983	995	1020	1042	1068	1097	1101	1105	1109	1113
759	774	790	805	820	834	850	866	882	898	913	932	951	969	981	1005	1027	1053	1081	1086	1089	1093	1098

313																						
838	873	936	946	985	1018	1063	1074	1092	1129	1178	1203	1239	1286	1298	1315	1345	1367	1412	1418	1424	1431	1437
796	829	889	899	936	967	1010	1020	1037	1073	1119	1143	1177	1222	1233	1249	1278	1299	1341	1347	1353	1359	1365
754	786	842	851	886	916	957	967	983	1016	1060	1083	1115	1157	1168	1183	1210	1230	1271	1276	1282	1288	1293
712	742	796	804	837	865	904	913	928	960	1001	1023	1053	1093	1103	1118	1143	1162	1200	1205	1210	1216	1221
670	698	749	757	788	814	850	859	874	903	942	962	991	1029	1038	1052	1076	1094	1130	1134	1139	1145	1150

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
2	29	Pleasure Motorhome	253	290	324	362	401	433	475	519	555	580	628		
2	30	Pleasure Motorhome	250	286	319	357	395	427	468	512	547	572	619		
2	0	Pleasure Passenger Vehicle	452	498	572	607	643	681	714	747	783	811	822	835	853
2	5	Pleasure Passenger Vehicle	429	473	543	577	611	647	678	710	744	770	781	793	810
2	10	Pleasure Passenger Vehicle	407	448	515	546	579	613	643	672	705	730	740	751	768
2	15	Pleasure Passenger Vehicle	384	423	486	516	547	579	607	635	666	689	699	710	725
2	20	Pleasure Passenger Vehicle	362	398	458	486	514	545	571	598	626	649	658	668	682
2	25	Pleasure Passenger Vehicle	339	373	429	455	482	511	535	560	587	608	616	626	640
2	26	Pleasure Passenger Vehicle	334	369	423	449	476	504	528	553	579	600	608	618	631
2	27	Pleasure Passenger Vehicle	330	364	418	443	469	497	521	545	572	592	600	610	623
2	28	Pleasure Passenger Vehicle	325	359	412	437	463	490	514	538	564	584	592	601	614
2	29	Pleasure Passenger Vehicle	321	354	406	431	457	484	507	530	556	576	584	593	606
2	30	Pleasure Passenger Vehicle	316	349	400	425	450	477	500	523	548	568	575	584	597
2	0	Pleasure Truck 4,540 kg or less GVW	340	398	418	442	460	483	502	519	546	568	591	625	644
2	5	Pleasure Truck 4,540 kg or less GVW	323	378	397	420	437	459	477	493	519	540	561	594	612
2	10	Pleasure Truck 4,540 kg or less GVW	306	358	376	398	414	435	452	467	491	511	532	562	580
2	15	Pleasure Truck 4,540 kg or less GVW	289	338	355	376	391	411	427	441	464	483	502	531	547
2	20	Pleasure Truck 4,540 kg or less GVW	272	318	334	354	368	386	402	415	437	454	473	500	515
2	25	Pleasure Truck 4,540 kg or less GVW	255	298	313	331	345	362	376	389	409	426	443	469	483
2	26	Pleasure Truck 4,540 kg or less GVW	252	295	309	327	340	357	371	384	404	420	437	462	477
2	27	Pleasure Truck 4,540 kg or less GVW	248	291	305	323	336	353	366	379	399	415	431	456	470
2	28	Pleasure Truck 4,540 kg or less GVW	245	287	301	318	331	348	361	374	393	409	426	450	464
2	29	Pleasure Truck 4,540 kg or less GVW	241	283	297	314	327	343	356	368	388	403	420	444	457
2	30	Pleasure Truck 4,540 kg or less GVW	238	279	293	309	322	338	351	363	382	398	414	437	451
2	0	Police/Emergency Passenger Vehicle	487	537	616	654	693	733	769	805	844	873	886	900	919
2	0	Police/Emergency Truck 4,540 kg or less GVW	614	614	614	614	614	614	614	614	614	614	614	614	614
2	0	Police/Emergency Truck 4,541 to 16,330 kg GVW		567	567	567	567	567	567	567	567	567	567	567	567
2	0	Police/Emergency Truck 16,331 kg or more GVW		493	493	493	493	493	493	493	493	493	493	493	493
2	0	Repairer	249												
2	0	Sand/Gravel Truck 10,891 to 16,330 kg GVW		514	587	636	694	743	800	852	905	958	1011	1063	1117
2	0	Sand/Gravel Truck 16,331 kg or more GVW		712	712	712	712	712	712	712	712	712	712	712	712
2	0	School Bus 20 seats or less	139	153	167	172	185	195	209	217	241	250	261	271	283
2	0	School Bus 21 to 35 seats	153	172	185	195	209	217	228	241	269	281	292	305	316
2	0	School Bus 36 to 50 seats	172	195	209	217	228	241	263	269	289	302	314	324	339
2	0	School Bus 51 seats or more	195	217	228	241	263	269	276	289	328	345	356	371	384
2	0	Taxi/Livery Passenger Vehicle	3291												
2	0	Tow Truck 4,540 kg or less GVW	401	470	494	522	543	570	592	613	645	670	697	738	760
2	0	Tow Truck 4,541 to 16,330 kg GVW		585	667	722	789	845	910	969	1029	1089	1149	1209	1269
2	0	Tow Truck 16,331 kg or more GVW		450	450	450	450	450	450	450	450	450	450	450	450
2	0	Transit Bus 20 seats or less	406	434	472	561	661	763	798	833	868	902	938	974	1013
2	0	Transit Bus 21 to 35 seats	434	472	561	661	763	820	855	891	925	960	1001	1040	1081
2	0	Transit Bus 36 to 50 seats	472	561	661	763	820	882	915	953	985	1026	1066	1109	1154
2	0	Transit Bus 51 seats or more	573	677	780	839	902	969	1004	1040	1077	1122	1164	1212	1260
2	0	U Drive Bus	950												
2	0	U Drive Moped	159	236	281	331	359	370	387	405	423	440			
2	0	U Drive Motorhome	749												
2	0	U Drive Passenger Vehicle	420	463	531	563	597	632	663	694	727	753	763	776	792
2	0	U Drive Truck 4,540 kg or less GVW	379	443	466	492	512	537	559	578	608	632	657	696	717
2	0	U Drive Truck 4,541 to 16,330 kg GVW		266	304	329	359	384	414	441	468	495	523	550	577

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
869	887	906	922	940	956	973	992	1011	1028	1046	1068	1089	1111	1124	1151	1176	1206	1239	1243	1248	1252	1257
826	843	861	876	893	908	924	942	960	977	994	1015	1035	1055	1068	1093	1117	1146	1177	1181	1186	1189	1194
782	798	815	830	846	860	876	893	910	925	941	961	980	1000	1012	1036	1058	1085	1115	1119	1123	1127	1131
739	754	770	784	799	813	827	843	859	874	889	908	926	944	955	978	1000	1025	1053	1057	1061	1064	1068
695	710	725	738	752	765	778	794	809	822	837	854	871	889	899	921	941	965	991	994	998	1002	1006
652	665	679	691	705	717	730	744	758	771	784	801	817	833	843	863	882	904	929	932	936	939	943
643	656	670	682	696	707	720	734	748	761	774	790	806	822	832	852	870	892	917	920	924	926	930
634	648	661	673	686	698	710	724	738	750	764	780	795	811	821	840	858	880	904	907	911	914	918
626	639	652	664	677	688	701	714	728	740	753	769	784	800	809	829	847	868	892	895	899	901	905
617	630	643	655	667	679	691	704	718	730	743	758	773	789	798	817	835	856	880	883	886	889	892
608	621	634	645	658	669	681	694	708	720	732	748	762	778	787	806	823	844	867	870	874	876	880
653	681	730	738	768	794	829	838	851	880	919	938	966	1002	1012	1025	1048	1065	1101	1105	1110	1115	1120
620	647	693	701	730	754	788	796	808	836	873	891	918	952	961	974	996	1012	1046	1050	1054	1059	1064
588	613	657	664	691	715	746	754	766	792	827	844	869	902	911	922	943	958	991	994	999	1003	1008
555	579	620	627	653	675	705	712	723	748	781	797	821	852	860	871	891	905	936	939	943	948	952
522	545	584	590	614	635	663	670	681	704	735	750	773	802	810	820	838	852	881	884	888	892	896
490	511	547	553	576	595	622	628	638	660	689	703	724	751	759	769	786	799	826	829	832	836	840
483	504	540	546	568	588	613	620	630	651	680	694	715	741	749	758	776	788	815	818	821	825	829
477	497	533	539	561	580	605	612	621	642	671	685	705	731	739	748	765	777	804	807	810	814	818
470	490	526	531	553	572	597	603	613	634	662	675	696	721	729	738	755	767	793	796	799	803	806
464	484	518	524	545	564	589	595	604	625	652	666	686	711	719	728	744	756	782	785	788	792	795
457	477	511	517	538	556	580	587	596	616	643	657	676	701	708	717	734	745	771	773	777	780	784
936	956	975	993	1012	1030	1048	1069	1089	1108	1127	1150	1173	1196	1211	1240	1267	1299	1335	1339	1344	1349	1354
614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614	614
567	567	567	567	567																		
493	493	493	493	493																		
1170	1244	1319	1359	1380																		
712	712	712	712	712																		
294																						
328																						
352																						
400																						
771	803	861	871	906	937	978	988	1004	1038	1084	1106	1140	1183	1194	1210	1237	1257	1299	1304	1310	1316	1322
1330	1414	1499	1545	1568																		
450	450	450	450	450																		
1053																						
1123																						
1200																						
1308																						
807	824	841	856	873	888	904	921	938	955	971	992	1011	1031	1043	1069	1092	1119	1150	1154	1159	1163	1167
727	758	812	821	855	884	922	932	947	979	1022	1044	1075	1116	1127	1141	1167	1186	1225	1230	1236	1241	1247
605	643	682	705	716																		

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
3	28	All Purpose Motorhome	431	492	552	616	683	737	809	883	945	988	1070		
3	29	All Purpose Motorhome	425	486	544	608	673	727	798	871	932	974	1055		
3	30	All Purpose Motorhome	419	479	536	599	664	717	787	859	919	960	1040		
3	0	All Purpose Passenger Vehicle	707	779	893	948	1005	1064	1115	1167	1224	1267	1285	1305	1333
3	5	All Purpose Passenger Vehicle	672	740	848	901	955	1011	1059	1109	1163	1204	1221	1240	1266
3	10	All Purpose Passenger Vehicle	636	701	804	853	904	958	1003	1050	1102	1140	1156	1174	1200
3	15	All Purpose Passenger Vehicle	601	662	759	806	854	904	948	992	1040	1077	1092	1109	1133
3	20	All Purpose Passenger Vehicle	566	623	714	758	804	851	892	934	979	1014	1028	1044	1066
3	25	All Purpose Passenger Vehicle	530	584	670	711	754	798	836	875	918	950	964	979	1000
3	26	All Purpose Passenger Vehicle	523	576	661	702	744	787	825	864	906	938	951	966	986
3	27	All Purpose Passenger Vehicle	516	569	652	692	734	777	814	852	894	925	938	953	973
3	28	All Purpose Passenger Vehicle	509	561	643	683	724	766	803	840	881	912	925	940	960
3	29	All Purpose Passenger Vehicle	502	553	634	673	714	755	792	829	869	900	912	927	946
3	30	All Purpose Passenger Vehicle	495	545	625	664	703	745	780	817	857	887	899	913	933
3	0	All Purpose Snow Vehicle (HTA)	402												
3	0	All Purpose Trailer $2500 or less	6												
3	0	All Purpose Trailer $2501 or more		27	46	72	95	131	151	165	185	193	202	211	220
3	0	All Purpose Truck 4,540 kg or less GVW	500	586	615	650	676	710	738	764	803	835	868	919	948
3	5	All Purpose Truck 4,540 kg or less GVW	475	557	584	617	642	674	701	726	763	793	825	873	901
3	10	All Purpose Truck 4,540 kg or less GVW	450	527	553	585	608	639	664	688	723	751	781	827	853
3	15	All Purpose Truck 4,540 kg or less GVW	425	498	523	552	575	603	627	649	683	710	738	781	806
3	20	All Purpose Truck 4,540 kg or less GVW	400	469	492	520	541	568	590	611	642	668	694	735	758
3	25	All Purpose Truck 4,540 kg or less GVW	375	439	461	487	507	532	553	573	602	626	651	689	711
3	26	All Purpose Truck 4,540 kg or less GVW	370	434	455	481	500	525	546	565	594	618	642	680	702
3	27	All Purpose Truck 4,540 kg or less GVW	365	428	449	474	493	518	539	558	586	610	634	671	692
3	28	All Purpose Truck 4,540 kg or less GVW	360	422	443	468	487	511	531	550	578	601	625	662	683
3	29	All Purpose Truck 4,540 kg or less GVW	355	416	437	461	480	504	524	542	570	593	616	652	673
3	30	All Purpose Truck 4,540 kg or less GVW	350	410	430	455	473	497	517	535	562	584	608	643	664
3	0	Antique Vehicle - Bus	106												
3	0	Antique Vehicle - Motorcycle	106												
3	0	Antique Vehicle - Passenger Vehicle	106												
3	0	Antique Vehicle - Truck	106												
3	0	Artisan Truck 4,540 kg or less GVW	413	483	508	537	558	586	609	630	663	689	717	758	782
3	5	Artisan Truck 4,540 kg or less GVW	392	459	483	510	530	557	579	598	630	655	681	720	743
3	10	Artisan Truck 4,540 kg or less GVW	372	435	457	483	502	527	548	567	597	620	645	682	704
3	15	Artisan Truck 4,540 kg or less GVW	351	411	432	456	474	498	518	535	564	586	609	644	665
3	20	Artisan Truck 4,540 kg or less GVW	330	386	406	430	446	469	487	504	530	551	574	606	626
3	25	Artisan Truck 4,540 kg or less GVW	310	362	381	403	418	439	457	472	497	517	538	568	586
3	26	Artisan Truck 4,540 kg or less GVW	306	357	376	397	413	434	451	466	491	510	531	561	579
3	27	Artisan Truck 4,540 kg or less GVW	301	353	371	392	407	428	445	460	484	503	523	553	571
3	28	Artisan Truck 4,540 kg or less GVW	297	348	366	387	402	422	438	454	477	496	516	546	563
3	29	Artisan Truck 4,540 kg or less GVW	293	343	361	381	396	416	432	447	471	489	509	538	555
3	30	Artisan Truck 4,540 kg or less GVW	289	338	356	376	391	410	426	441	464	482	502	531	547
3	0	Artisan Truck 4,541 to 16,330 kg GVW		522	594	642	701	752	809	862	915	970	1026	1081	1137
3	5	Artisan Truck 4,541 to 16,330 kg GVW		496	564	610	666	714	769	819	869	921	975	1027	1080
3	10	Artisan Truck 4,541 to 16,330 kg GVW		470	535	578	631	677	728	776	823	873	923	973	1023
3	15	Artisan Truck 4,541 to 16,330 kg GVW		444	505	546	596	639	688	733	778	824	872	919	966
3	20	Artisan Truck 4,541 to 16,330 kg GVW		418	475	514	561	602	647	690	732	776	821	865	910
3	25	Artisan Truck 4,541 to 16,330 kg GVW		391	445	481	526	564	607	646	686	727	769	811	853

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1358	1386	1415	1441	1469	1494	1521	1550	1579	1607	1635	1669	1702	1735	1756	1799	1838	1884	1936	1943	1950	1957	1964
1290	1317	1344	1369	1396	1419	1445	1472	1500	1527	1553	1586	1617	1648	1668	1709	1746	1790	1839	1846	1852	1859	1866
1222	1247	1273	1297	1322	1345	1369	1395	1421	1446	1471	1502	1532	1561	1580	1619	1654	1696	1742	1749	1755	1761	1768
1154	1178	1203	1225	1249	1270	1293	1317	1342	1366	1390	1419	1447	1475	1493	1529	1562	1601	1646	1652	1657	1663	1669
1086	1109	1132	1153	1175	1195	1217	1240	1263	1286	1308	1335	1362	1388	1405	1439	1470	1507	1549	1554	1560	1566	1571
1018	1039	1061	1081	1102	1120	1141	1162	1184	1205	1226	1252	1276	1301	1317	1349	1378	1413	1452	1457	1462	1468	1473
1005	1026	1047	1066	1087	1106	1126	1147	1168	1189	1210	1235	1259	1284	1299	1331	1360	1394	1433	1438	1443	1448	1453
991	1012	1033	1052	1072	1091	1110	1131	1153	1173	1194	1218	1242	1267	1282	1313	1342	1375	1413	1418	1423	1429	1434
978	998	1019	1038	1058	1076	1095	1116	1137	1157	1177	1202	1225	1249	1264	1295	1323	1356	1394	1399	1404	1409	1414
964	984	1005	1023	1043	1061	1080	1100	1121	1141	1161	1185	1208	1232	1247	1277	1305	1338	1375	1380	1384	1389	1394
951	970	990	1009	1028	1046	1065	1085	1105	1125	1144	1168	1191	1214	1229	1259	1287	1319	1355	1360	1365	1370	1375
228																						
961	1001	1073	1085	1130	1167	1218	1231	1251	1294	1350	1379	1420	1474	1488	1508	1541	1567	1618	1625	1632	1640	1647
913	951	1019	1031	1073	1109	1157	1169	1188	1229	1282	1310	1349	1400	1414	1433	1464	1489	1537	1544	1550	1558	1565
865	901	966	976	1017	1050	1096	1108	1126	1165	1215	1241	1278	1327	1339	1357	1387	1410	1456	1462	1469	1476	1482
817	851	912	922	960	992	1035	1046	1063	1100	1147	1172	1207	1253	1265	1282	1310	1332	1375	1381	1387	1394	1400
769	801	858	868	904	934	974	985	1001	1035	1080	1103	1136	1179	1190	1206	1233	1254	1294	1300	1306	1312	1318
721	751	805	814	847	875	913	923	938	970	1012	1034	1065	1105	1116	1131	1156	1175	1213	1219	1224	1230	1235
711	741	794	803	836	864	901	911	926	958	999	1020	1051	1091	1101	1116	1140	1160	1197	1202	1208	1214	1219
702	731	783	792	825	852	889	899	913	945	985	1007	1037	1076	1086	1101	1125	1144	1181	1186	1191	1197	1202
692	721	773	781	814	840	877	886	901	932	972	993	1022	1061	1071	1086	1110	1128	1165	1170	1175	1181	1186
682	711	762	770	802	829	865	874	888	919	958	979	1008	1047	1056	1071	1094	1113	1149	1154	1159	1164	1169
673	701	751	759	791	817	853	862	876	906	945	965	994	1032	1042	1056	1079	1097	1133	1137	1142	1148	1153
793	826	885	895	932	966	1005	1016	1032	1067	1114	1138	1187	1216	1228	1256	1278	1317	1343	1341	1347	1353	1359
753	785	841	850	885	918	955	965	980	1014	1058	1081	1128	1155	1167	1193	1214	1251	1276	1274	1280	1285	1291
714	743	796	805	839	869	904	914	929	960	1003	1024	1068	1094	1105	1130	1150	1185	1209	1207	1212	1218	1223
674	702	752	761	792	821	854	864	877	907	947	967	1009	1034	1044	1068	1086	1119	1142	1140	1145	1150	1155
634	661	708	716	746	773	804	813	826	854	891	910	950	973	982	1005	1022	1054	1074	1073	1078	1082	1087
595	619	664	671	699	724	754	762	774	800	835	853	890	912	921	942	958	988	1007	1006	1010	1015	1019
587	611	655	662	690	715	744	752	764	790	824	842	878	900	909	929	946	975	994	992	997	1001	1006
579	603	646	653	680	705	734	742	753	779	813	831	867	888	896	917	933	961	980	979	983	988	992
571	595	637	644	671	696	724	732	743	768	802	819	855	876	884	904	920	948	967	966	970	974	978
563	586	628	635	662	686	714	721	733	758	791	808	843	863	872	892	907	935	954	952	956	961	965
555	578	619	626	652	676	703	711	722	747	780	797	831	851	860	879	895	922	940	939	943	947	951
1194	1271	1349	1392	1415																		
1134	1207	1282	1322	1344																		
1075	1144	1214	1253	1273																		
1015	1080	1147	1183	1203																		
955	1017	1079	1114	1132																		
895	953	1012	1044	1061																		

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
3	5	Pleasure Motorcycle-Touring 1001 cc or more	1073	1173	1201	1276	1312	1379	1443	1520	1609	1631			
3	10	Pleasure Motorcycle-Touring 1001 cc or more	1016	1111	1138	1209	1243	1307	1367	1440	1525	1545			
3	15	Pleasure Motorcycle-Touring 1001 cc or more	960	1050	1074	1142	1174	1234	1291	1360	1440	1459			
3	20	Pleasure Motorcycle-Touring 1001 cc or more	903	988	1011	1074	1105	1162	1215	1280	1355	1374			
3	25	Pleasure Motorcycle-Touring 1001 cc or more	847	926	948	1007	1036	1089	1139	1200	1270	1288			
3	26	Pleasure Motorcycle-Touring 1001 cc or more	835	914	935	994	1022	1074	1124	1184	1254	1271			
3	27	Pleasure Motorcycle-Touring 1001 cc or more	824	902	923	980	1008	1060	1109	1168	1237	1253			
3	28	Pleasure Motorcycle-Touring 1001 cc or more	813	889	910	967	994	1045	1094	1152	1220	1236			
3	29	Pleasure Motorcycle-Touring 1001 cc or more	802	877	897	954	981	1031	1078	1136	1203	1219			
3	30	Pleasure Motorcycle-Touring 1001 cc or more	790	864	885	940	967	1016	1063	1120	1186	1202			
3	0	Pleasure Motorhome	466	532	596	666	737	796	873	954	1021	1066	1155		
3	5	Pleasure Motorhome	443	505	566	633	700	756	829	906	970	1013	1097		
3	10	Pleasure Motorhome	419	479	536	599	663	716	786	859	919	959	1039		
3	15	Pleasure Motorhome	396	452	507	566	626	677	742	811	868	906	982		
3	20	Pleasure Motorhome	373	426	477	533	590	637	698	763	817	853	924		
3	25	Pleasure Motorhome	349	399	447	499	553	597	655	715	766	799	866		
3	26	Pleasure Motorhome	345	394	441	493	545	589	646	706	756	789	855		
3	27	Pleasure Motorhome	340	388	435	486	538	581	637	696	745	778	843		
3	28	Pleasure Motorhome	336	383	429	480	531	573	629	687	735	768	832		
3	29	Pleasure Motorhome	331	378	423	473	523	565	620	677	725	757	820		
3	30	Pleasure Motorhome	326	372	417	466	516	557	611	668	715	746	808		
3	0	Pleasure Passenger Vehicle	565	622	714	757	803	850	891	932	977	1012	1026	1043	1065
3	5	Pleasure Passenger Vehicle	537	591	678	719	763	807	846	885	928	961	975	991	1012
3	10	Pleasure Passenger Vehicle	508	560	643	681	723	765	802	839	879	911	923	939	958
3	15	Pleasure Passenger Vehicle	480	529	607	643	683	722	757	792	830	860	872	887	905
3	20	Pleasure Passenger Vehicle	452	498	571	606	642	680	713	746	782	810	821	834	852
3	25	Pleasure Passenger Vehicle	424	466	535	568	602	637	668	699	733	759	769	782	799
3	26	Pleasure Passenger Vehicle	418	460	528	560	594	629	659	690	723	749	759	772	788
3	27	Pleasure Passenger Vehicle	412	454	521	553	586	620	650	680	713	739	749	761	777
3	28	Pleasure Passenger Vehicle	407	448	514	545	578	612	642	671	703	729	739	751	767
3	29	Pleasure Passenger Vehicle	401	442	507	537	570	603	633	662	694	719	728	741	756
3	30	Pleasure Passenger Vehicle	395	435	500	530	562	595	624	652	684	708	718	730	745
3	0	Pleasure Truck 4,540 kg or less GVW	365	428	449	475	494	518	539	558	587	610	634	671	692
3	5	Pleasure Truck 4,540 kg or less GVW	347	407	427	451	469	492	512	530	558	579	602	637	657
3	10	Pleasure Truck 4,540 kg or less GVW	328	385	404	427	445	466	485	502	528	549	571	604	623
3	15	Pleasure Truck 4,540 kg or less GVW	310	364	382	404	420	440	458	474	499	518	539	570	588
3	20	Pleasure Truck 4,540 kg or less GVW	292	342	359	380	395	414	431	446	470	488	507	537	554
3	25	Pleasure Truck 4,540 kg or less GVW	274	321	337	356	370	388	404	418	440	457	475	503	519
3	26	Pleasure Truck 4,540 kg or less GVW	270	317	332	351	366	383	399	413	434	451	469	497	512
3	27	Pleasure Truck 4,540 kg or less GVW	266	312	328	347	361	378	393	407	429	445	463	490	505
3	28	Pleasure Truck 4,540 kg or less GVW	263	308	323	342	356	373	388	402	423	439	456	483	498
3	29	Pleasure Truck 4,540 kg or less GVW	259	304	319	337	351	368	383	396	417	433	450	476	491
3	30	Pleasure Truck 4,540 kg or less GVW	255	300	314	332	346	363	377	391	411	427	444	470	484
3	0	Police/Emergency Passenger Vehicle	744	819	940	997	1058	1119	1173	1228	1287	1332	1351	1373	1402
3	0	Police/Emergency Truck 4,540 kg or less GVW	844	844	844	844	844	844	844	844	844	844	844	844	844
3	0	Police/Emergency Truck 4,541 to 16,330 kg GVW		779	779	779	779	779	779	779	779	779	779	779	779
3	0	Police/Emergency Truck 16,331 kg or more GVW		756	756	756	756	756	756	756	756	756	756	756	756
3	0	Repairer	288												
3	0	Sand/Gravel Truck 10,891 to 16,330 kg GVW		580	662	716	782	838	902	961	1020	1079	1139	1198	1258
3	0	Sand/Gravel Truck 16,331 kg or more GVW		865	865	865	865	865	865	865	865	865	865	865	865
3	0	School Bus 20 seats or less	199	225	236	253	269	282	282	313	347	363	376	392	408
3	0	School Bus 21 to 35 seats	225	253	269	278	282	313	331	347	394	409	424	443	459
3	0	School Bus 36 to 50 seats	253	282	282	313	331	347	368	394	400	415	432	449	467
3	0	School Bus 51 seats or more	282	313	331	347	368	394	397	404	408	424	442	458	478
3	0	Taxi/Livery Passenger Vehicle	4652												
3	0	Tow Truck 4,540 kg or less GVW	463	542	570	602	626	657	684	707	744	773	804	851	878
3	0	Tow Truck 4,541 to 16,330 kg GVW		603	688	745	813	871	938	999	1061	1123	1185	1246	1309
3	0	Tow Truck 16,331 kg or more GVW		579	579	579	579	579	579	579	579	579	579	579	579
3	0	Transit Bus 20 seats or less	556	599	644	771	906	1047	1096	1144	1193	1241	1290	1342	1395
3	0	Transit Bus 21 to 35 seats	599	644	771	906	1047	1127	1174	1223	1272	1320	1376	1430	1487

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1085	1107	1130	1151	1173	1193	1215	1238	1261	1284	1306	1333	1359	1386	1403	1437	1468	1505	1546	1552	1557	1563	1569
1031	1052	1073	1093	1114	1133	1154	1176	1198	1220	1241	1266	1291	1317	1333	1365	1395	1430	1469	1474	1479	1485	1491
976	996	1017	1036	1056	1074	1093	1114	1135	1156	1175	1200	1223	1247	1263	1293	1321	1354	1391	1397	1401	1407	1412
922	941	960	978	997	1014	1033	1052	1072	1091	1110	1133	1155	1178	1193	1221	1248	1279	1314	1319	1323	1329	1334
868	886	904	921	938	954	972	990	1009	1027	1045	1066	1087	1109	1122	1150	1174	1204	1237	1242	1246	1250	1255
814	830	847	863	880	895	911	928	946	963	979	1000	1019	1039	1052	1078	1101	1129	1159	1164	1168	1172	1177
803	819	836	852	868	883	899	916	933	950	966	986	1006	1026	1038	1063	1086	1114	1144	1148	1152	1157	1161
792	808	825	840	856	871	887	904	921	937	953	973	992	1012	1024	1049	1072	1099	1129	1133	1137	1141	1145
781	797	814	829	845	859	875	891	908	924	940	960	978	998	1010	1035	1057	1084	1113	1117	1121	1125	1130
770	786	802	817	833	847	863	879	895	912	927	946	965	984	996	1020	1042	1069	1098	1102	1105	1110	1114
759	775	791	806	821	835	850	867	883	899	914	933	951	970	982	1006	1028	1053	1082	1086	1090	1094	1098
702	731	784	793	825	853	890	900	914	945	987	1007	1038	1077	1087	1101	1126	1144	1182	1187	1193	1198	1203
667	694	745	753	784	810	845	855	868	898	938	957	986	1023	1033	1046	1070	1087	1123	1128	1133	1138	1143
632	658	706	714	742	768	801	810	823	850	888	906	934	969	978	991	1013	1030	1064	1068	1074	1078	1083
597	621	666	674	701	725	756	765	777	803	839	856	882	915	924	936	957	972	1005	1009	1014	1018	1023
562	585	627	634	660	682	712	720	731	756	790	806	830	862	870	881	901	915	946	950	954	958	962
526	548	588	595	619	640	667	675	685	709	740	755	778	808	815	826	844	858	886	890	895	898	902
519	541	580	587	610	631	659	666	676	699	730	745	768	797	804	815	833	847	875	878	883	887	890
512	534	572	579	602	623	650	657	667	690	721	735	758	786	794	804	822	835	863	867	871	875	878
505	526	564	571	594	614	641	648	658	680	711	725	747	775	783	793	811	824	851	855	859	863	866
498	519	557	563	586	606	632	639	649	671	701	715	737	765	772	782	799	812	839	843	847	851	854
491	512	549	555	577	597	623	630	640	661	691	705	727	754	761	771	788	801	827	831	835	839	842
1429	1458	1489	1516	1545	1571	1600	1631	1661	1691	1720	1756	1790	1826	1847	1893	1934	1982	2037	2044	2051	2059	2066
844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844	844
779	779	779	779	779																		
756	756	756	756	756																		
1319	1402	1486	1531	1554																		
865	865	865	865	865																		
424																						
478																						
487																						
496																						
890	927	993	1005	1046	1081	1128	1141	1159	1198	1251	1277	1316	1365	1378	1396	1428	1451	1499	1505	1512	1519	1525
1372	1458	1546	1593	1617																		
579	579	579	579	579																		
1451																						
1548																						

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
4	26	All Purpose Motorcycle-Touring 501 to 1000 cc	1063	1163	1190	1265	1300	1367	1430	1507	1595	1617			
4	27	All Purpose Motorcycle-Touring 501 to 1000 cc	1048	1148	1174	1248	1283	1348	1411	1486	1573	1595			
4	28	All Purpose Motorcycle-Touring 501 to 1000 cc	1034	1132	1158	1230	1265	1330	1392	1466	1552	1573			
4	29	All Purpose Motorcycle-Touring 501 to 1000 cc	1020	1116	1142	1213	1247	1311	1372	1446	1530	1551			
4	30	All Purpose Motorcycle-Touring 501 to 1000 cc	1005	1100	1126	1196	1230	1293	1353	1425	1508	1529			
4	0	All Purpose Motorcycle-Touring 1001 cc or more	1436	1572	1608	1709	1757	1847	1933	2036	2155	2185			
4	5	All Purpose Motorcycle-Touring 1001 cc or more	1364	1493	1528	1624	1669	1755	1836	1934	2047	2076			
4	10	All Purpose Motorcycle-Touring 1001 cc or more	1292	1415	1447	1538	1581	1662	1740	1832	1939	1966			
4	15	All Purpose Motorcycle-Touring 1001 cc or more	1221	1336	1367	1453	1493	1570	1643	1731	1832	1857			
4	20	All Purpose Motorcycle-Touring 1001 cc or more	1149	1258	1286	1367	1406	1478	1546	1629	1724	1748			
4	25	All Purpose Motorcycle-Touring 1001 cc or more	1077	1179	1206	1282	1318	1385	1450	1527	1616	1639			
4	26	All Purpose Motorcycle-Touring 1001 cc or more	1063	1163	1190	1265	1300	1367	1430	1507	1595	1617			
4	27	All Purpose Motorcycle-Touring 1001 cc or more	1048	1148	1174	1248	1283	1348	1411	1486	1573	1595			
4	28	All Purpose Motorcycle-Touring 1001 cc or more	1034	1132	1158	1230	1265	1330	1392	1466	1552	1573			
4	29	All Purpose Motorcycle-Touring 1001 cc or more	1020	1116	1142	1213	1247	1311	1372	1446	1530	1551			
4	30	All Purpose Motorcycle-Touring 1001 cc or more	1005	1100	1126	1196	1230	1293	1353	1425	1508	1529			
4	0	All Purpose Motorhome	810	926	1037	1159	1283	1386	1520	1661	1777	1856	2011		
4	5	All Purpose Motorhome	769	880	985	1101	1219	1317	1444	1578	1688	1763	1910		
4	10	All Purpose Motorhome	729	833	933	1043	1155	1247	1368	1495	1599	1670	1810		
4	15	All Purpose Motorhome	688	787	881	985	1091	1178	1292	1412	1510	1578	1709		
4	20	All Purpose Motorhome	648	741	830	927	1026	1109	1216	1329	1422	1485	1609		
4	25	All Purpose Motorhome	607	694	778	869	962	1039	1140	1246	1333	1392	1508		
4	26	All Purpose Motorhome	599	685	767	858	949	1026	1125	1229	1315	1373	1488		
4	27	All Purpose Motorhome	591	676	757	846	937	1012	1110	1213	1297	1355	1468		
4	28	All Purpose Motorhome	583	667	747	834	924	998	1094	1196	1279	1336	1448		
4	29	All Purpose Motorhome	575	657	736	823	911	984	1079	1179	1262	1318	1428		
4	30	All Purpose Motorhome	567	648	726	811	898	970	1064	1163	1244	1299	1408		
4	0	All Purpose Passenger Vehicle	726	800	918	974	1033	1093	1145	1199	1257	1301	1319	1341	1369
4	5	All Purpose Passenger Vehicle	690	760	872	925	981	1038	1088	1139	1194	1236	1253	1274	1301
4	10	All Purpose Passenger Vehicle	653	720	826	877	930	984	1030	1079	1131	1171	1187	1207	1232
4	15	All Purpose Passenger Vehicle	617	680	780	828	878	929	973	1019	1068	1106	1121	1140	1164
4	20	All Purpose Passenger Vehicle	581	640	734	779	826	874	916	959	1006	1041	1055	1073	1095
4	25	All Purpose Passenger Vehicle	544	600	688	730	775	820	859	899	943	976	989	1006	1027
4	26	All Purpose Passenger Vehicle	537	592	679	721	764	809	847	887	930	963	976	992	1013
4	27	All Purpose Passenger Vehicle	530	584	670	711	754	798	836	875	918	950	963	979	999
4	28	All Purpose Passenger Vehicle	523	576	661	701	744	787	824	863	905	937	950	966	986
4	29	All Purpose Passenger Vehicle	515	568	652	692	733	776	813	851	892	924	936	952	972
4	30	All Purpose Passenger Vehicle	508	560	643	682	723	765	801	839	880	911	923	939	958
4	0	All Purpose Snow Vehicle (HTA)	369												
4	0	All Purpose Trailer $2500 or less	5												
4	0	All Purpose Trailer $2501 or more		25	42	66	87	120	138	151	169	176	184	193	201
4	0	All Purpose Truck 4,540 kg or less GVW	540	632	664	702	730	766	797	825	867	902	938	992	1023
4	5	All Purpose Truck 4,540 kg or less GVW	513	600	631	667	693	728	757	784	824	857	891	942	972
4	10	All Purpose Truck 4,540 kg or less GVW	486	569	598	632	657	689	717	742	780	812	844	893	921
4	15	All Purpose Truck 4,540 kg or less GVW	459	537	564	597	620	651	677	701	737	767	797	843	870
4	20	All Purpose Truck 4,540 kg or less GVW	432	506	531	562	584	613	638	660	694	722	750	794	818
4	25	All Purpose Truck 4,540 kg or less GVW	405	474	498	526	547	574	598	619	650	676	703	744	767
4	26	All Purpose Truck 4,540 kg or less GVW	400	468	491	519	540	567	590	610	642	667	694	734	757
4	27	All Purpose Truck 4,540 kg or less GVW	394	461	485	512	533	559	582	602	633	658	685	724	747
4	28	All Purpose Truck 4,540 kg or less GVW	389	455	478	505	526	552	574	594	624	649	675	714	737
4	29	All Purpose Truck 4,540 kg or less GVW	383	449	471	498	518	544	566	586	616	640	666	704	726
4	30	All Purpose Truck 4,540 kg or less GVW	378	442	465	491	511	536	558	577	607	631	657	694	716
4	0	Antique Vehicle - Bus	106												
4	0	Antique Vehicle - Motorcycle	106												
4	0	Antique Vehicle - Passenger Vehicle	106												
4	0	Antique Vehicle - Truck	106												
4	0	Artisan Truck 4,540 kg or less GVW	409	479	503	532	553	580	603	624	657	683	710	751	775
4	5	Artisan Truck 4,540 kg or less GVW	389	455	478	505	525	551	573	593	624	649	674	713	736
4	10	Artisan Truck 4,540 kg or less GVW	368	431	453	479	498	522	543	562	591	615	639	676	697
4	15	Artisan Truck 4,540 kg or less GVW	348	407	428	452	470	493	513	530	558	581	603	638	659

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1395	1424	1453	1480	1508	1534	1562	1592	1622	1650	1679	1714	1748	1782	1804	1848	1888	1935	1988	1996	2003	2010	2017
1325	1353	1380	1406	1433	1457	1484	1512	1541	1567	1595	1628	1661	1693	1714	1756	1794	1838	1889	1896	1903	1909	1916
1255	1282	1308	1332	1357	1381	1406	1433	1460	1485	1511	1543	1573	1604	1624	1663	1699	1741	1789	1796	1803	1809	1815
1186	1210	1235	1258	1282	1304	1328	1353	1379	1402	1427	1457	1486	1515	1533	1571	1605	1645	1690	1697	1703	1708	1714
1116	1139	1162	1184	1206	1227	1250	1274	1298	1320	1343	1371	1398	1426	1443	1478	1510	1548	1590	1597	1602	1608	1614
1046	1068	1090	1110	1131	1150	1171	1194	1216	1237	1259	1285	1311	1336	1353	1386	1416	1451	1491	1497	1502	1507	1513
1032	1054	1075	1095	1116	1135	1156	1178	1200	1221	1242	1268	1294	1319	1335	1368	1397	1432	1471	1477	1482	1487	1493
1018	1040	1061	1080	1101	1120	1140	1162	1184	1204	1226	1251	1276	1301	1317	1349	1378	1413	1451	1457	1462	1467	1472
1004	1025	1046	1066	1086	1104	1125	1146	1168	1188	1209	1234	1259	1283	1299	1331	1359	1393	1431	1437	1442	1447	1452
990	1011	1032	1051	1071	1089	1109	1130	1152	1171	1192	1217	1241	1265	1281	1312	1340	1374	1411	1417	1422	1427	1432
976	997	1017	1036	1056	1074	1093	1114	1135	1155	1175	1200	1224	1247	1263	1294	1322	1354	1392	1397	1402	1407	1412

209																						
1037	1081	1158	1172	1220	1260	1316	1330	1351	1397	1458	1489	1534	1592	1607	1628	1664	1692	1748	1755	1763	1771	1779
985	1027	1100	1113	1159	1197	1250	1263	1283	1327	1385	1415	1457	1512	1527	1547	1581	1607	1661	1667	1675	1682	1690
933	973	1042	1055	1098	1134	1184	1197	1216	1257	1312	1340	1381	1433	1446	1465	1498	1523	1573	1579	1587	1594	1601
881	919	984	996	1037	1071	1119	1130	1148	1187	1239	1266	1304	1353	1366	1384	1414	1438	1486	1492	1499	1505	1512
830	865	926	938	976	1008	1053	1064	1081	1118	1166	1191	1227	1274	1286	1302	1331	1354	1398	1404	1410	1417	1423
778	811	868	879	915	945	987	997	1013	1048	1093	1117	1150	1194	1205	1221	1248	1269	1311	1316	1322	1328	1334
767	800	857	867	903	932	974	984	1000	1034	1079	1102	1135	1178	1189	1205	1231	1252	1294	1299	1305	1311	1316
757	789	845	856	891	920	961	971	986	1020	1064	1087	1120	1162	1173	1188	1215	1235	1276	1281	1287	1293	1299
747	778	834	844	878	907	948	958	973	1006	1050	1072	1104	1146	1157	1172	1198	1218	1259	1264	1269	1275	1281
736	768	822	832	866	895	934	944	959	992	1035	1057	1089	1130	1141	1156	1181	1201	1241	1246	1252	1257	1263
726	757	811	820	854	882	921	931	946	978	1021	1042	1074	1114	1125	1140	1165	1184	1224	1228	1234	1240	1245

785	818	877	887	923	954	996	1007	1023	1057	1104	1127	1161	1205	1216	1232	1260	1281	1323	1329	1334	1340	1346
746	777	833	843	877	906	946	957	972	1004	1049	1071	1103	1145	1155	1170	1197	1217	1257	1263	1267	1273	1279
706	736	789	798	831	859	896	906	921	951	994	1014	1045	1084	1094	1109	1134	1153	1191	1196	1201	1206	1211
667	695	745	754	785	811	847	856	870	898	938	958	987	1024	1034	1047	1071	1089	1125	1130	1134	1139	1144

TERR	DISC %	INSURANCE USE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12
4	10	Pleasure Motorcycle-Touring 1001 cc or more	994	1089	1114	1184	1218	1280	1339	1411	1493	1514			
4	15	Pleasure Motorcycle-Touring 1001 cc or more	939	1028	1052	1119	1150	1209	1265	1333	1410	1430			
4	20	Pleasure Motorcycle-Touring 1001 cc or more	884	968	990	1053	1082	1138	1190	1254	1327	1346			
4	25	Pleasure Motorcycle-Touring 1001 cc or more	829	907	928	987	1015	1066	1116	1176	1244	1261			
4	26	Pleasure Motorcycle-Touring 1001 cc or more	818	895	916	974	1001	1052	1101	1160	1228	1245			
4	27	Pleasure Motorcycle-Touring 1001 cc or more	807	883	904	961	988	1038	1086	1145	1211	1228			
4	28	Pleasure Motorcycle-Touring 1001 cc or more	796	871	891	948	974	1024	1071	1129	1194	1211			
4	29	Pleasure Motorcycle-Touring 1001 cc or more	785	859	879	934	961	1010	1056	1113	1178	1194			
4	30	Pleasure Motorcycle-Touring 1001 cc or more	773	847	867	921	947	995	1042	1098	1161	1177			
4	0	Pleasure Motorhome	489	558	625	699	774	836	917	1002	1072	1119	1213		
4	5	Pleasure Motorhome	465	530	594	664	735	794	871	952	1018	1063	1152		
4	10	Pleasure Motorhome	440	502	562	629	697	752	825	902	965	1007	1092		
4	15	Pleasure Motorhome	416	474	531	594	658	711	779	852	911	951	1031		
4	20	Pleasure Motorhome	391	446	500	559	619	669	734	802	858	895	970		
4	25	Pleasure Motorhome	367	418	469	524	580	627	688	751	804	839	910		
4	26	Pleasure Motorhome	362	413	462	517	573	619	679	741	793	828	898		
4	27	Pleasure Motorhome	357	407	456	510	565	610	669	731	783	817	885		
4	28	Pleasure Motorhome	352	402	450	503	557	602	660	721	772	806	873		
4	29	Pleasure Motorhome	347	396	444	496	550	594	651	711	761	794	861		
4	30	Pleasure Motorhome	342	391	437	489	542	585	642	701	750	783	849		
4	0	Pleasure Passenger Vehicle	576	635	729	773	820	867	909	952	998	1033	1048	1064	1087
4	5	Pleasure Passenger Vehicle	547	603	693	734	779	824	864	904	948	981	996	1011	1033
4	10	Pleasure Passenger Vehicle	518	571	656	696	738	780	818	857	898	930	943	958	978
4	15	Pleasure Passenger Vehicle	490	540	620	657	697	737	773	809	848	878	891	904	924
4	20	Pleasure Passenger Vehicle	461	508	583	618	656	694	727	762	798	826	838	851	870
4	25	Pleasure Passenger Vehicle	432	476	547	580	615	650	682	714	748	775	786	798	815
4	26	Pleasure Passenger Vehicle	426	470	539	572	607	642	673	704	739	764	776	787	804
4	27	Pleasure Passenger Vehicle	420	464	532	564	599	633	664	695	729	754	765	777	794
4	28	Pleasure Passenger Vehicle	415	457	525	557	590	624	654	685	719	744	755	766	783
4	29	Pleasure Passenger Vehicle	409	451	518	549	582	616	645	676	709	733	744	755	772
4	30	Pleasure Passenger Vehicle	403	444	510	541	574	607	636	666	699	723	734	745	761
4	0	Pleasure Truck 4,540 kg or less GVW	396	464	487	515	535	562	584	604	636	661	688	728	750
4	5	Pleasure Truck 4,540 kg or less GVW	376	441	463	489	508	534	555	574	604	628	654	692	712
4	10	Pleasure Truck 4,540 kg or less GVW	356	418	438	463	481	506	526	544	572	595	619	655	675
4	15	Pleasure Truck 4,540 kg or less GVW	337	394	414	438	455	478	496	513	541	562	585	619	637
4	20	Pleasure Truck 4,540 kg or less GVW	317	371	390	412	428	450	467	483	509	529	550	582	600
4	25	Pleasure Truck 4,540 kg or less GVW	297	348	365	386	401	421	438	453	477	496	516	546	562
4	26	Pleasure Truck 4,540 kg or less GVW	293	343	360	381	396	416	432	447	471	489	509	539	555
4	27	Pleasure Truck 4,540 kg or less GVW	289	339	356	376	391	410	426	441	464	483	502	531	547
4	28	Pleasure Truck 4,540 kg or less GVW	285	334	351	371	385	405	420	435	458	476	495	524	540
4	29	Pleasure Truck 4,540 kg or less GVW	281	329	346	366	380	399	415	429	452	469	488	517	532
4	30	Pleasure Truck 4,540 kg or less GVW	277	325	341	360	374	393	409	423	445	463	482	510	525
4	0	Police/Emergency Passenger Vehicle	697	767	880	934	991	1048	1099	1150	1206	1248	1266	1286	1313
4	0	Police/Emergency Truck 4,540 kg or less GVW	747	747	747	747	747	747	747	747	747	747	747	747	747
4	0	Police/Emergency Truck 4,541 to 16,330 kg GVW		624	624	624	624	624	624	624	624	624	624	624	624
4	0	Police/Emergency Truck 16,331 kg or more GVW		478	478	478	478	478	478	478	478	478	478	478	478
4	0	Repairer	267												
4	0	Sand/Gravel Truck 10,891 to 16,330 kg GVW		509	581	629	687	736	792	844	896	948	1001	1052	1105
4	0	Sand/Gravel Truck 16,331 kg or more GVW		766	766	766	766	766	766	766	766	766	766	766	766
4	0	School Bus 20 seats or less	181	204	217	230	245	256	272	288	316	332	343	356	371
4	0	School Bus 21 to 35 seats	204	230	245	256	272	288	303	316	359	374	388	406	422
4	0	School Bus 36 to 50 seats	230	256	272	288	303	316	346	359	363	377	395	410	425
4	0	School Bus 51 seats or more	256	288	303	316	346	359	362	368	374	388	406	422	440
4	0	Taxi/Livery Passenger Vehicle	4133												
4	0	Tow Truck 4,540 kg or less GVW	352	412	433	457	476	499	519	537	565	587	611	646	667
4	0	Tow Truck 4,541 to 16,330 kg GVW		504	575	623	680	728	784	835	887	938	990	1041	1094
4	0	Tow Truck 16,331 kg or more GVW		452	452	452	452	452	452	452	452	452	452	452	452
4	0	Transit Bus 20 seats or less	440	472	505	606	713	823	862	900	939	975	1016	1058	1099
4	0	Transit Bus 21 to 35 seats	496	533	642	750	868	934	973	1016	1058	1100	1143	1189	1235
4	0	Transit Bus 36 to 50 seats	505	606	713	823	885	954	995	1031	1068	1112	1155	1201	1249

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1107	1130	1154	1175	1197	1218	1240	1264	1288	1310	1333	1361	1388	1415	1432	1467	1499	1536	1579	1584	1590	1596	1602
1052	1073	1096	1116	1137	1157	1178	1201	1224	1244	1266	1293	1319	1344	1360	1394	1424	1459	1500	1505	1510	1516	1522
996	1017	1039	1057	1077	1096	1116	1138	1159	1179	1200	1225	1249	1273	1289	1320	1349	1382	1421	1426	1431	1436	1442
941	960	981	999	1017	1035	1054	1074	1095	1113	1133	1157	1180	1203	1217	1247	1274	1306	1342	1346	1351	1357	1362
886	904	923	940	958	974	992	1011	1030	1048	1066	1089	1110	1132	1146	1174	1199	1229	1263	1267	1272	1277	1282
830	847	865	881	898	913	930	948	966	982	1000	1021	1041	1061	1074	1100	1124	1152	1184	1188	1192	1197	1201
819	836	854	869	886	901	918	935	953	969	986	1007	1027	1047	1060	1086	1109	1137	1168	1172	1177	1181	1185
808	825	842	858	874	889	905	923	940	956	973	994	1013	1033	1045	1071	1094	1121	1153	1156	1161	1165	1169
797	814	831	846	862	877	893	910	927	943	960	980	999	1019	1031	1056	1079	1106	1137	1140	1145	1149	1153
786	802	819	834	850	865	880	897	914	930	946	966	985	1005	1017	1042	1064	1091	1121	1125	1129	1133	1137
775	791	808	822	838	853	868	885	902	917	933	953	972	990	1002	1027	1049	1075	1105	1109	1113	1117	1121
760	792	849	859	894	924	964	975	991	1024	1069	1091	1124	1167	1178	1194	1220	1240	1281	1287	1292	1298	1304
722	752	807	816	849	878	916	926	941	973	1016	1036	1068	1109	1119	1134	1159	1178	1217	1223	1227	1233	1239
684	713	764	773	805	832	868	877	892	922	962	982	1012	1050	1060	1075	1098	1116	1153	1158	1163	1168	1174
646	673	722	730	760	785	819	829	842	870	909	927	955	992	1001	1015	1037	1054	1089	1094	1098	1103	1108
608	634	679	687	715	739	771	780	793	819	855	873	899	934	942	955	976	992	1025	1030	1034	1038	1043
570	594	637	644	670	693	723	731	743	768	802	818	843	875	883	895	915	930	961	965	969	973	978
562	586	628	636	662	684	713	721	733	758	791	807	832	864	872	884	903	918	948	952	956	961	965
555	578	620	627	653	675	704	712	723	748	780	796	821	852	860	872	891	905	935	940	943	948	952
547	570	611	618	644	665	694	702	714	737	770	786	809	840	848	860	878	893	922	927	930	935	939
540	562	603	610	635	656	684	692	704	727	759	775	798	829	836	848	866	880	910	914	917	922	926
532	554	594	601	626	647	675	682	694	717	748	764	787	817	825	836	854	868	897	901	904	909	913
1338	1366	1394	1420	1447	1472	1499	1527	1556	1583	1611	1644	1677	1710	1730	1773	1811	1856	1908	1914	1921	1928	1935
747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747	747
624	624	624	624	624																		
478	478	478	478	478																		
1158	1231	1305	1345	1365																		
766	766	766	766	766																		
387																						
440																						
443																						
457																						
676	704	755	763	795	821	857	866	880	910	950	970	999	1037	1047	1061	1084	1102	1138	1143	1148	1153	1159
1146	1219	1292	1331	1351																		
452	452	452	452	452																		
1142																						
1285																						
1298																						