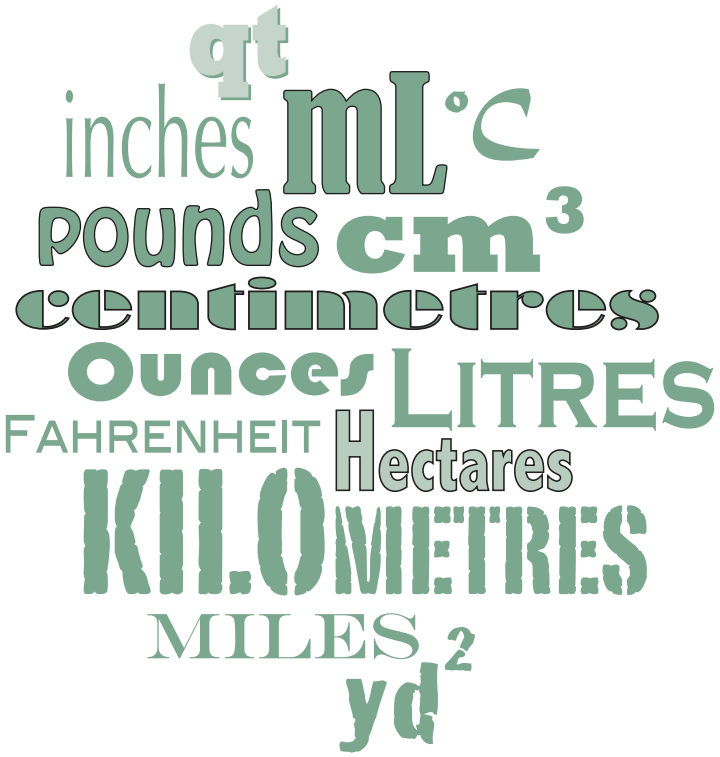
Version 01

The Imperial System

Apprenticeship and Workplace Mathematics (Grade 10/Literacy Foundations Level 7)



OPEN SCHOOL BC

Course History

New, March 2012

Project Partners

This course was developed in partnership with the Distributed Learning Resources Branch of Alberta Education and the following organizations:

- Black Gold Regional Schools
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Viewing Your PDF Learning Package

This PDF Learning Package is designed to be viewed in Acrobat. If you are using the optional media resources, you should be able to link directly to the resource from the pdf viewed in Acrobat Reader. The links may not work as expected with other pdf viewers.

Download Adobe Acrobat Reader:
http://get.adobe.com/reader/

Section Organization

This section on The Imperial System is made up of several lessons.

Lessons

Lessons have a combination of reading and hands-on activities to give you a chance to process the material while being an active learner. Each lesson is made up of the following parts:

Essential Questions

The essential questions included here are based on the main concepts in each lesson. These help you focus on what you will learn in the lesson.

Focus

This is a brief introduction to the lesson.

Get Started

This is a quick refresher of the key information and skills you will need to be successful in the lesson.

Activities

Throughout the lesson you will see three types of activities:

- Try This activities are hands-on, exploratory activities.
- Self-Check activities provide practice with the skills and concepts recently taught.
- Mastering Concepts activities extend and apply the skills you learned in the lesson.

You will mark these activities using the solutions at the end of each section.

Explore

Here you will explore new concepts, make predictions, and discover patterns.

Bringing Ideas Together

This is the main teaching part of the lesson. Here, you will build on the ideas from the Get Started and the Explore. You will expand your knowledge and practice your new skills.

Lesson Summary

This is a brief summary of the lesson content as well as some instructions on what to do next.

At the end of each section you will find:

Solutions
This contains all of the solutions to the Activities.

Appendix
Here you will find the Data Pages along with other extra resources that you need to complete the section. You will be directed to these as needed.

Glossary
This is a list of key terms and their definitions.

Throughout the section, you will see the following features:

Icons
Throughout the section you will see a few icons used on the left-hand side of the page. These icons are used to signal a change in activity or to bring your attention to important instructions.

AWM online resource (optional)
This indicates a resource available on the internet. If you do not have access, you may skip these sections.

Solutions

My Notes

The column on the outside edge of most pages is called "My Notes". You can use this space to:

- write questions about things you don't understand.
- note things that you want to look at again.
- draw pictures that help you understand the math.
- identify words that you don't understand.
- connect what you are learning to what you already know.
- make your own notes or comments.

Materials and Resources

There is no textbook required for this course.

You will be expected to have certain tools and materials at your disposal while working on the lessons. When you begin a lesson, have a look at the list of items you will need. You can find this list on the first page of the lesson, right under the lesson title.

In general, you should have the following things handy while you work on your lessons:

- a scientific calculator
- a ruler
- a geometry set
- Data Pages (found in the appendix)

The Imperial System

Canada is a trading nation with strong links to its past. It is a member of the British Commonwealth and, until the latter half of the twentieth century, used the system of weights and measures that evolved in Britain. This system is known as the imperial system. You likely recognize many units from this system such as the foot, yard, and mile, the acre, the gallon, the pound, and degrees Fahrenheit. Canada's largest trading partner, the United States, still uses a modified form of the imperial system. American standard units and imperial units are still used in Canada in many of the trades. Carpenters, plumbers, and mechanics, to name a few, must be familiar with metric and imperial units.

Photo by Maisei Raman © 2010

In this section you will:

- describe the relationships of the units of length, area, volume, capacity, mass and temperature in the imperial system.
- compare the American and British imperial units.
- convert between imperial and SI units.

Lesson A
Length

To complete this lesson, you will need:

- a ruler or a tape measure that shows inches
- the Data Pages found in the appendix

In this lesson, you will complete:

- 8 activities

Essential Questions

- How are lengths and distances commonly measured in the imperial system?
- How are the units of the imperial system related to each other?
- length and distance be converted between the imperial and metric systems?

My Notes

Focus

Have you thought about a career in the construction trades? Many trades still work with feet (ft or ′) and inches (in or ″)—part of the imperial system of weights and measures.

Photo by Paul Matthew Photography © 2010

Did You Know?

The imperial system of weights and measures was first defined in 1824—less than 200 years ago!

If you talk to framing carpenters, they will point out that interior drywall and exterior sheeting commonly used throughout North America is manufactured in 4-ft × 8-ft lengths.

Drywall and sheeting are screwed to vertical posts called studs. Framing carpenters must carefully measure the horizontal distances between studs so the ends of the sheeting or drywall fall in the middle of the studs and can be screwed on securely. Do you know how far apart vertical studs are in a new home?

Get Started

My Notes

In ancient times, people used parts of their bodies as units of measure. In Ancient Egypt, the *cubit* was a unit of measure based on the length of one's forearm. One cubit is equal to the distance from your elbow to the tip of your middle finger. In the next activity you will look at how thumb-widths and foot-lengths can be used to measure distances.

Activity 1
Try This

In the past, common units of measure were the length of a person's foot and, for smaller measures, the width of a person's thumb just below the nail. On a sheet of paper, carefully trace your foot. (Save your tracing. You will use it again later in this lesson.)

1. How many thumb-widths long is the tracing of your foot?

   _____

2. What fraction of your traced foot is your thumb width?

   _____

Turn to the solutions at the end of the section and mark your work.

My Notes

Why is it important to have consistency within a system of measurement?

Fractions in the Imperial System

Since the size of feet and thumbs differs from person to person, standard lengths must be set in order for measurements to be consistent. Common units of length in the imperial system are the standard **foot** and the **inch**.

Did you find that your foot was about 12 thumbs in width, and each thumb was $\frac{1}{12}$ of a foot? _____

To work with lengths in the imperial system, you will need to polish your skills in adding and subtracting fractions. Please take a look at the following example.

Example 1

Add the following fractions:

$$\frac{3}{4}+\frac{5}{8}$$

Solution

$$\frac{3}{4}+\frac{5}{8}=\frac{3\times 2}{4\times 2}+\frac{5}{8}$$

The common denominator is 8.

$$=\frac{6}{8}+\frac{5}{8}$$

Leave the denominators the same, and add the numerators.

$$=\frac{11}{8}$$

$$=1\frac{3}{8}$$

This is an improper fraction. Change it to a mixed number. Remember, $1=\frac{8}{8}$

Activity 2
Self-Check

My Notes

Complete the following operations.

1. $\frac{3}{8}+1\frac{7}{16}=$

2. $2\frac{1}{2}-\frac{3}{4}=$

Turn to the solutions at the end of the section and mark your work.

Explore

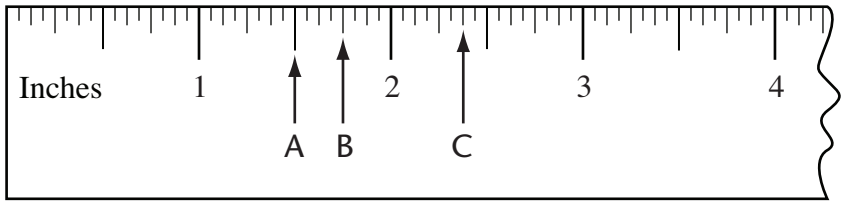
In this lesson you will use a ruler or tape measure with inches marked. By studying these markings on a ruler, you can learn to use your ruler to measure lengths properly.

My Notes

Activity 3
Try This

Have a look at your ruler or tape measure. Examine the lines that are marked on the ruler showing inches and parts of inches. What do all those lines mean? The longest vertical lines on the ruler are located every whole inch. These lines are at 1 in, 2 in, 3 in, and so on.

Now, have a look at the graphic below. It shows a close-up of a ruler with some of the divisions labeled.



1. What do the second-longest lines (labeled A on the ruler) mark?

   _____

   _____

2. What fraction do the third-longest lines (labeled B on the ruler) mark?

   _____

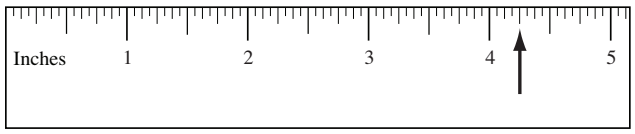
3. What do the next shorter lines (line C on the ruler) mark?

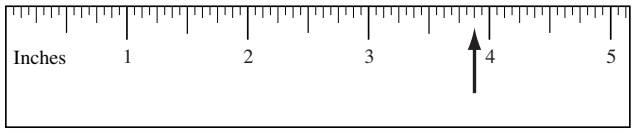
   _____

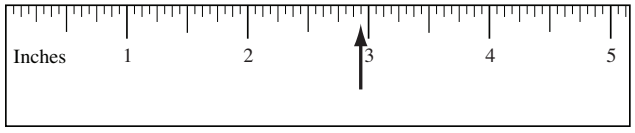
   Notice: the shorter the line, the smaller the fraction of an inch it represents. As the lengths of the lines decrease, each measure is $\frac{1}{2}$ of the previous measure.

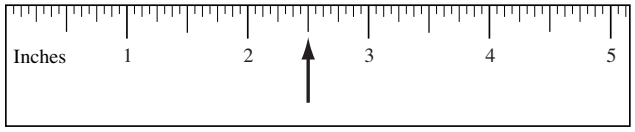
My Notes

4. State each measure to the nearest fraction of an inch.

a. 

b. 

c. 

d. 

5. Use your ruler or tape measure to measure four items of your choice. Use the lines on your ruler or tape measure to be as precise as you can be.

Item Measured	Measurement

Turn to the solutions at the end of the section and mark your work.

My Notes

Bringing Ideas Together

In Get Started you discovered that there are about 12 thumb widths in a foot length. The ancient Romans also divided their foot measure into 12 parts. The word inch comes from the Latin word *uncia*, which means "a 12th part".

Did You Know?

In some languages the same word is used for thumb and inch. For example, in French, the word for both thumb and inch is *pouce*.

Working with Inches

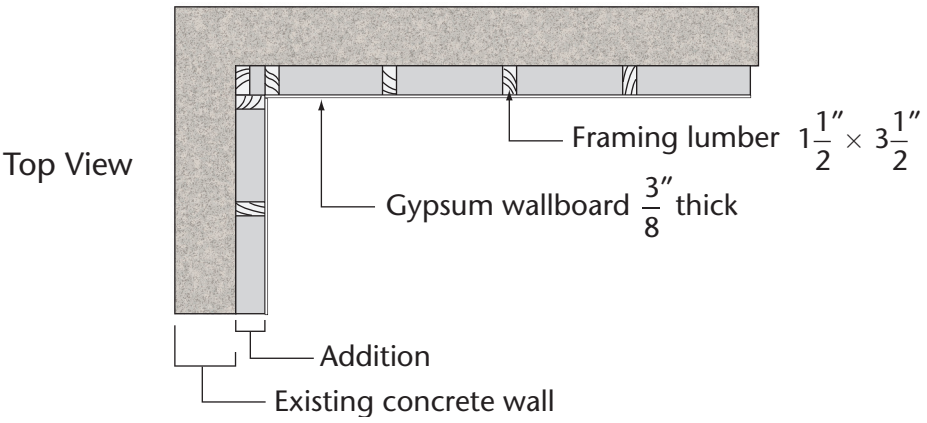
In the imperial system, inches are divided into fractional parts. You saw in Activity 3 that inches can be divided into halves, quarters, eighths, sixteenths and thirty-secondths. To work within the imperial system, it is important to be able to perform operations on these fractions. Let's look at an example.

Example 2

John and his mother are finishing their basement. For the outside walls, they plan to use two-by-four framing lumber.

Two-by-four framing lumber actually measures just $1\frac{1}{2}$ in × $3\frac{1}{2}$ in.

The lumber is to be covered with gypsum board measuring $\frac{3}{8}$ in. How thick will this added layer of the wall be?



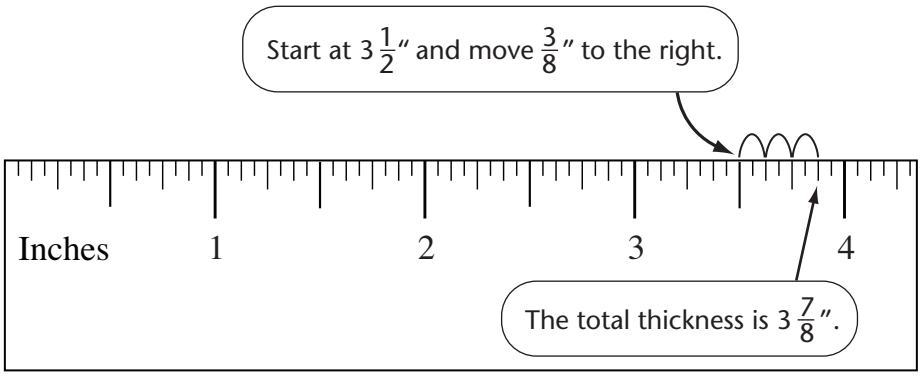
My Notes

Solution

A *two-by-four* is actually $1\frac{1}{2}$" by $3\frac{1}{2}$".

The total thickness of the framing lumber and wallboard is $3\frac{1}{2}+\frac{3}{8}$.

These fractions can be added using a ruler.



Alternatively, you could add the fractions using pencil and paper:

$$3\frac{1}{2}+\frac{3}{8}=3\frac{1\times4}{2\times4}+\frac{3}{8}$$

The common denominator is 8.

$$=3\frac{4}{8}+\frac{3}{8}$$

$$=3\frac{7}{8}$$

The total thickness of the framing lumber and wallboard is $3\frac{7}{8}$ inches.

My Notes

Activity 4
Self-Check

Pat wants to plane some wood off the width of a two-by-six. If a two-by-six is $5\frac{1}{2}$ in wide, determine what the finished width would be if:

Photo by Uwe Bumann © 2010

a. $\frac{3}{16}''$ is planed off.

b. $\frac{5}{32}''$ is planed off.

Turn to the solutions at the end of the section and mark your work.

Feet and Inches

My Notes

At the beginning of this lesson you traced your foot. Retrieve your tracing and measure it using your ruler or tape measure. How long, in inches, is your foot?

Answer: _____

In the imperial system, there are 12 inches in a standard foot.

$$1 \text{ ft} = 12 \text{ in}$$

or

$$1 \text{ in} = \frac{1}{12} \text{ ft}$$

Let's try converting between these units.

Example 3

An Iroquois longhouse was 79'11" long. What was the length of the longhouse in inches?

Solution

1 ft = 12 in

So,

$$\begin{aligned} 79\,\text{ft} &= (79 \times 12)\,\text{in} \\ &= 948\,\text{in} \end{aligned}$$

$$\begin{aligned} 79'11'' &= 79\,\text{ft}\ 11\,\text{in} \\ &= 948\,\text{in} + 11\,\text{in} \\ &= 959\,\text{in} \end{aligned}$$

The Iroquois longhouse was 959 inches long.

My Notes

Example 4

Meilin is 53 in tall. What is her height in feet and inches?

Solution

Remember, 12 in = 1 ft.

Divide 53 by 12 to get the number of feet.

$$53 \text{ in} = \frac{53}{12} \text{ ft}$$
$$= 4.416 \text{ ft}$$

She is more than 4 ft tall—but how much more?

$$4 \text{ ft} = 4(12)\text{in}$$
$$= 48 \text{ in}$$

4 feet is the same as 48 inches. How many more inches is 53 in?

$$53 \text{ in} - 48 \text{ in} = 5 \text{ in}$$

So,

$$53 \text{ in} = 48 \text{ in} + 5 \text{ in}$$
$$= 4 \text{ ft} + 5 \text{ in}$$
$$= 4' \, 5"$$

Meilin is 4' 5" tall.

Note: In this example, a calculator was used to do the division. If long division were used, the quotient would be the number of feet and the remainder would be the number of inches.

$$\begin{array}{r} 4 \\ 12\overline{)53} \\ \underline{48} \\ 5 \end{array}$$

quotient = # of feet

remainder = # of inches

Activity 5
Self-Check

My Notes

Please answer the questions below.

1. One of the tallest women in the world is De-Fen Yao. She is 93 in tall. How tall is she in feet and inches?

2. The 2008 women's Olympic record in pole vaulting is $16' \, 6\frac{3}{4}''$. What is this record in inches?

My Notes

3. Janice is cutting 1′3″ off a 7′ board. After the cut, what is the length of the board in feet and inches?

4. Add 5′7″, 3′4″, and 6′5″.

Turn to the solutions at the end of the section and mark your work.

More Imperial Units of Length

For distances too long to measure with inches or feet, **yards** and **miles** are the imperial units used.

The word yard comes from the Old English word, *gyrd,* for stick. A yard is about the width of a front door, or the distance from your nose to the tips of your fingers when you stretch your arm to the side.

If you've ever been to the United States, you may have seen road signs posted in miles. A mile is longer than a kilometre. A speed of 100 km/h is about 60 mph.

My Notes

Did You Know?

The mile originated in Ancient Rome. In Rome, two steps were called a *passus*. A passus was about five feet. One thousand passus was the Roman mile. The English word *mile* comes from the Latin word *mille*, which means 1000. About how many steps is a mile? 1 passus = 2 steps, so 1000 passus = 2000 steps—a good approximation, even today, for the mile!

My Notes

Activity 6
Try This

The multimedia *Imperial System Length Conversion* can be used to convert one unit of length in the imperial system to another unit. Move the left slider according to the unit you are starting with and the right slider to the units you are converting to.

If you have access, you may use *Imperial System Length Conversion* (http://media.openschool.bc.ca/osbcmedia/math/mathawm10/html/implengthconvert/lengthImpConvert.htm) to help summarize the conversion equivalents used so far in this lesson.

Use *Imperial System Length Conversion* to fill in the blanks:

1 mi = _____ yd

1 yd = _____ ft

1 ft = _____ in

Turn to the solutions at the end of the section and mark your work.

Conversions

You've already had some practice converting between feet and inches. In the next examples you'll see two calculation methods for converting between units. If you already have a method that you like to use, feel free to use it!

Example 5

Jack's driveway is 57 ft long. What is that distance in yards?

My Notes

Solution

Method 1—Using Proportions

First, write a **proportion** with the question information on one side and the conversion information on the other side.

Let n be the distance in yards.

$$\frac{n}{57\text{ ft}} = \frac{1\text{ yd}}{3\text{ ft}}$$

Make sure the units in the numerators are the same.

Make sure the units in the denominators are the same.

$$\frac{n}{57\text{ ft}} = \frac{1\text{ yd}}{3\text{ ft}}$$

Find the cross products to solve the proportion.

$$n(3\text{ ft}) = (1\text{ yd})(57\text{ ft})$$

Divide by 3 to get *n* by itself.

$$n = \frac{(1\text{ yd})(57\text{ ft})}{(3\text{ ft})}$$

$$n = 19\text{ yd}$$

Jack's driveway is 19 yd long.

Method 2—Multiplying or Dividing by a Conversion Factor

You may have noticed in the solution above, that you could have simply divided by 3 to get the answer. In this case, since 1 yd = 3 ft, 3 is the conversion factor.

$$\begin{aligned} 57\text{ ft} &= \text{yards} \\ &= (57 \div 3)\text{ yd} \\ &= 19\text{ yd} \end{aligned}$$

The conversion factor is 3. You divide because yards are bigger than feet so there will be less of them.

Jack's driveway is 19 yd long.

You can see that you'll get the same answer with both methods. Whichever method you use, make sure to show your work!

You can find a list of conversion factors on your Data Pages. Get yours now and have a look. You'll find the Data Pages in the Appendix at the end of the section. Keep this handy as you go through the rest of the lesson.

My Notes

Example 6

Convert 4400 yards to miles.

Method 1—Using Proportions

Let x be the number of miles in 4400 yards.

$$\frac{4400 \text{ yards}}{x} = \frac{1760 \text{ yards}}{1 \text{ mi}}$$

$$x(1760) = 4400(1 \text{ mi})$$

$$x = \frac{(4400 \text{ yd})(1 \text{ mi})}{1760 \text{ yd}}$$

$$x = 2.5 \text{ mi}$$

There should be fewer miles because they are bigger, so this answer is reasonable.

Method 2—Multiplying or Dividing by a Conversion Factor

$$4400 \text{ yd} = \_\_\_\_\_ \text{ mi}$$
$$= (4400 \div 1760) \text{ yd}$$
$$= 2.5 \text{ mi}$$

The conversion factor is 1760. You divide because miles are bigger than yards so there will be less of them.

Activity 7
Self-Check

My Notes

Please complete the questions below. Choose whichever conversion method you like, or try them both!

1. On golf courses, white tees are placed a little closer to the green than the blue tees. If you are playing from the white tees, the Mountain View Golf Course in Whitehorse, Yukon, is 6114 yd long. How many miles long is that length? Round your answer to the nearest tenth of a mile.

2. Marcie is driving to her friend's farm. Her friend's father said their house was a quarter mile off the main road. How many yards off the main road does Marcie's friend live?

3. A quarter section of land is a square one-half mile on each side. How many feet of fencing would be needed to fence a quarter section?

My Notes

4. A Canadian Football League field is 110 yd from goal line to goal line. How many feet is 110 yd?

5. Barbara is fencing a quarter mile of pasture on her farm. If she decides to use three strands of barbed wire, how many feet of wire will she need altogether?

Turn to the solutions at the end of the section and mark your work.

Converting Between Imperial and Metric Units

My Notes

While the metric system is standard in Canada, the imperial system is still used in the United States. Many Canadians travel to the United States and many businesses trade goods and services across the border. For these reasons, and others, it is important to be able to translate between the metric and imperial systems.

Take out your ruler or tape measure. Does it have both imperial and metric measurements marked? If so, answer the following questions.

How many centimetres are there in an inch?

Answer: _____

How many centimetres are there in a foot?

Answer: _____

The modern inch is about 2.54 cm in length. Since there are 12 inches in one foot, there are (12 × 2.54) cm, or 30.48 cm in a foot.

Have a look at the "Table of Conversions" in your Data Pages. You will see that this table lists the conversion factors to use to convert between the metric and imperial systems.

The Data Pages can be found in the Appendix.

The process of converting between units of different systems is the same as when you were working within a single system. Simply use the "Table of Conversions" along with whichever calculation method you prefer. We'll do one example before moving to the Activity.

Example 7

While travelling in the United States you see a sign that says the next gas station is 110 miles away. You look at your fuel gauge and know you have enough gas left for about 150 km. Do you stop now for gas, or do you continue driving?

My Notes

Solution

Method 1 – Using Proportions

Look at the "Table of Conversions" on your Data Pages. Find the conversion you need.

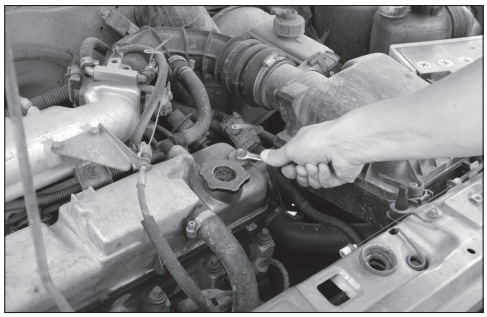


Photo by Tselichtchev © 2010

1 mi = 1.6 km

Now set up your proportion.

Let x be the distance in kilometres.

$$\frac{110 \text{ mi}}{x} = \frac{1 \text{ mi}}{1.6 \text{ km}}$$

Remember to keep the same units on the top!

$$x(1 \text{ mi}) = (110 \text{ mi})(1.6 \text{ km})$$

Notice that you are multiplying by 1.6

$$x = \frac{(110 \cancel{\text{mi}})(1.6 \text{ km})}{1 \cancel{\text{mi}}}$$

$$x = 176 \text{ km}$$

This answer is reasonable. Kilometres are smaller than miles so there should be more kilometres.

Since you only have enough gas to drive 150 km, you should stop and fill up your tank now, otherwise you won't make it to the next gas station!

Method 2—Multiplying or Dividing by a Conversion Factor

Look at the "Table of *Co*nversions" on your Data Pages. Find the conversion you need.

1 mi = 1.6 km

Now calculate.

$$110 \text{ mi} = \_\_\_\_\_ \text{ km}$$
$$= (110 \times 1.6) \text{ km}$$
$$= 176 \text{ km}$$

The conversion factor is 1.6. You multiply because kilometres are smaller than miles so there will be more of them.

Using this method, you get the same answer—you should stop for gas now!

Activity 8
Self-Check

My Notes

Please answer the following questions. You may use the Data Pages.

1. A television screen measures 21 in on the diagonal. How many centimetres is the screen's diagonal?

2. Jack is 6 ft 2 in tall. What is his height to the nearest centimetre?

My Notes

3. The distance from Michael's house to the Red Pheasant First Nation is 12.3 km. How far is this distance in miles? Round your answer to 1 decimal place.

Turn to the solutions at the end of the section and mark your work.

There are many online tools that you can use to make conversions quickly and easily. Visit the *AWM Website (http://www.openschool.bc.ca/courses/math/awm10)* for links to some of these tools.

Lesson Summary

My Notes

Building a new home means reading, interpreting, and applying an architect's plans. Framing carpenters must make careful measurements so everything fits together properly as intended. Measurements, even in modern construction, are often made using the imperial system.

Photo by Fever Pitch © 2010

In this lesson you discovered that the common units of length in the imperial system are the inch, foot, yard, and mile. You examined how they are applied in situations and how one unit can be converted to another. You also converted between the metric and imperial measurement systems.

Lesson B
Area

To complete this lesson, you will need:

- a ruler that shows feet and inches
- a tape measure that shows feet and inches
- newspapers
- scissors
- a marker
- a calculator
- the Data Pages found in the appendix

In this lesson, you will complete:

- 8 activities

Essential Questions

- How are areas commonly measured in the imperial system?
- How are the units of area related?
- How can you convert between these units and area units in the SI (metric) system?

My Notes

Focus

Have you ever taken on, or helped out with, a renovation or redecoration project? Have you installed new flooring or new carpets?

Photo by Lepas © 2010

If you've been to a carpet outlet, you may have noticed that the price is often quoted by both the square metre and the **square yard**. The price per square yard is often featured more prominently because it looks cheaper. A square yard is smaller than a square metre, so the price per square yard is less than the price per square metre. However, it doesn't matter if you pay per square yard or per square foot—the cost to carpet a certain area (like your bedroom, for example) will be the same.

Get Started

Which do you find easier—converting among units within the SI (metric) system or in the imperial system? Why?

Most people find converting among units within the SI system easier. To convert among SI units, you just have to move the decimal to the left or right. SI units are defined in terms of powers of ten! But to convert among imperial units, you have to multiply or divide by numbers different from 10; for example, to convert miles to feet, you must multiply by 5280.

My Notes

Most people use a calculator to convert among imperial measures. However, it is easy to make a mistake keying in the numbers or operations. To check if the answer your calculator displays is reasonable, you must use your estimation skills and a little mental arithmetic. These are skills you will use throughout your life—on the job, shopping, or around the home.

The next example may help you recall estimation skills you developed in previous math courses.

Example 1

Estimate the number of inches in 19 ft. Then calculate the exact answer carefully with a calculator to see if your estimate is reasonably accurate.

Solution

19 ft = (19 × 12) in

To estimate, round each number to the nearest ten.

19 rounds to 20 because 19 is closer to 20 than 10.
12 rounds to 10 because 12 is closer to 10 than 20.

So, 19 × 12 is about 20 × 10 or 200. In 19 ft, there are about 200 in.

This estimate makes sense since the exact answer is 228 in!

This example illustrates how you can estimate products quickly in your head. First round each number so there is only one digit that is not zero. Then multiply the rounded values together. You can use this skill in the next activity, and throughout this course.

My Notes

Activity 1
Try This

Below, you will find a sample of a student's solution to a math problem. The student's solution contains an error! In this activity, you will read carefully through the solution and answer the questions that follow it.

Problem:
Convert 39 miles to a distance in yards.

Student Solution:

let x = the distance in yards

$$\frac{x}{39\ mi} = \frac{1760\ yd}{1\ mi}$$

$$x(1\ mi) = (1760\ yd)(39\ mi)$$

$$x = \frac{(1760\ yd)(39\ mi)}{(1\ mi)}$$

$$x = 29\ 640\ yd$$

39 miles is equal to 29 640 yards

1. Where did the student make his or her mistake?

2. Estimate the correct answer.

3. What is the exact answer?

My Notes

4. How could estimation have helped this student recognize their error?

Turn to the solutions at the end of the section and mark your work.

Is Your Answer Reasonable?

Often estimation is used to determine a product to save you finding the exact product with your calculator or with a long-hand method. But while you are developing your estimation skills, you can use the exact answer to confirm that you are estimating correctly. Calculating the exact answer allows you to confirm that your estimation skills are in good shape.

Once you have developed confidence in your estimation skills, you can use your estimated answers to judge whether a calculated answer is reasonable.

My Notes

Activity 2
Try This

First, estimate the product and write down your estimate. Then use a calculator to find the exact answer. Compare your estimates with the answers shown on the calculator.

1. 31 × 5280

2. 480 × 12

3. 13 × 27

4. 162.5 × 144

Turn to the solutions at the end of the section and mark your work.

Explore

In the Imperial System, area can be measured in **square inches**, **square feet**, and **square yards**.

How do the square inch, square foot, and square yard compare with each other in size? That's what you will investigate next.

Photo by Filaphoto © 2010

My Notes

Activity 3
Try This

You will need a ruler and a tape measure that shows feet and inches, old newspapers, scissors, a marker, a calculator, and your estimation skills!

From an old newspaper, cut out at least 13 identical squares. Each square must measure one foot on each side, so be sure to use your ruler! Each of these squares is *one square foot*.

With your marker, write the words square foot on each square.

Next arrange as many of these squares as is necessary to form a large square three feet on each side.

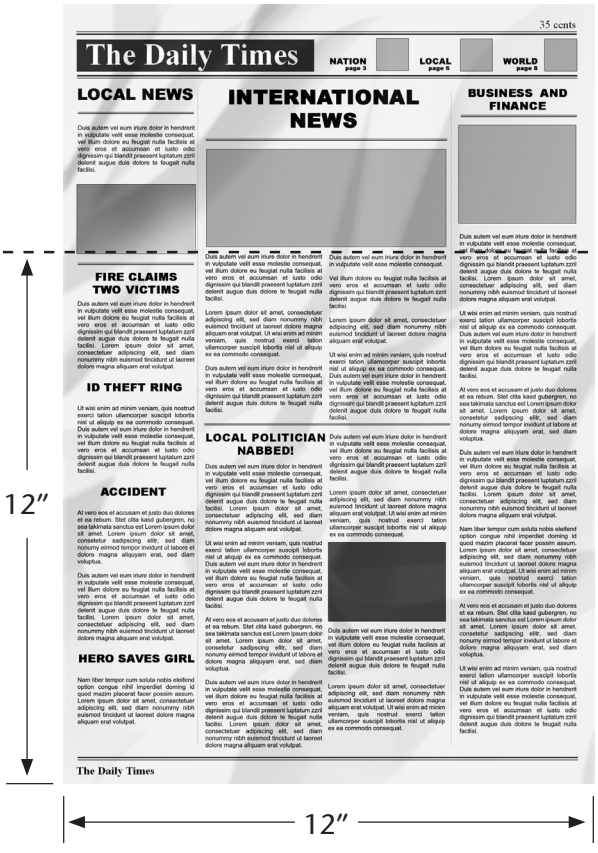


Photo by R. Cherubin © 2010

My Notes

1. a. How many square feet are there in your arrangement?

b. What might you call this large square area? (Hint: 3 ft = 1 yd)

Now you'll need one of the square feet. From the corner of the square foot, cut a small square that measures one inch on each side. This small square is one square inch.

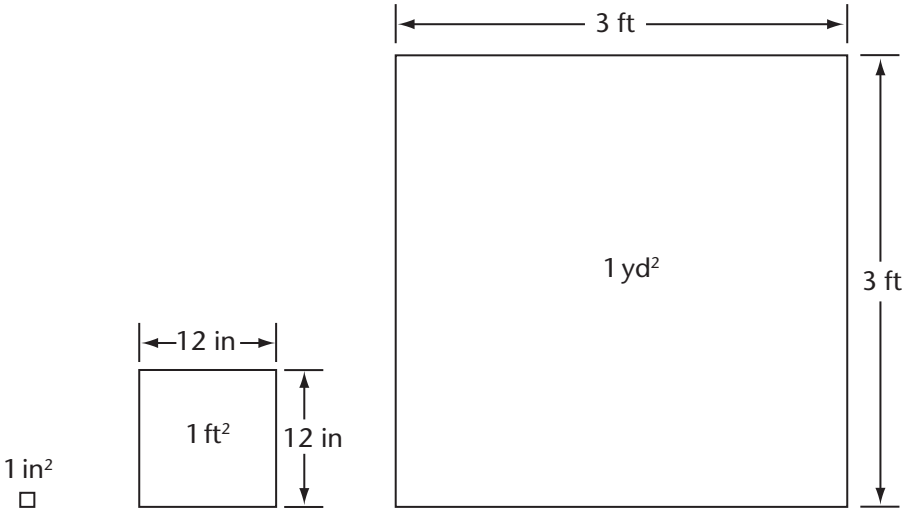
2. a. How many square inches are there in a square foot? (Hint: you may need to draw on your square foot.)

b. How did you arrive at your answer?

Turn to the solutions at the end of the section and mark your work.

Bringing Ideas Together

My Notes



You have discovered that the squares having a side length of an inch, foot, or yard can be used as units of area. The related area units are square inch, square foot, and square yard.

In Explore you discovered:

- A foot is 12 in long, so the area of a square foot is $12\,\text{in} \times 12\,\text{in} = 144\,\text{in}^2$.
  So, $1\ \text{ft}^2 = 144\,\text{in}^2$.

- A yard is 3 ft long, so the area of a square yard is $3\ \text{ft} \times 3\ \text{ft} = 9\ \text{ft}^2$.
  So, $1\ \text{yd}^2 = 9\ \text{ft}^2$.

Example 2

A wigwam, which is a semicircular structure originally made by First Nations out of young tree saplings, has an interior close to the shape of a rectangle. The interior is 12 ft by 9 ft 3 in.

a. What is the area of the wigwam in square feet? Estimate your answer first and then calculate the exact answer.

b. What is the area of the wigwam in square yards?

My Notes

If you have internet access, you can also view the animated *Area of a Wigwam Solution* (http://media.openschool.bc.ca/osbcmedia/math/mathawm10/html/area_of_wigwam.htm) as an animation.

Part a: Estimation

Round 9 ft 3 in → 9 ft

$$l \times w = 12 \text{ ft}^2 \times 9 \text{ ft}$$
$$= 108 \text{ ft}^2$$

The actual answer should be slightly bigger, since 9 ft 3 in was reduced to 9 ft.

Part b: Exact Calculation

$$A = l \times w$$

Convert 9 feet 3 inches into feet only. Remember that one foot has 12 inches.

$$1 \text{ ft} = 12 \text{ in}$$

So 3 inches is 3/12th of a foot.

$$A = l \times w$$
$$9 \text{ ft } 3 \text{ in} = 9 \text{ ft} + \frac{3}{12} \text{ ft}$$

Substitute the values for length and width into the formula:

$$A = l \times w$$
$$= 12 \text{ ft} \times 9\frac{3}{12} \text{ ft}$$

Solve for Area:

$$A = 12 \text{ ft} \times 9\frac{3}{12} \text{ ft}$$
$$= 108 \text{ ft}^2 + \frac{36}{12} \text{ ft}^2$$

Remember that you multiply 12 × 9 to get 108 square feet.

$$A = 12 \text{ ft} \times 9\frac{3}{12} \text{ ft}$$
$$= 108 \text{ ft}^2 + \frac{36}{12} \text{ ft}^2$$

My Notes

Then you multiply 12 by $\frac{3}{12}^{\text{ths}}$ to get $\frac{36}{12}$.

$\frac{36}{12}$ is equal to 3:

$$\begin{aligned} A &= 108 \text{ ft}^2 + 3 \text{ ft}^2 \\ &= 111 \text{ ft}^2 \end{aligned}$$

So the area of the wigwam equals 111 square feet.

You can also use your calculator for this problem. If you use your calculator, you'll get rid of the fractions by dividing.

Alternative Calculator Method

$$\begin{aligned} 9 \text{ ft } 3 \text{ ft} &= 9 \text{ ft} + \frac{3}{12} \text{ ft} \\ &= 9 \text{ ft} + 0.25 \text{ ft} \\ &= 9.25 \text{ ft} \\ A &= l \times w \\ &= 12 \text{ ft} + 9.25 \text{ ft} \\ &= 111 \text{ ft}^2 \end{aligned}$$

You may have noticed that the second method uses decimals. Generally, decimals are not used in imperial units of length and area; fractions are more commonly used. We have included the second method because there are times when using decimals makes the calculation easier. Please make sure you understand both methods before moving on.

Example 3

Dawn bought wallpaper for her bedroom. The roll of wallpaper is $20\frac{1}{2}$ in wide. Dawn's walls are 8 ft high. She plans to cover the walls in vertical strips from floor to ceiling. What is the area that can be covered with one vertical strip of wallpaper?

Estimate first to predict an answer that would make sense.

My Notes

Solution

Estimate first.

$20\frac{1}{2}$ inches is just less than 24 in or 2 ft.

An 8-ft strip, which is 2 ft wide, covers 8 ft × 2 ft or 16 ft^2.

Now use your calculator to determine the area more precisely.

$$20\frac{1}{2}\text{ in} = \left(20\frac{1}{2} \div 12\right)\text{ft}$$

Dividing by 12 is the same as multiplying by $\frac{1}{12}$.

$$= \left(20\frac{1}{2} \times \frac{1}{12}\right)\text{ft}$$

Change the mixed number to an improper fraction.

$$= \left(\frac{41}{2} \times \frac{1}{12}\right)\text{ft}$$

$$= \frac{41}{24}\text{ft}$$

Since we need to complete another operation with this fraction, leave it as an improper fraction.

Now, find the area that can be covered with one strip of wallpaper.

Since $A = l \times w$,

$$= \frac{41}{24}\text{ft} \times 8\text{ft}$$

$8 = \frac{8}{1}$

$$= \frac{41}{\cancel{24}_{3}}\text{ft} \times \frac{\cancel{8}^{1}}{1}\text{ft}$$

Simplify

$$= \frac{41}{3}\text{ft} \times \frac{1}{1}\text{ft}$$

$$= \frac{41}{3}\text{ft}^2$$

Change the improper fraction to a mixed number

$$= 13\frac{2}{3}\text{ft}^2$$

Each strip of wallpaper covers $13\frac{2}{3}\text{ft}^2$

Alternate solution using decimal values:

You must first convert $20\frac{1}{2}$ in to feet.

width = $20\frac{1}{2}$ in

Divide 20.5 by 12 on your calculator.

= 1.708333... ft

Hint: Leave this answer on your calculator display.

Since $A = l \times w$,

$= 1.708333... \text{ ft} \times 8 \text{ ft}$

$= 13.67 \text{ ft}^2$

Multiply the answer on your calculator by 8.

Each strip of wallpaper covers about 13.67 ft^2.

Tip

When you do calculations involving multiple steps using your calculator, do not round the result unless it is the final answer to a question. If you need to use this value in subsequent steps, wait until you have reached the final answer before rounding.

My Notes

My Notes

Activity 4
Self-Check

Please complete the questions that follow. Show all of your work. You may use the Data Pages.

1. Jasper wants to install parquet flooring in his kitchen. A parquet floor is a floor made of flat pieces of wood arranged in a pattern. Jasper sees an advertisement in a flyer that quotes prices per square foot. How many square feet will he need if the floor is a rectangle 10 ft 9 in × 11 ft 6 in?

Photo by Baloncici © 2010

2. A sheet of printer paper is 8.5 in × 11 in. Darcy says it is almost 1 ft^2. Is he correct? Explain your answer.

3. Paula purchased a new home 1260 ft^2 in area. What is its area in square yards?

4. Boris's front lawn is a rectangle measuring 50 ft by 30 ft. He purchased a fall fertilizer that must be applied at a rate of 6 lb per 1000 ft^2. How many pounds of fertilizer should he apply?

5. The sole of each of Norma's shoes is 36 in^2 in area. When Norma stands with both feet flat on the floor, what is the total area in square feet that the shoes cover?

6. How many square inches are there in 1 yd^2?

Turn to the solutions at the end of the section and mark your work.

My Notes

My Notes

Beyond the Square Yard

Do you remember the units used in the SI (metric) system for describing larger areas such as the area of a field or even the area of a province?

_____

_____

In the metric system, the hectare and square kilometre are used to describe large areas.

In the imperial system the **acre** and **square mile** are used to describe areas too large to be easily described by the square foot or square yard.

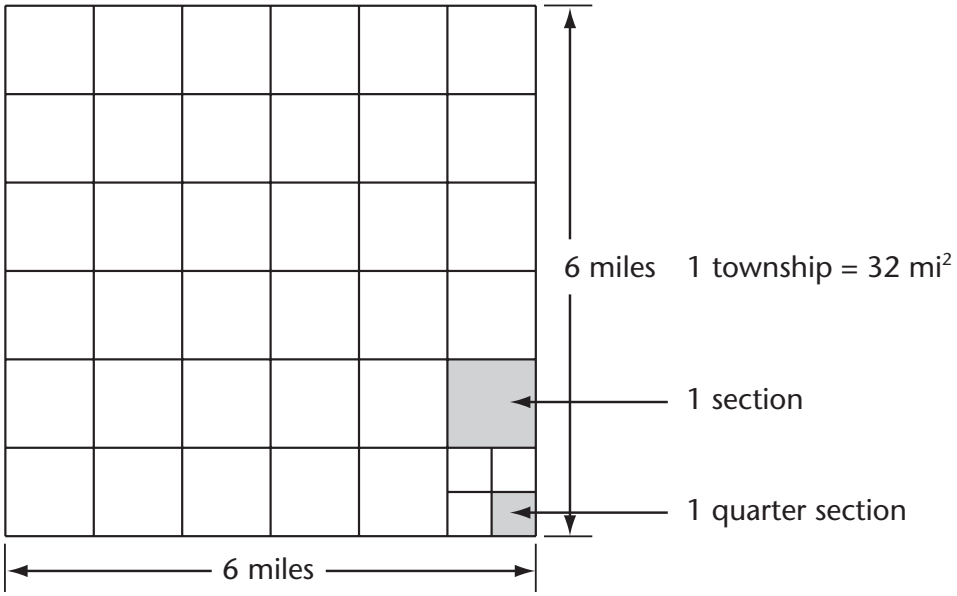
Did You Know?

The acre was originally defined as the area of a field that could be plowed by a single ox in one day. The word acre comes from the Old English word *aecer*, meaning field.

Photo by Kurt De Bruyn © 2010

My Notes

In the last half of the nineteenth century, surveyors mapped Western Canada. The land was divided into squares that measured 6 miles on a side. These large squares were called townships.



A square mile was called a section, so there were 36 sections in a township. Each section was divided into quarters, or quarter sections. Each quarter section was one-half mile by one-half mile. These quarter sections were parcelled out as homesteads. Each quarter section was 160 acres in size. An acre, an imperial area measurement, is a square that measures approximately 70 yards on a side.

Today, you can see evidence of this survey from the air. North-south roads in the country are 1 mile apart. East-west roads are 2 miles apart. Seen from the air, the roads divide the countryside into rectangles measuring 1 mile by 2 miles in size. Each of these rectangles is two sections.

Photo by Fedorov Oleksiy © 2010

My Notes

Example 4

An American football field is 360 ft by 160 ft. Is its area much smaller than, roughly the same as, or much larger than one acre?

Solution

Compare the area of the football field to an acre, 4840 yd^2.

$$\begin{aligned}\text{area of field} &= l \times w \\ &= 360 \text{ ft} \times 160 \text{ ft} \\ &= 57\,600 \text{ ft}^2\end{aligned}$$

Convert this area to square yards. Recall, that 1 yd^2 = 9 ft^2.

$$\text{area of field} = \left(\frac{57\,600}{9}\right) \text{yd}^2$$

$$= 6400 \text{ yd}^2$$

An American football field is roughly one acre in area.

In fact, it is 1.3 times larger than an acre as you can see from this calculation:

Photo by Brocreative © 2010

$$\frac{\text{Area of American football field in sq yds}}{\text{Area of one acre in sq yds}} = \frac{6400}{4840}$$

$$\approx 1.3$$

Divide 6400 by 4840 on your calculator.

You can use the interactive multimedia *Imperial System Area Conversion (http://media.openschool.bc.ca/osbcmedia/math/mathawm10/html/impareaconvert/lengthImpConvert.htm)* to confirm the solution to the previous example.

Activity 5
Self-Check

My Notes

Please complete the following problems.

1. There are 160 ac in a quarter section. How many acres are there in a section that is 1 mi^2 in area?

2. When the Doukhobors immigrated to Canada from Russia in 1899, they were granted 773 400 ac for their farms and communities in what is now Saskatchewan and Manitoba. What is the area of this land grant in square miles?

3. According to the United States Department of Agriculture, in 2009, American farmers planted 320.9 million acres of principal crops. What is this acreage in square miles?

My Notes

4. Using your answer from Question 3, how long would the sides of a square be that enclosed 320.9 million acres? Express your answer to the nearest mile.

   Hint: How do you find the side length of any square from its area? For example, what is the side length of a square having an area of 9 mi^2?
   The side length of any square is the square root of its area.
   Since $\sqrt{9} = 3$, each side of the square is 3 mi long.

Turn to the solutions at the end of the section and mark your work.

Converting Between Metric and Imperial

It is often necessary to convert between area measurements in the SI (metric) and imperial systems.

Example 5

How many square centimeters fit in one square inch?

Solution

1 in = 2.54 cm

This comes from the "Table of Conversions" in your Data Pages.

$$1\ \text{in}^2 = 1\ \text{in} \times 1\ \text{in}$$
$$= 2.54\ \text{cm} \times 2.54\ \text{cm}$$
$$= 6.4516\ \text{cm}^2$$

Remember that when you were working with linear measurements, you used the "Table of Conversions" in your Data Pages to help convert between the SI (metric) and imperial measurement systems. As you will see in the next questions, you can create your own table for area measurements.

My Notes

Activity 6
Self-Check

Complete the following tables. Round to 4 decimal places when necessary. Two rows in each table have been done for you.

1.

Imperial	Metric
1 in^2	6.4516 cm^2
1 ft^2	_____ m^2
1 yd^2	_____ m^2
1 ac	0.4047 ha
1 mi^2	_____ km^2

2.

Metric	Imperial
1 cm^2	_____ in^2
1 m^2	_____ ft^2
1 m^2	_____ yd^2
1 ha	2.4711 ac
1 km^2	0.3861 mi^2

Turn to the solutions at the end of the section and mark your work.

My Notes

Converting Between Metric and Imperial (Continued)

The tables you completed in Activity 6 might help you simplify conversions between systems. Let's look at an example before you do some conversions on your own.

Example 6

The area of Jasper's living room is 180 ft^2. What is the area in m^2?

Solution

1 ft^2 = 0.0929 m^2

This is the conversion factor you found in Activity 6.

1 ft^2 - 0.0929 m^2

To solve this, you could set up a proportion.

Let x = the area in square metres.

$$\frac{x}{180\ \text{ft}^2} = \frac{0.0929\ \text{m}^2}{1\ \text{ft}^2}$$

$$x(1\ \text{ft}^2) = (0.0929\ \text{m}^2)(180\ \text{ft}^2)$$

$$x = \frac{(0.0929\ \text{m}^2)(180\ \text{ft}^2)}{(1\ \text{ft}^2)}$$

$$x = 16.722\ \text{m}^2$$

The living room area is about 16.722 m^2.

Activity 7
Self-Check

My Notes

Do the following questions. Use the information from the tables in Activity 6.

1. Nick planted 320 acres of canola. How many hectares of canola did he plant? Round your answer to 1 decimal place.

2. The area of Morris's front lawn is 100 yd^2. What is the area in square metres? Round your answer to the nearest unit.

3. The printed area of a wedding invitation is 150 cm^2. What is the area in in^2? Round your answer to 1 decimal place.

Turn to the solutions at the end of the section and mark your work.

My Notes

There are many online tools that you can use to make conversions quickly and easily. Some are included on the *AWM Website (http://www.openschool.bc.ca/courses/math/awm10)*.

Activity 8
Mastering Concepts

Try this question.

In 2009 in Canada, about 141 000 new homes were constructed. If the average size of each home is 1800 ft^2 in area, how many square miles of new homes does this represent? Express your answer to the nearest square mile.

Turn to the solutions at the end of the section and mark your work.

Lesson Summary

The cost of flooring when building a new home depends on the size of the area that has to be covered. You may have noticed that stores often quote prices for hardwood, linoleum, tile, carpet, and other forms of flooring in dollars per square foot or square yard. The square foot and square yard are imperial units of area.

In this lesson you discovered that common imperial units of area included the square inch, square foot, and square yard. Larger areas are described using the acre and square mile.

Photo by AVAVA © 2010

My Notes

Lesson C
Volume and Capacity

To complete this lesson, you will need:

- a calculator
- a ruler
- a tape measure that shows feet and inches
- Data Pages found in the appendix

In this lesson, you will complete:

- 6 activities

Essential Questions

- How are volumes and capacity commonly measured in the imperial system?
- How are the units related?
- How can you convert between metric and imperial units?

My Notes

Focus

Modern home design incorporates energy conservation. What could you do in your own home to minimize energy consumption?

Photo by Jonathan Larsen © 2010

Marlene and her class are discussing ways people can reduce the amount of energy used in their homes. One student's suggestion was to turn down the thermostat to a cooler, but still comfortable, temperature.

Marlene added that in her home, her mother installed a thermostat that automatically changes the setting to a cooler temperature at night when everyone in her family is asleep. Marlene's mother monitored the amount of natural gas the family used to heat their home this February as compared to previous years and noticed a significant saving.

When the teacher asked Marlene how much natural gas they used in February, she replied, "we only used 20 000 cubic feet—almost 1800 cubic feet less than last year!"

Peter interrupted, "cubic feet? What's a cubic foot?" The teacher replied, "The cubic foot is a unit of volume in the imperial system. Many gas meters still measure the volume of gas consumed in that unit."

Then the class turned their attention to how much 20 000 cubic feet was and how many times you could fill their classroom with 20 000 cubic feet of air!

Get Started

My Notes

In Lesson B you practised estimating the answers to multiplication questions. Remember that your estimation skills are important in deciding whether or not an answer given for a problem seems reasonable.

When working with units in the imperial system, you often multiply or divide by numbers that are difficult to handle mentally. Are there estimation techniques for division that make this task simpler?

The following example shows an estimation technique that relies on rounding each number to numbers that will easily divide into each other.

Example 1

Consider the following division question:

$$217 \div 27$$

Use your calculator to find the answer. _____

Now how could you estimate this answer without a calculator?

_____

_____

_____

Solution

Using your calculator, you should have found

$$217 \div 27 = 8.037...$$

To estimate an answer to this question, follow these steps.

Begin by rounding 27 to one non-zero digit. 27 is between 20 and 30. 27 is closer to 30 than to 20. So, 27 rounds to 30.

Next you should round the number being divided, 217, to two non-zero digits.

Why should you choose to round to two digits rather than one? Suppose you round 217 to one digit. 217 lies between 200 and 300. Because it is closer to 200, 217 rounds to 200.

My Notes

But the 2 in 200 is not divisible by the 3 in 30 a whole number of times. So instead, 217 is rounded to 210 because the 21 in 210 is divisible by the 3 in 30 a whole number of times.

Why wouldn't you round 217 to 220 instead? Well, 3 does not divide into 22 a whole number of times, and we're trying to make the estimate easy to calculate.

What is $21 \div 3$?
$21 \div 3 = 7$

What is $210 \div 30$?
$210 \div 30$ is also 7.

So, the estimated value of $217 \div 27$ is 7, which is close to the value recorded from your calculator.

You just used **compatible numbers** to estimate the answer to a division question.

For example, the numbers 21 and 3 are compatible numbers because 3 divides into 21 a whole number of times.

Example 2

Suppose the following numbers are to be used in a division. Which of the following numbers are compatible numbers?

a. 32 and 7
b. 15 and 5
c. 44 and 11
d. 40 and 6

Solution

a. 7 does not divide into 32 a whole number of times, so these numbers are not compatible.
b. 15 and 5 are compatible because $15 \div 5 = 3$.
c. 44 and 11 are compatible because $44 \div 11 = 4$.
d. 6 does not divide into 40 a whole number of times, so these numbers are not compatible.

Activity 1
Self-Check

My Notes

Estimate the value in each of the following questions:

1. 35 146 ÷ 41 =

2. 6700 ÷ 301 =

3. 3758 ÷513 =

4. 916 ÷ 22.7 =

5. 81 070 ÷ 403.98 =

Turn to the solutions at the end of the section and mark your work.

My Notes

Explore

In Section 1 you explored volume as it is measured in the SI (metric) system. In the next activity you will investigate the volume of an object as it is measured in the imperial system.

Activity 2
Try This

You will need an imperial measuring tape to complete this activity.

Step 1: Look around your house for a medium-sized object that is approximately the shape of a rectangular prism. You may choose a microwave oven, a toaster oven, a bedside table, a storage box, or another similar object.

Step 2: Using your measuring tape, measure the length, width and height of your object in inches.

Photo by Portfolio © 2010

You should round your measurements to the nearest inch. Record your measurements in the table below.

Step 3: Using your measuring tape, measure the length, width and height of your object in feet. You should round your measurements to the nearest foot. Record your measurements in the table below.

Object	Length		Width		Height	
	(in)	(ft)	(in)	(ft)	(in)	(ft)

Step 4: Calculate the volume of your object using the dimensions measured in inches. Remember, the formula for volume of a rectangular prism is:

$$V = l \times w \times h$$

My Notes

Step 5: Calculate the volume of your object using the dimensions measured in feet. Remember, the formula for volume of a rectangular prism is:

$$V = l \times w \times h$$

1. When the dimensions are measured in inches, what units do you use to describe volume? Explain how you know.

My Notes

2. When the dimensions are measured in feet, what units do you use to describe volume? Explain how you know.

You will return to this activity later in the lesson.

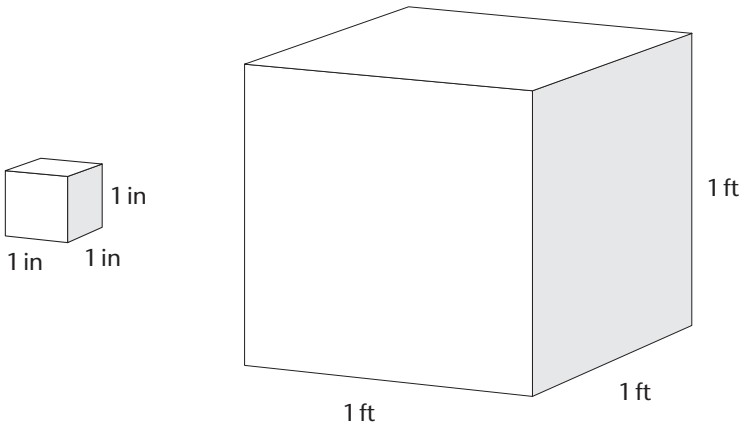
Turn to the solutions at the end of the section and mark your work.

Bringing Ideas Together

In the Explore you calculated the volume of an object in cubic inches and in cubic feet. Now let's look at how these two units are related to each other.

The Cubic Inch and the Cubic Foot

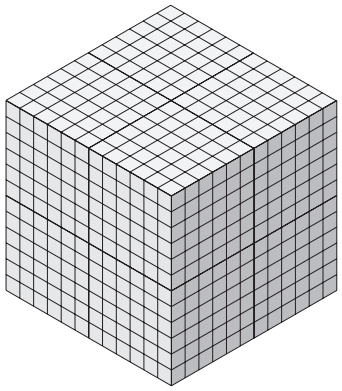
The **cubic inch** is a cube that measures one inch on each side. The **cubic foot** is a cube that measures one foot on each side.



Do you know how many cubic inches fit in one cubic foot?

My Notes

Remember, there are 12 inches in a foot. That means the cubic foot measures 12 inches by 12 inches by 12 inches.



To find the number of cubic inches in a cubic foot, you can count up the number of cubic inches making up the cubic foot. Each layer is made up of a 12 by 12 square, so each layer contains 144 cubic inches. There are 12 layers in the cube.

$12 \times 144 = 1728$

So, there are 1728 cubic inches in a cubic foot.

You could also calculate the number of cubic inches in a cubic foot by using the formula for volume of a rectangular prism.

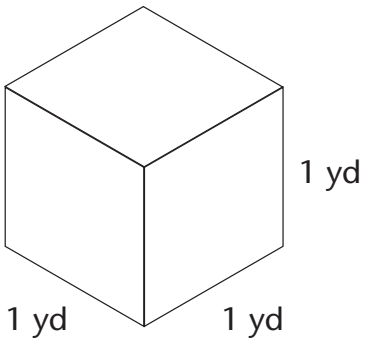
$$\begin{aligned} V &= l \times w \times h \\ 1\text{ ft}^3 &= 1\text{ ft} \times 1\text{ ft} \times 1\text{ ft} \\ &= 12\text{ in} \times 12\text{ in} \times 12\text{ in} \\ &= 1728\text{ in}^3 \end{aligned}$$

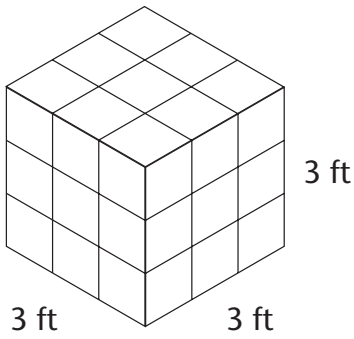
The Cubic Yard

The **cubic yard** is another common imperial unit of volume. What is the relationship between cubic feet and cubic yards?

My Notes

Remember that 1 yd = 3 ft. You can see this in the graphic below.





You can figure out the relationship between cubic yards and cubic feet by applying the formula $V = l \times w \times h$.

$$V = 1\text{ yd} \times 1\text{ yd} \times 1\text{ yd}$$
$$= 1\text{ yd}^3$$

and

$$V = 3\text{ ft} \times 3\text{ ft} \times 3\text{ ft}$$
$$= 27\text{ ft}^3$$

So, 1 yd^3 = 27 ft^3.

Garden soil, concrete, sand, and gravel are often sold by the cubic yard.

Example 3

A tissue box is 5 in wide, 9 in long, and 3 in high.

a. What is its volume in cubic inches?
b. What is its volume in cubic feet?

Express your answer as either whole numbers or fractions.

Solution

a. $V = l \times w \times h$
$= 9\text{ in} \times 5\text{ in} \times 3\text{ in}$
$= 135\text{ in}^3$

The volume of the tissue box is 135 in^3.

My Notes

b. ***Method 1***

Since the answer is required in cubic feet, first change each dimension to feet.

$$5 \text{ in} = \frac{5}{12}\text{ft}$$
$$9 \text{ in} = \frac{9}{12}\text{ft}$$
$$3 \text{ in} = \frac{3}{12}\text{ft}$$

Now find the volume. Because the dimensions are in feet, your answer will be in cubic feet.

$$V = l \times w \times h$$
$$= \frac{5}{12}\text{ft} \times \frac{9}{12}\text{ft} \times \frac{3}{12}\text{ft}$$
$$= \frac{5}{12}\text{ft} \times \frac{3}{4}\text{ft} \times \frac{1}{4}\text{ft}$$
$$= \frac{5}{64}\text{ft}^3$$

The volume is $\frac{5}{64}\text{ft}^3$

Method 2

Convert cubic inches to cubic feet directly since the volume is already calculated in cubic inches.

Recall:
$1 \text{ ft}^3 = 1728 \text{ in}^3$

To convert directly you can set up a proportion.

Let n = the volume in cubic feet

$$\frac{n}{135 \text{ in}^3} = \frac{1 \text{ ft}^3}{1728 \text{ in}^3}$$
$$n(1728 \text{ in}^3) = (1 \text{ ft}^3)(135 \text{ in}^3)$$
$$n = \frac{(1 \text{ ft}^3)(135 \text{ in}^3)}{(1728 \text{ in}^3)}$$
$$n = \frac{5}{64}\text{ft}^3$$

The volume is $\frac{5}{64}\text{ft}^3$.

My Notes

Example 4

Chuck ordered 4 yd^3 of soil to raise the level of the flower beds along his house. How many cubic feet of soil did he order?

Solution

Because 1 yd^3 = 3 ft × 3 ft × 3 ft = 27 ft^3,

$$4\ yd^3 = 4 \times 27\ ft^3$$
$$= 108\ ft^3$$

Chuck ordered 108 ft^3 of soil.

You may want to try these conversions using technology to help you. Open *Imperial System Volume Conversion (http://media.openschool.bc.ca/osbcmedia/math/mathawm10/html/impvolumeconvert/lengthImpConvert.htm)*. Try using the conversion tool to check the unit conversions in the previous examples.

Activity 3
Self-Check

1. In Activity 2 you measured an object and found its volume in cubic inches and in cubic feet.

   a. Go back to Activity 2 and find the volumes you calculated. Record them here.

      Volume of your object in cubic inches: _____

      Volume of your object in cubic feet: _____

   b. Using the conversion factor 1 ft^3 = 1728 in^3, convert the volume you calculated in cubic inches, to cubic feet.

My Notes

c. Compare your answer for (b) with the volume in cubic feet that you calculated in Activity 2. Are they close to the same? If they are quite different, can you give a reason for this difference?

2. Give an example of an everyday object that has this volume:

Answers will vary. Sample answers are given.

a. one cubic inch _____

b. one cubic foot _____

c. one cubic yard _____

3. Connie is interested in classic cars. At a recent auto show, she saw a 1981 Ford Mustang 4.6 on display. The engine displacement was given as 281 in^3. What is the engine displacement in cubic feet? Round your answer to two decimal places.

My Notes

Did You Know?

The SSC Ultimate Aero TT is the world's most powerful car with 1183 horsepower.

4. A cardboard box is 24 in long, 18 in wide, and 18 in high.
   a. What is its volume in cubic feet?

   b. What is its volume in cubic yards?

Turn to the solutions at the end of the section and mark your work.

Units of Capacity

In Section 1 we discussed the difference between volume and capacity and looked at some metric units for these measures. Volume describes how many cubic units you can divide an object into. Capacity describes how much a container can hold. One metric unit of capacity is the litre (L). Can you remember some others?

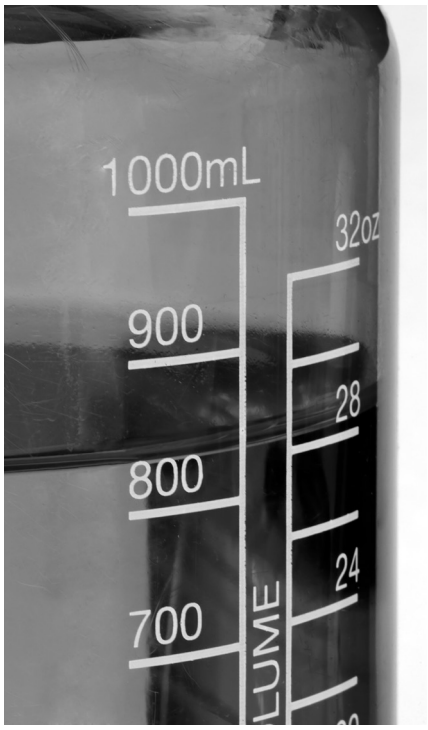


Photo by Geoffrey Kuchera © 2010

My Notes

The imperial units of capacity include the fluid ounce, cup, **pint**, **quart**, and **gallon**.

There are $2\frac{1}{2}$ cups in a pint, 2 pints in a quart, and 4 quarts in a gallon.

If you have done a little baking, or followed a recipe, you have probably encountered the cup and the liquid ounce. There are 160 liquid ounces in an imperial gallon and 40 liquid ounces in an imperial quart. You may also see ounces listed on the packages of imported goods.

Did You Know?

The word gallon comes from the Latin word *galleta*. *Galleta* is the Latin word for *pail*. A four-litre pail of ice cream holds about one gallon.

In the United States, milk and juice are commonly sold in gallon, quart, and pint containers. These American measures are different from their imperial counterparts in Britain. The American quart and gallon are only $\frac{5}{6}$ as large as their British imperial equivalents.

My Notes

Take out your Data Pages and look at the "Table of Conversions". You will need to keep this table handy as you work through the rest of this lesson.

Example 5

René's cousin in Seattle is painting the bedrooms in his home. He calculated that he needs enough paint to cover 900 ft^2. How many gallons should he buy if 1 qt covers 75 ft^2?

Solution

You know that 1 qt of paint covers 75 ft^2, so first, figure out how many quarts you need to cover 900 ft^2. Set up a proportion.

Let x = the amount, in quarts, of paint needed.

$$\frac{x}{900\ \text{ft}^2} = \frac{1\ \text{qt}}{75\ \text{ft}^2}$$
$$x(75\ \text{ft}^2) = (1\ \text{qt})(900\ \text{ft}^2)$$
$$x = \frac{(1\ \text{qt})(900\ \text{ft}^2)}{(75\ \text{ft}^2)}$$
$$x = 12\ \text{qt}$$

Now, convert the number of quarts to gallons. Set up a proportion.

Let n = the amount, in gallons, of paint needed.

$$\frac{n}{12\ \text{qt}} = \frac{1\ \text{gal}}{4\ \text{qt}}$$
$$n(4\ \text{qt}) = (1\ \text{gal})(12\ \text{qt})$$
$$n = \frac{(1\ \text{gal})(12\ \text{qt})}{(4\ \text{qt})}$$
$$n = 3\ \text{gal}$$

René's cousin needs to buy 3 gal of paint.

Activity 4
Self-Check

My Notes

Please answer the following questions. You may use the Data Pages.

1. When travelling in North Dakota, Mary bought a gallon of milk for $3.00.
   a. How many quarts are in 1 gal?

   b. Calculate how much a quart costs.

2. Bill wants to paint the exterior of his garage door. The garage door measures 16 ft × 7 ft. He has 2 qt of paint leftover in a gallon container he purchased previously. The directions on the gallon container say it holds enough paint to cover 250 ft^2. Will Bill have enough paint for this project?

Turn to the solutions at the end of the section and mark your work.

My Notes

Imperial and American Measures of Capacity

We can use conversion tables to help us convert between imperial and metric units of volume and capacity. However, converting between units of capacity is a bit more complicated. As mentioned previously, American units of capacity have similar names as the British imperial units, but they aren't the same sizes.

The American gallon is very close to 4 L, but the imperial gallon is 20% larger. This creates confusion when talking about fuel consumption, for instance. Twenty miles per gallon does not mean the same thing in Canada as it does in the United States.

Did You Know?

Canada is the largest provider of oil and natural gas for the United States.

Before looking at the conversion tables for metric, imperial, and American standard measures, work through the following example to see how entries in the tables are obtained.

Example 6

How many cubic centimetres are there in 1 in^3?

Solution

Remember that 1 in = 2.54 cm.

So, $1\ in^3 = 1\ in \times 1\ in \times 1\ in$

$= 2.54\ cm \times 2.54\ cm \times 2.54\ cm$

$= 16.387\ 064\ cm^3$

There are about 16.39 cm^3 in 1 in^3.

My Notes

Look at the following conversion tables. The entries have been rounded.

Metric	Imperial (British)	American Measures
1 cm^3	0.06 in^3	0.06 in^3
1 m^3	1.31 yd^3	1.31 yd^3
1 m^3	35.31 ft^3	35.31 ft^3
1 L	0.22 gal	0.26 gal (US)
1 L	0.88 qt	1.06 qt (US)

Imperial (British)	American Measures	Metric
1 in^3	1 in^3	16.39 cm^3
1 ft^3	1 ft^3	0.03 m^3
1 yd^3	1 yd^3	0.76 m^3
1 qt	1.20 qt (US)	1.14 L
1 gal	1.20 gal (US)	4.55 L

American Measures	Imperial (British)	Metric
1 in^3	1 in^3	16.39 cm^3
1 ft^3	1 ft^3	0.028 m^3
1 yd^3	1 yd^3	0.76 m^3
1 qt (US)	0.83 qt	0.95 L
1 gal (US)	0.83 gal	3.79 L

You should also familiarize yourself with the "Table of Conversions" in the Data Pages.

Work through the following examples to see how to use these tables.

My Notes

Example 7

Bernice is ordering topsoil for her garden. She calculated she needs 15 yd^3. When she telephones in her order, how many cubic metres should she ask for? Round your answer to 1 decimal place.

Solution

1 $yd^3 \approx 0.76\ m^3$

So, to convert, multiply by the conversion factor found in the tables.

$$\begin{aligned} 15\ yd^3 &= (15 \times 0.76)\ m^3 \\ &= 11.4\ m^3 \\ &= 11.4\ m^3 \end{aligned}$$

Bernice should order 11.4 m^3 of topsoil.

Example 8

A compact car in the United States is advertised as averaging 32 mi/gal. How many miles to the imperial gallon would it average? Round to one decimal place.

Solution

A British imperial gallon is larger than a US gallon. A car would go further on one imperial gallon than it would on one US gallon.

We know that the car goes 32 mi for every US gallon.

We can write $\dfrac{32\ \text{mi}}{1\ \text{US gal}}$.

We also know that 1 US gal = 0.83 British gal.

So,

$$\frac{32\ \text{mi}}{1\ \text{US gal}} = \frac{32\ \text{mi}}{0.83\ \text{British gal}} = 38.6\ \text{mi/British gal}$$

The compact car would average 38.6 miles to the imperial gallon.

Activity 5
Self-Check

My Notes

Please answer the following questions. You may use the conversion tables from this lesson, or the "Table of Conversions" in the Data Pages.

1. How many litres of paint are there in 5 US gallons? Round your answer to one decimal place.

2. Bill bought 3 qt of milk in Montana, US. How many litres of milk did he buy? Round your answer to one decimal place.

3. If gasoline sells for $0.936 per litre, how much is it per British imperial gallon? Round your answer to the nearest cent.

4. How many cubic feet are there in a load of concrete 2 m^3? Round your answer to 1 decimal place.

Turn to the solutions at the end of the section and mark your work.

My Notes

Activity 6
Mastering Concepts

Aaron wants to order enough topsoil to raise a rectangular flower bed 8 in. If the flower bed measures 21 ft × 3 ft, how many cubic yards of topsoil should he order if the landscape firm sells soil to the nearest one-half cubic yard? Make sure he doesn't come up short!

Turn to the solutions at the end of the section and mark your work.

Lesson Summary

Natural gas from western Canada flows through pipelines to markets across North America. Consumers are billed based on the amount of gas they use. If your home uses natural gas for heating, ask to see last month's bill to find out how much natural gas your home used. The volume of natural gas you consumed was most likely quoted in thousands of cubic feet and then converted to an energy equivalent. The cubic foot is a measure of volume in the imperial system.

Photo by Jim Parkin © 2010

My Notes

Lesson D
Mass

To complete this lesson, you will need:

- a scale
- a suitcase or box
- a calculator
- Data Pages found in the appendix

In this lesson, you will complete:

- 7 activities

Essential Questions

- How are masses commonly measured in the imperial system?.
- How are the units for mass in the imperial system related?
- How are masses converted between the imperial and SI units?

My Notes

Focus

Curtis is making a batch of cookies. He is using a favourite recipe from his grandmother's cookbook. The recipe calls for two ounces of fresh butter. He asks his sister for advice.

"How much butter is two ounces?" asked Curtis.

"I think ounces are parts of a pound!" his sister answered.

"Well," Curtis complained, "I just bought this brick of butter and all it says on the wrapping is 454 g. Now what?"

Photo by Robyn Mackenzie © 2010

How might you help him add the correct amount of butter?

Get Started

In Section 1, Lesson D, we looked at metric units of mass. Remember, the terms mass and weight have slightly different meanings. Briefly describe this difference below. (You may refer to Section 1 Lesson D if you need to refresh your memory.)

_____

_____

_____

In this lesson, as we did before, we will use the terms mass and weight interchangeably.

Estimating Mass

Even in Canada, many people still use the imperial unit pound to describe their body mass or when they buy produce in a supermarket.

Photo by Rob Wilson © 2010

Have you ever travelled by air? If you have, then you know that many airlines place restrictions on the size of your checked baggage. For example, some airlines limit passengers travelling in economy class to two checked bags, and neither bag can exceed 50 pounds. If passengers check more bags or if their bags are too heavy, the passengers are charged a penalty.

How would you decide, before leaving for the airport, if your suitcases meet the weight-restrictions? In Activity 1 you will test your skills in estimating mass in pounds.

My Notes

Activity 1
Try This

You will need a bathroom scale and an empty suitcase or box.

Caution: Do not try to handle more weight than you can safely lift. You may wish to ask a friend or family member to help you with this activity.

Fill the suitcase with items such as clothes, books or canned goods until you think, when you lift the suitcase, that it weighs close to 50 pounds.

Now use your scale to measure the mass of the suitcase.

My Notes

How might you weigh the suitcase if it doesn't balance on the scale?

One method is to weigh yourself first and make note of your mass. Then stand on the scale while holding the suitcase and make note of the combined mass of you and the suitcase. Subtract your mass from the combined mass of you and the suitcase. The difference is the mass of the suitcase!

Add or subtract items until you have a 50-pound suitcase.

1. How good were you at estimating weight?

2. If you were going on a holiday, would you trust an estimate without actually weighing your suitcase? (What if you were going to be charged extra money for going over the weight limit?)

Turn to the solutions at the end of the section and mark your work.

Explore

My Notes

Whether or not you were successful in estimating the mass of your suitcase in Activity 1, you might find it helpful to establish some reference points for measuring masses. Knowing the masses of some everyday objects will help you to estimate masses more accurately. This can come in handy when you are baking and don't have a scale, or when you are estimating the cost of produce at a market.

Activity 2 will help you establish some reference points for measuring masses in pounds.

Activity 2
Try This

Use the following table for the questions in this activity.

Target Mass (pounds)	Item 1		Item 2	
	Selected Item	Measured Mass (pounds)	Selected Item	Measured Mass (pounds)
1				
2				
5				
10				
20				
50				
100				

1. Fill in the two "Selected Item" columns in the table given above. To do this, select items that you find around your home that you think match the target masses given.

My Notes

2. Check the accuracy of your list by weighing the items on your scale and recording their masses in the table given above.

3. Explain how you selected the items in the table.

4. How important is it to use a scale to measure the mass of an object?

Turn to the solutions at the end of the section and mark your work.

Bringing Ideas Together

My Notes

In Explore and Get Started you weighed items in pounds. The pound, as a unit of mass, dates back at least as far as the time of the Romans. The symbol for one pound is lb. This symbol is an abbreviation of the Latin word *libra*—the word for a set of scales used for weighing objects.

Did You Know?

As mentioned above, *libra* is the Latin word used for *scales*. A scale is considered to be any instrument that measures mass.

Photo by Glam © 2010

The symbol for the birth sign Libra is a set of scales because the constellation Libra is thought to look like a set of scales. These older-style scales are made up of two pans connected to a bar.

Photo by EdBockStock © 2010

Newer scales, like bathroom scales, are often compact devices that have a spring-loaded platform that moves down in response to the weight on it.

Pounds and Ounces

The Roman pound was divided into 12 parts. The Latin word *uncia* for "twelfth part," as you will recall, gave the word inch. It also gives the English word *ounce*. The troy pound, used for precious metals such as gold and silver, still has 12 ounces. However, the modern pound commonly used for weight (mass) is divided into 16 ounces. The symbol for the ounce is oz.

The following example deals with the relationship between pounds and ounces.

My Notes

Example 1

Krysta's baby weighed 6 lb 7 oz at birth. Altogether, how many ounces did she weigh?

Solution

Remember, 1 lb = 16 oz.

$$\begin{aligned} 6\text{ lb }7\text{ oz} &= 6\text{ lb } + 7\text{ oz} \\ &= (6 \times 16)\text{oz} + 7\text{ oz} \\ &= 96\text{ oz} + 7\text{ oz} \\ &= 103\text{ oz} \end{aligned}$$

Multiply by 16 to convert from pounds to ounces.

At birth, Krysta's baby weighed 103 oz.

Now it's time to weigh your skills! Try the next activity.

Activity 3
Self-Check

My Notes

Please answer the following questions.

1. An average egg weighs about 2 oz. How many pounds would two dozen eggs weigh?

2. A butcher slices a 5-lb ham into 160 pieces. What is the average weight in ounces per slice?

Turn to the solutions at the end of the section and mark your work.

My Notes

Tonnes of Tons!

In the imperial system, large masses are measured in **tons**. There are **short tons** and **long tons**. Short tons are used in the United States, and are often referred to simply as tons. Long tons are part of the British imperial system.

Photo by Bram van Broekhoven © 2010

Did You Know?

The British defined the ton as equal to 160 stone when they considered the stone as the basic unit of weight. One stone equals 14 lb. Therefore their ton, now also known as the long ton, is equal to 2240 lb.

These short and long tons are not to be confused with the **tonnes** we learned about in Section 1 Lesson D—those were *metric tonnes*.

Here's a summary of the different ton(ne)s. You can use these conversion factors as you work through the rest of this lesson.

1 short ton = 2000 pounds = 907 kilograms

1 long ton = 2240 pounds = 1016 kilograms

1 metric tonne = 2200 pounds = 1000 kilograms

My Notes

Example 2

Mr. Watnee hauls gravel. He estimates that 1 yd^3 weighs 3000 lb. How many tons (short) would a load of gravel 5 yd^3 weigh?

Solution

To solve this, let's set up a proportion. Remember, 1 ton = 2000 lb.

Let x = the mass of gravel in tons.

$$\frac{x}{15\,000 \text{ lb}} = \frac{1 \text{ ton}}{2000 \text{ lb}}$$

$$x(2000 \text{ lb}) = (1 \text{ ton})(15\,000 \text{ lb})$$

$$x = \frac{(1 \text{ ton})(15\,000 \text{ lb})}{(2000 \text{ lb})}$$

$$x = 7.5 \text{ ton}$$

Mr. Watnee's load of gravel weighs 7.5 tons.

My Notes

Activity 4
Self-Check

Please answer the following questions. You may use the Data Pages and the coversion factors in this lesson.

1. Sergey loaded 200 bushels of wheat into the box of his truck. The grain weighed 5.2 tons (short). How many pounds did each bushel of wheat weigh?

2. If 1 yd^3 of gravel weighs 1.5 tons (short), how many pounds does 1 ft^3 of gravel weigh? Round your answer to the nearest pound.

Turn to the solutions at the end of the section and mark your work.

Converting Between Metric and Imperial

As for length, area, volume, and capacity, there is a need from time to time to convert masses between the imperial and SI systems.

You can use Imperial to *SI Weight Conversion (http://media.openschool.bc.ca/osbcmedia/math/mathawm10/html/imptosiconvert/ImpLengthSIConvert.htm)* to view conversions between metric and imperial measurements.

My Notes

Mass Conversions

Conversion tables help you convert between systems. Use the tables below to convert between units of mass. (Note the masses have been rounded to 2 decimal places.)

Imperial	Metric
1 oz	28.35 g
1 lb	0.45 kg
1 ton (short) = 2000 lb	0.91 t
1 ton (long) = 2240 lb	1.02 t

Imperial	Metric
1 g	0.04 oz
1 kg	2.20 lb
1 t	1.10 ton (short)
1 t	0.98 ton (long)

Have a look at the following example before moving on to Activity 5.

My Notes

Example 5

Jenny weighs 116 lb. What is her mass to the nearest kilogram?

Solution

We can solve this by either setting up a proportion or multiplying by the conversion factor. Let's set up a proportion.

From the Data Pages, we know that 1 kg = 2.2 lb.

Let x = Jenny's mass in kilograms.

$$\frac{x}{116 \text{ lb}} = \frac{1 \text{ kg}}{2.2 \text{ lb}}$$

$$x(2.2 \text{ lb}) = (1 \text{ kg})(116 \text{ lb})$$

$$x = \frac{(1 \text{ kg})(116 \text{ lb})}{(2.2 \text{ lb})}$$

$$x = 52.\overline{72} \text{ kg}$$

Rounding to the nearest kilogram, Jenny's mass is about 53 kg.

Activity 5
Self-Check

My Notes

Now check your skills in converting between imperial and SI masses. Complete the following questions using the conversion tables from Mass Conversions.

1. Apples cost $0.79 per pound. What is their cost per kilogram? Round your answer to the nearest cent.

2. The mass of a Canadian two-dollar coin is 7.3 g. What is its mass in ounces? Round your answer to 2 decimal places.

3. How much does 1 gal (imperial) of water weigh, in pounds, if 1 L of water has a mass of 1 kg? Round your answer to the nearest pound.

Turn to the solutions at the end of the section and mark your work.

My Notes

Activity 6
Mastering Concepts

Try this question. You will need to apply your knowledge of volume, capacity and mass.

Connie is planning to lay a concrete driveway 60 ft long, 15 ft wide, and 4 in thick. If 1 yd^3 of concrete weighs 4000 lb, how many short tons of concrete are needed for the driveway? Round your answer to 1 decimal place.

Turn to the solutions at the end of the section and mark your work.

Lesson Summary

My Notes

When following a recipe, do you feel more comfortable measuring quantities using the SI or imperial system?

Photo by Inga Nielsen © 2010

In this lesson, you discovered that the common units for mass in the imperial system are the pound, ounce, and the short and long tons. You explored converting between the units of mass in the metric and imperial systems.

Lesson E
Temperature

To complete this lesson, you will need:

- (if possible) a thermometer that has both a Celsius and Fahrenheit scale
- calculator
- Data Pages found in the appendix

In this lesson, you will complete:

- 5 activities

Essential Questions

- How are temperatures measured on the Fahrenheit scale?
- With what common Fahrenheit temperatures should you be familiar?
- How are the Celsius and Fahrenheit scales related?

My Notes

Focus

When holidaying in Canada or the United States, national parks are a favoured destination.

Photo by Pixelite © 2010

Joshua Tree National Park is located in the desert of southern California. This park is renowned for its spectacular rock formations and unusual vegetation. The extremes of the desert climate can be shocking if you aren't prepared! In January, the daytime temperatures can be warm enough for short sleeves and shorts; but at night, the temperature can dip well below freezing.

If you have travelled in the United States, you may have noticed that they don't use the Celsius thermometer. They measure temperature in degrees Fahrenheit.

Get Started

The Fahrenheit scale was devised by Daniel Fahrenheit almost 300 years ago. Fahrenheit was a German-speaking instrument maker and scientist. He worked with a scientist in Denmark.

In Activity 1 you will explore some of the steps used to develop important points on the Fahrenheit scale. We'll return to the story of Daniel Fahrenheit after the activity.

Activity 1
Try This

My Notes

You will need a thermometer with both Celsius and Fahrenheit scales, ice, water, and table salt to complete this activity.

If you don't have the materials to complete this activity, simply use *Taking Temperatures (http://media.openschool.bc.ca/osbcmedia/math/mathawm10/html/taking_temp.html)*.

(**Note:** if you do not have internet access and you do not have the materials, just skip ahead to the next topic, The Farenheit Scale.)

Whether you're actually completing this experiment, or using the media, please follow the instructions and use the table below to record the temperatures in degrees Celcius and in degrees Fahrenheit.

Instructions
If you're doing the experiment:

- **Step 1.** Fill two cups with crushed ice (or small ice cubes). In one cup, add a handful of salt and stir.
- **Step 2.** Once the ice is about halfway melted, use the thermometer to measure the temperature. Record the temperature in the table below.
- **Step 3.** Measure your body temperature by placing the thermometer under your armpit and holding it there for 2 minutes. Record the temperature in the table below.
- **Step 4.** Fill a small pot with water. Place the pot on the stove and bring to a boil. (Alternatively, you could boil water using an electric kettle.) Carefully measure the temperature of the boiling water using your thermometer. Record the temperature in the table below.

My Notes

If you're using the media:

- **Step 1.** Go to your AWM 10 Media CD and open *Taking Temperatures*.
- **Step 2.** Drag the thermometer to each of the four items and record the resulting temperatures in the following table.

Situation	Temperature on the Celsius (°C) scale	Temperature on the Fahrenheit (oF) scale
Freezing/Melting Point of Water		
Ice/Salt Mixture		
Body Temperature		
Boiling Water		

What conclusions can you draw from the results you recorded in the table?

Turn to the solutions at the end of the section and mark your work.

The Fahrenheit Scale

Daniel Fahrenheit proposed that 0º on his scale would be the temperature of a salt-ice mixture, the coldest temperature he thought was possible to create.

Fahrenheit used the temperature of a healthy person's armpit as the next benchmark. He called that temperature 96º. He chose 96 instead of 100 because 96 could be divided by 12 (just like the number of inches in a foot!). It turned out, based on these benchmarks, that the freezing point of water on this scale was 32º.

When his scale was revised later, based on the work of other scientists, it was decided to keep 32º as the freezing point of water and make 212º the boiling point so there would be an even 180º between them. It is interesting to note that after this small adjustment, body temperature was not 96º as Fahrenheit wanted, but 98.6º.

The Fahrenheit temperature scale is a scale that sets the freezing point of water at 32ºF and the boiling point of water at 212ºF.

Now that you are familiar with some benchmarks on the Fahrenheit and Celsius scales, you should be prepared to complete the activities in Explore.

My Notes

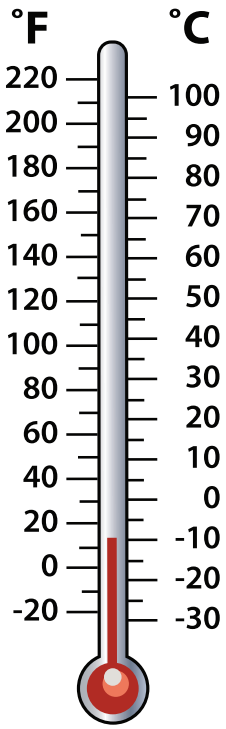
Explore

On both the Fahrenheit and Celsius scales, we use "degrees" as the units of measurement. What is the relationship between degrees Fahrenheit and degrees Celcuis? Are the "degrees" the same size on both scales or are they different? You will find the answers to these questions in Activity 2.

My Notes

Activity 2
Try This

Use the image of the thermometer to help you answer the questions that follow.



1. How many Celsius degrees are there between freezing and boiling?

   _____

   _____

2. How many Fahrenheit degrees are there between freezing and boiling?

   _____

   _____

3. Which degree is larger—a Fahrenheit degree or a Celsius degree? How do you know?

   _____

   _____

4. Determine each of the following ratios. Express them as fractions in their simplest terms.

   a. $$\frac{\text{number of Fahrenheit degrees between boiling and freezing}}{\text{number of Celsius degrees between boiling and freezing}} = \_\_\_\_\_$$

   b. $$\frac{\text{number of Celsius degrees between boiling and freezing}}{\text{number of Fahrenheit degrees between boiling and freezing}} = \_\_\_\_\_$$

5. Use your answers for the ratios in question 4 to complete the equations below.

   a. 1 Celsius degree = ____ × 1 Fahrenheit degree

   b. 1 Fahrenheit degree = ____ × 1 Celsius degree

Turn to the solutions at the end of the section and mark your work.

My Notes

Using Ratios to Convert Temperatures

The fractions you found in Activity 2 show the relationship between degrees on the Fahrenheit scale and degrees on the Celsius scale.

$\frac{F}{C}=\frac{9}{5}$ and $\frac{C}{F}=\frac{5}{9}$, where F stands for the number of Fahrenheit degrees and C stands for the number of Celsius degrees

So, $F=\frac{9}{5}\times C$

$C=\frac{5}{9}\times F$

You can use these ratios to convert between degrees Fahrenheit and degrees Celsius. To do this you would consider how far a given temperature is from a benchmark such as the freezing point of water; that is:

- Calculate the span of degrees between the given temperature and the freezing temperature of water.
- Convert this span to the number of degrees on the scale you are converting to.
- Add this span to the freezing point of water on the new scale.

Example 1

The temperature of water in a bathtub is 140°F. What is this temperature on the Celsius scale?

Solution

Remember that on the Fahrenheit scale, the freezing point of water is 32°F. So, first consider how far 140°F is from this benchmark.

140°F – 32°F = 108°F above the freezing point of water.

My Notes

Then, you can convert this range to degrees Celsius.

$$108° \times \frac{5}{9}°C = 60°C$$

140°F is 60°C above the freezing point of water.

Now we must consider the Celsius scale. The freezing point of water on that scale is 0°C. So,

$$\begin{aligned} 60°C \text{ above freezing} &= 60°C + 0°C \\ &= 60°C \end{aligned}$$

Bringing Ideas Together

Now you will bring the ideas from Get Started and Explore together to examine conversions more closely.

Converting Fahrenheit to Celsius

Example 2

Convert 68°F to a temperature in degrees Celsius.

Solution

First, pick a benchmark temperature. Freezing on the Fahrenheit scale is 32°F.

68°F is 68 – 32 = 36 Fahrenheit degrees above freezing

Now convert this range to degrees Celsius. Remember, there are only 5 Celsius degrees for every 9 Fahrenheit degrees.

Multiply the number of Fahrenheit degrees by $\frac{5°C}{9°F}$.

$$\begin{aligned} \text{number of Celsius degrees above freezing} &= 36°F \times \frac{5°C}{9°F} \\ &= 20°C \end{aligned}$$

Since freezing, on the Celsius scale, is 0 degrees,

68°F = 20°C.

My Notes

Let's summarize the steps we used to solve this problem and create a formula.

Celsius temperature = $\frac{5}{9}$ × (Fahrenheit temperature – 32)

This formula can be abbreviated $C = \frac{5}{9}(F - 32)$.

You can use this formula to convert from Fahrenheit scale to the Celsius scale. Take out your Data Pages. Look at the section titled "Formulae". The first formula you see there is the one we have just developed!

Let's look at another example.

Example 3

The temperature last January in Minot, ND, fell to –30ºF. What was this temperature to the nearest tenth in degrees Celsius?

Solution

Let's use the formula.

$$C = \frac{5}{9}(F - 32)$$

$$C = \frac{5}{9}(-30 - 32)$$

$$C = \frac{5}{9}(-62)$$

$$C = -34.444...$$

So, –30ºF is approximately –34.4ºC.

As you can see, the formula works for both positive and negative temperatures.

My Notes

Converting Celsius to Fahrenheit

So far, we have used the $C = \frac{5}{9}(F - 32)$ formula to convert from Fahrenheit scale to the Celsius scale. Can you use this formula to convert from degrees Celsius to degrees Fahrenheit? _____

In order to convert from Fahrenheit to Celsius, we need to rearrange the formula. We want to be able to substitute in a temperature in degrees Celsius and obtain the temperature in degrees Fahrenheit. So, let's rearrange the formula to solve for F.

$C = \frac{5}{9}(F - 32)$ can be written as $C = \frac{5(F - 32)}{9}$

Our objective is to get the F by itself on one side of the equation.

$$(9)C = \frac{5(F - 32)}{\cancel{9}}(\cancel{9})$$

Multiply both sides by 9 to get rid of the 9 in the denominator.

$$9C = 5(F - 32)$$

$$\frac{9C}{5} = \frac{\cancel{5}(F - 32)}{\cancel{5}}$$

Divide both sides by 5 to get rid of the 5 on the left side.

$$\frac{9}{5}C = F - 32$$

$$\frac{9}{5}C + 32 = F - 32 + 32$$

Add 32 to both sides to isolate F.

$$\frac{9}{5}C + 32 = F$$

You can also write this formula as $F = \frac{9}{5}C + 32$.

Notice that this formula is not given on the Data Pages. You will need to know how to rearrange the formula given in order to convert between the Fahrenheit and Celsius temperature scales.

Let's use the formula we found above to do one last example.

My Notes

Example 4

Last night the temperature dropped to 15°C. What is this temperature in Fahrenheit?

Solution

In this example we are converting from degrees Celsius to degrees Fahrenheit. Use the formula and substitute the value that you know.

$$F = \frac{9}{5}C + 32$$
$$F = \frac{9}{5}(15) + 32$$
$$F = 27 + 32$$
$$F = 59$$

The temperature 15°C equals 59°F.

To quickly convert between temperatures, you can use the multimedia *Temperature Conversion (http://media.openschool.bc.ca/osbcmedia/math/mathawm10/html/tempconvert/tempConversion.htm)*. You can use this tool to check the solutions to examples 2–4.

My Notes

Activity 3
Self-Check

You will now apply the formulas for converting between temperature scales. You may use your Data Pages.

Please answer the following questions.

1. Martin has a fever of 101.3°F. How many Fahrenheit degrees above normal is his temperature?

2. The coldest temperature in Canada was –63°C recorded on February 3, 1947, in Snag, Yukon. What is this temperature in degrees Fahrenheit?

3. The highest recorded temperature in Death Valley in the southwestern United States was 134°F reached on July 10, 1913. What is this temperature in degrees Celsius? Round your answer to 1 decimal place.

4. A recipe for Swiss steak calls for an oven temperature of 160°C. What would the oven setting be in degrees Fahrenheit?

Turn to the solutions at the end of the section and mark your work.

Activity 4
Mastering Concepts

My Notes

If you have mastered the concepts in this lesson and would like a challenge, try these questions.

1. Scientists state that absolute zero, the temperature at which molecular motion is at a minimum, is approximately –273.15°C. What is the equivalent temperature in degrees Fahrenheit?

2. On the Kelvin scale, the temperature at which molecular motion is at a minimum is set to be 0 K. Each degree on the Kelvin scale is the same size as the degree on the Celsius scale. Approximately what would body temperature be on the Kelvin scale?

My Notes

3. The *Rankine* scale is another temperature scale. Zero on the Rankine scale correlates to absolute zero on the Celsius temperature scale: –273.15°C. Each degree on the Rankine scale is the same size as the degree on the Fahrenheit scale. Using the information from #1 and #2, determine what body termperature would be on the Rankine scale.

Turn to the solutions at the end of the section and mark your work.

Lesson Summary

My Notes

Winter and summer sports are governed by the weather. Do you check weather forecasts when planning your weekend activities? In Canada since the 1960s, temperature is reported on the Celsius scale, but if you were in the United States today, the temperature would be given in Fahrenheit.

Photo by ALPO © 2010

In this lesson, you investigated the way temperatures are measured using the Celsius and Fahrenheit temperature scales. You also examined some common Fahrenheit and Celsius temperatures. Through an exploration of the relationship between degrees Celsius and degrees Fahrenheit, you discovered how a temperature can be converted between the two scales.

The Imperial System— Appendix

TABLE OF CONVERSIONS

1 inch	≈	2.54 centimetres
1 foot	≈	30.5 centimetres
1 foot	≈	0.305 metres
1 foot	=	12 inches
1 yard	=	3 feet
1 yard	≈	0.915 metres
1 mile	=	1760 yards
1 mile	≈	1.6 kilometres
1 kilogram	≈	2.2 pounds
1 litre	≈	1.06 US quarts
1 litre	≈	0.26 US gallons
1 gallon	≈	4 quarts
1 British gallon	≈	$\frac{6}{5}$ US gallon

FORMULAE

Temperature

$$C = \frac{5}{9}(F - 32)$$

Trigonometry

(Put your calculator in Degree Mode)

- Right triangles

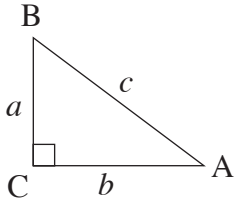
Pythagorean Theorem

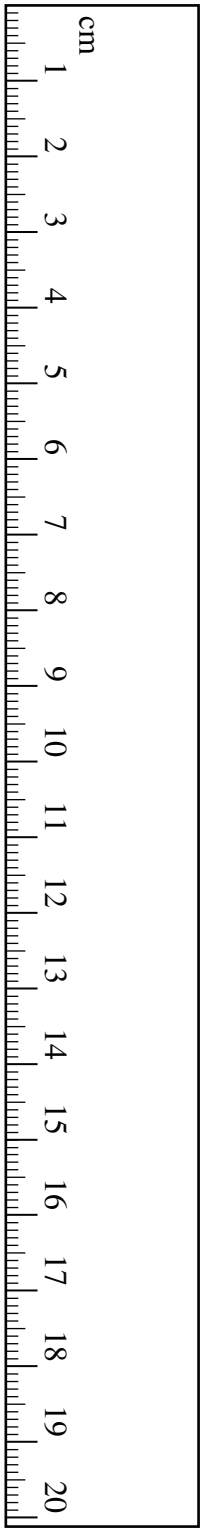
$$a^2 + b^2 = c^2$$

$$\sin A = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos A = \frac{\text{adjacent}}{\text{hypotenuse}}$$

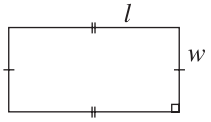
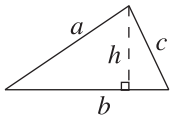
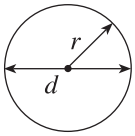
$$\tan A = \frac{\text{opposite}}{\text{adjacent}}$$



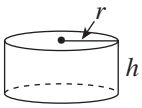
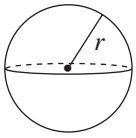
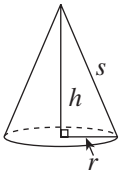
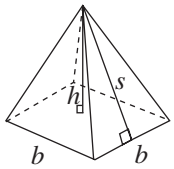
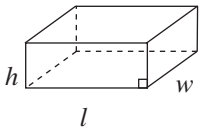


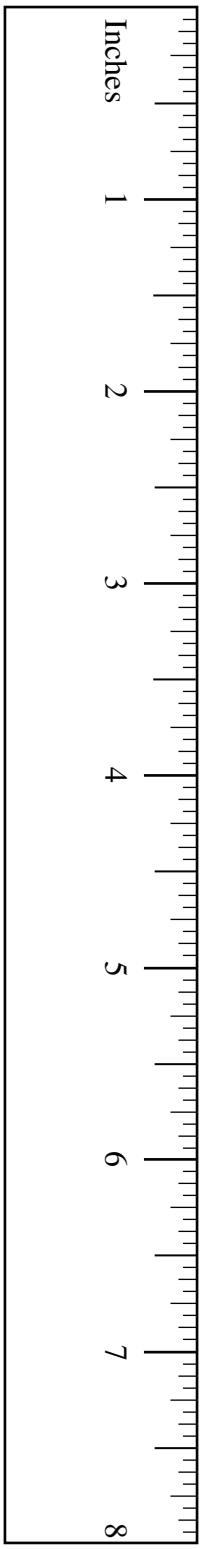
GEOMETRIC FORMULAE

Key Legend	
l = length	P = perimeter
w = width	C = circumference
b = base	A = area
h = height	SA = surface area
s = slant height	V = volume
r = radius	
d = diameter	

Geometric Figure	Perimeter	Area
Rectangle 	$P = 2l + 2w$ **or** $P = 2(l + w)$	$A = lw$
Triangle 	$P = a + b + c$	$A = \frac{bh}{2}$
Circle 	$C = \pi d$ **or** $C = 2\pi r$	$A = \pi r^2$

Note: Use the value of **π** programmed in your calculator rather than the approximation of 3.14.

Geometric Figure	Surface Area
Cylinder 	$A_{top} = \pi r^2$ $A_{base} = \pi r^2$ $A_{side} = 2\pi rh$ $SA = 2\pi r^2 + 2\pi rh$
Sphere 	$SA = 4\pi r^2$ **or** $SA = \pi d^2$
Cone 	$A_{side} = \pi rs$ $A_{base} = \pi r^2$ $SA = \pi r^2 + \pi rs$
Square-Based Pyramid 	$A_{triangle} = \frac{1}{2}bs$ (for each triangle) $A_{base} = b^2$ $SA = 2bs + b^2$
Rectangular Prism 	$SA = wh + wh + lw + lw + lh + lh$ **or** $SA = 2(wh + lw + lh)$
General Right Prism	SA = the sum of the areas of all the faces
General Pyramid	SA = the sum of the areas of all the faces



Note: Use the value of **π** programmed in your calculator rather than the approximation of 3.14.

Canada Pension Plan Contributions
Weekly (52 pay periods a year)

Cotisations au Régime de pensions du Canada
Hebdomadaire (52 périodes de paie par année)

Pay Rémunération From - De	To - À	CPP RPC	Pay Rémunération From - De	To - À	CPP RPC	Pay Rémunération From - De	To - À	CPP RPC	Pay Rémunération From - De	To - À	CPP RPC
358.11 -	358.31	14.40	372.66 -	372.85	15.12	387.20 -	387.40	15.84	401.75 -	401.94	16.56
358.32 -	358.51	14.41	372.86 -	373.05	15.13	387.41 -	387.60	15.85	401.95 -	402.14	16.57
358.52 -	358.71	14.42	373.06 -	373.25	15.14	387.61 -	387.80	15.86	402.15 -	402.35	16.58
358.72 -	358.91	14.43	373.26 -	373.46	15.15	387.81 -	388.00	15.87	402.36 -	402.55	16.59
358.92 -	359.11	14.44	373.47 -	373.66	15.16	388.01 -	388.20	15.88	402.56 -	402.75	16.60
359.12 -	359.32	14.45	373.67 -	373.86	15.17	388.21 -	388.41	15.89	402.76 -	402.95	16.61
359.33 -	359.52	14.46	373.87 -	374.06	15.18	388.42 -	388.61	15.90	402.96 -	403.15	16.62
359.53 -	359.72	14.47	374.07 -	374.26	15.19	388.62 -	388.81	15.91	403.16 -	403.36	16.63
359.73 -	359.92	14.48	374.27 -	374.47	15.20	388.82 -	389.01	15.92	403.37 -	403.56	16.64
359.93 -	360.12	14.49	374.48 -	374.67	15.21	389.02 -	389.21	15.93	403.57 -	403.76	16.65
360.13 -	360.33	14.50	374.68 -	374.87	15.22	389.22 -	389.42	15.94	403.77 -	403.96	16.66
360.34 -	360.53	14.51	374.88 -	375.07	15.23	389.43 -	389.62	15.95	403.97 -	404.16	16.67
360.54 -	360.73	14.52	375.08 -	375.27	15.24	389.63 -	389.82	15.96	404.17 -	404.37	16.68
360.74 -	360.93	14.53	375.28 -	375.48	15.25	389.83 -	390.02	15.97	404.38 -	404.57	16.69
360.94 -	361.13	14.54	375.49 -	375.68	15.26	390.03 -	390.22	15.98	404.58 -	404.77	16.70
361.14 -	361.34	14.55	375.69 -	375.88	15.27	390.23 -	390.43	15.99	404.78 -	404.97	16.71
361.35 -	361.54	14.56	375.89 -	376.08	15.28	390.44 -	390.63	16.00	404.98 -	405.17	16.72
361.55 -	361.74	14.57	376.09 -	376.28	15.29	390.64 -	390.83	16.01	405.18 -	405.38	16.73
361.75 -	361.94	14.58	376.29 -	376.49	15.30	390.84 -	391.03	16.02	405.39 -	405.58	16.74
361.95 -	362.14	14.59	376.50 -	376.69	15.31	391.04 -	391.23	16.03	405.59 -	405.78	16.75
362.15 -	362.35	14.60	376.70 -	376.89	15.32	391.24 -	391.44	16.04	405.79 -	405.98	16.76
362.36 -	362.55	14.61	376.90 -	377.09	15.33	391.45 -	391.64	16.05	405.99 -	406.18	16.77
362.56 -	362.75	14.62	377.10 -	377.29	15.34	391.65 -	391.84	16.06	406.19 -	406.39	16.78
362.76 -	362.95	14.63	377.30 -	377.50	15.35	391.85 -	392.04	16.07	406.40 -	406.59	16.79
362.96 -	363.15	14.64	377.51 -	377.70	15.36	392.05 -	392.24	16.08	406.60 -	406.79	16.80
363.16 -	363.36	14.65	377.71 -	377.90	15.37	392.25 -	392.45	16.09	406.80 -	406.99	16.81
363.37 -	363.56	14.66	377.91 -	378.10	15.38	392.46 -	392.65	16.10	407.00 -	407.19	16.82
363.57 -	363.76	14.67	378.11 -	378.31	15.39	392.66 -	392.85	16.11	407.20 -	407.40	16.83
363.77 -	363.96	14.68	378.32 -	378.51	15.40	392.86 -	393.05	16.12	407.41 -	407.60	16.84
363.97 -	364.16	14.69	378.52 -	378.71	15.41	393.06 -	393.25	16.13	407.61 -	407.80	16.85
364.17 -	364.37	14.70	378.72 -	378.91	15.42	393.26 -	393.46	16.14	407.81 -	408.00	16.86
364.38 -	364.57	14.71	378.92 -	379.11	15.43	393.47 -	393.66	16.15	408.01 -	408.20	16.87
364.58 -	364.77	14.72	379.12 -	379.32	15.44	393.67 -	393.86	16.16	408.21 -	408.41	16.88
364.78 -	364.97	14.73	379.33 -	379.52	15.45	393.87 -	394.06	16.17	408.42 -	408.61	16.89
364.98 -	365.17	14.74	379.53 -	379.72	15.46	394.07 -	394.26	16.18	408.62 -	408.81	16.90
365.18 -	365.38	14.75	379.73 -	379.92	15.47	394.27 -	394.47	16.19	408.82 -	409.01	16.91
365.39 -	365.58	14.76	379.93 -	380.12	15.48	394.48 -	394.67	16.20	409.02 -	409.21	16.92
365.59 -	365.78	14.77	380.13 -	380.33	15.49	394.68 -	394.87	16.21	409.22 -	409.42	16.93
365.79 -	365.98	14.78	380.34 -	380.53	15.50	394.88 -	395.07	16.22	409.43 -	409.62	16.94
365.99 -	366.18	14.79	380.54 -	380.73	15.51	395.08 -	395.27	16.23	409.63 -	409.82	16.95
366.19 -	366.39	14.80	380.74 -	380.93	15.52	395.28 -	395.48	16.24	409.83 -	410.02	16.96
366.40 -	366.59	14.81	380.94 -	381.13	15.53	395.49 -	395.68	16.25	410.03 -	410.22	16.97
366.60 -	366.79	14.82	381.14 -	381.34	15.54	395.69 -	395.88	16.26	410.23 -	410.43	16.98
366.80 -	366.99	14.83	381.35 -	381.54	15.55	395.89 -	396.08	16.27	410.44 -	410.63	16.99
367.00 -	367.19	14.84	381.55 -	381.74	15.56	396.09 -	396.28	16.28	410.64 -	410.83	17.00
367.20 -	367.40	14.85	381.75 -	381.94	15.57	396.29 -	396.49	16.29	410.84 -	411.03	17.01
367.41 -	367.60	14.86	381.95 -	382.14	15.58	396.50 -	396.69	16.30	411.04 -	411.23	17.02
367.61 -	367.80	14.87	382.15 -	382.35	15.59	396.70 -	396.89	16.31	411.24 -	411.44	17.03
367.81 -	368.00	14.88	382.36 -	382.55	15.60	396.90 -	397.09	16.32	411.45 -	411.64	17.04
368.01 -	368.20	14.89	382.56 -	382.75	15.61	397.10 -	397.29	16.33	411.65 -	411.84	17.05
368.21 -	368.41	14.90	382.76 -	382.95	15.62	397.30 -	397.50	16.34	411.85 -	412.04	17.06
368.42 -	368.61	14.91	382.96 -	383.15	15.63	397.51 -	397.70	16.35	412.05 -	412.24	17.07
368.62 -	368.81	14.92	383.16 -	383.36	15.64	397.71 -	397.90	16.36	412.25 -	412.45	17.08
368.82 -	369.01	14.93	383.37 -	383.56	15.65	397.91 -	398.10	16.37	412.46 -	412.65	17.09
369.02 -	369.21	14.94	383.57 -	383.76	15.66	398.11 -	398.31	16.38	412.66 -	412.85	17.10
369.22 -	369.42	14.95	383.77 -	383.96	15.67	398.32 -	398.51	16.39	412.86 -	413.05	17.11
369.43 -	369.62	14.96	383.97 -	384.16	15.68	398.52 -	398.71	16.40	413.06 -	413.25	17.12
369.63 -	369.82	14.97	384.17 -	384.37	15.69	398.72 -	398.91	16.41	413.26 -	413.46	17.13
369.83 -	370.02	14.98	384.38 -	384.57	15.70	398.92 -	399.11	16.42	413.47 -	413.66	17.14
370.03 -	370.22	14.99	384.58 -	384.77	15.71	399.12 -	399.32	16.43	413.67 -	413.86	17.15
370.23 -	370.43	15.00	384.78 -	384.97	15.72	399.33 -	399.52	16.44	413.87 -	414.06	17.16
370.44 -	370.63	15.01	384.98 -	385.17	15.73	399.53 -	399.72	16.45	414.07 -	414.26	17.17
370.64 -	370.83	15.02	385.18 -	385.38	15.74	399.73 -	399.92	16.46	414.27 -	414.47	17.18
370.84 -	371.03	15.03	385.39 -	385.58	15.75	399.93 -	400.12	16.47	414.48 -	414.67	17.19
371.04 -	371.23	15.04	385.59 -	385.78	15.76	400.13 -	400.33	16.48	414.68 -	414.87	17.20
371.24 -	371.44	15.05	385.79 -	385.98	15.77	400.34 -	400.53	16.49	414.88 -	415.07	17.21
371.45 -	371.64	15.06	385.99 -	386.18	15.78	400.54 -	400.73	16.50	415.08 -	415.27	17.22
371.65 -	371.84	15.07	386.19 -	386.39	15.79	400.74 -	400.93	16.51	415.28 -	415.48	17.23
371.85 -	372.04	15.08	386.40 -	386.59	15.80	400.94 -	401.13	16.52	415.49 -	415.68	17.24
372.05 -	372.24	15.09	386.60 -	386.79	15.81	401.14 -	401.34	16.53	415.69 -	415.88	17.25
372.25 -	372.45	15.10	386.80 -	386.99	15.82	401.35 -	401.54	16.54	415.89 -	416.08	17.26
372.46 -	372.65	15.11	387.00 -	387.19	15.83	401.55 -	401.74	16.55	416.09 -	416.28	17.27

Employee's maximum CPP contribution for the year 2009 is $2,118.60

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La cotisation maximale de l'employé au RPC pour l'année 2009 est de 2 118,60 $

Employment Insurance Premiums — Cotisations à l'assurance-emploi

Insurable Earnings Rémunération assurable From - De	To - À	EI premium Cotisation d'AE	Insurable Earnings Rémunération assurable From - De	To - À	EI premium Cotisation d'AE	Insurable Earnings Rémunération assurable From - De	To - À	EI premium Cotisation d'AE	Insurable Earnings Rémunération assurable From - De	To - À	EI premium Cotisation d'AE
333.24 -	333.81	5.77	374.86 -	375.43	6.49	416.48 -	417.05	7.21	458.10 -	458.67	7.93
333.82 -	334.39	5.78	375.44 -	376.01	6.50	417.06 -	417.63	7.22	458.68 -	459.24	7.94
334.40 -	334.97	5.79	376.02 -	376.58	6.51	417.64 -	418.20	7.23	459.25 -	459.82	7.95
334.98 -	335.54	5.80	376.59 -	377.16	6.52	418.21 -	418.78	7.24	459.83 -	460.40	7.96
335.55 -	336.12	5.81	377.17 -	377.74	6.53	418.79 -	419.36	7.25	460.41 -	460.98	7.97
336.13 -	336.70	5.82	377.75 -	378.32	6.54	419.37 -	419.94	7.26	460.99 -	461.56	7.98
336.71 -	337.28	5.83	378.33 -	378.90	6.55	419.95 -	420.52	7.27	461.57 -	462.13	7.99
337.29 -	337.86	5.84	378.91 -	379.47	6.56	420.53 -	421.09	7.28	462.14 -	462.71	8.00
337.87 -	338.43	5.85	379.48 -	380.05	6.57	421.10 -	421.67	7.29	462.72 -	463.29	8.01
338.44 -	339.01	5.86	380.06 -	380.63	6.58	421.68 -	422.25	7.30	463.30 -	463.87	8.02
339.02 -	339.59	5.87	380.64 -	381.21	6.59	422.26 -	422.83	7.31	463.88 -	464.45	8.03
339.60 -	340.17	5.88	381.22 -	381.79	6.60	422.84 -	423.41	7.32	464.46 -	465.02	8.04
340.18 -	340.75	5.89	381.80 -	382.36	6.61	423.42 -	423.98	7.33	465.03 -	465.60	8.05
340.76 -	341.32	5.90	382.37 -	382.94	6.62	423.99 -	424.56	7.34	465.61 -	466.18	8.06
341.33 -	341.90	5.91	382.95 -	383.52	6.63	424.57 -	425.14	7.35	466.19 -	466.76	8.07
341.91 -	342.48	5.92	383.53 -	384.10	6.64	425.15 -	425.72	7.36	466.77 -	467.34	8.08
342.49 -	343.06	5.93	384.11 -	384.68	6.65	425.73 -	426.30	7.37	467.35 -	467.91	8.09
343.07 -	343.64	5.94	384.69 -	385.26	6.66	426.31 -	426.87	7.38	467.92 -	468.49	8.10
343.65 -	344.21	5.95	385.27 -	385.83	6.67	426.88 -	427.45	7.39	468.50 -	469.07	8.11
344.22 -	344.79	5.96	385.84 -	386.41	6.68	427.46 -	428.03	7.40	469.08 -	469.65	8.12
344.80 -	345.37	5.97	386.42 -	386.99	6.69	428.04 -	428.61	7.41	469.66 -	470.23	8.13
345.38 -	345.95	5.98	387.00 -	387.57	6.70	428.62 -	429.19	7.42	470.24 -	470.80	8.14
345.96 -	346.53	5.99	387.58 -	388.15	6.71	429.20 -	429.76	7.43	470.81 -	471.38	8.15
346.54 -	347.10	6.00	388.16 -	388.72	6.72	429.77 -	430.34	7.44	471.39 -	471.96	8.16
347.11 -	347.68	6.01	388.73 -	389.30	6.73	430.35 -	430.92	7.45	471.97 -	472.54	8.17
347.69 -	348.26	6.02	389.31 -	389.88	6.74	430.93 -	431.50	7.46	472.55 -	473.12	8.18
348.27 -	348.84	6.03	389.89 -	390.46	6.75	431.51 -	432.08	7.47	473.13 -	473.69	8.19
348.85 -	349.42	6.04	390.47 -	391.04	6.76	432.09 -	432.65	7.48	473.70 -	474.27	8.20
349.43 -	349.99	6.05	391.05 -	391.61	6.77	432.66 -	433.23	7.49	474.28 -	474.85	8.21
350.00 -	350.57	6.06	391.62 -	392.19	6.78	433.24 -	433.81	7.50	474.86 -	475.43	8.22
350.58 -	351.15	6.07	392.20 -	392.77	6.79	433.82 -	434.39	7.51	475.44 -	476.01	8.23
351.16 -	351.73	6.08	392.78 -	393.35	6.80	434.40 -	434.97	7.52	476.02 -	476.58	8.24
351.74 -	352.31	6.09	393.36 -	393.93	6.81	434.98 -	435.54	7.53	476.59 -	477.16	8.25
352.32 -	352.89	6.10	393.94 -	394.50	6.82	435.55 -	436.12	7.54	477.17 -	477.74	8.26
352.90 -	353.46	6.11	394.51 -	395.08	6.83	436.13 -	436.70	7.55	477.75 -	478.32	8.27
353.47 -	354.04	6.12	395.09 -	395.66	6.84	436.71 -	437.28	7.56	478.33 -	478.90	8.28
354.05 -	354.62	6.13	395.67 -	396.24	6.85	437.29 -	437.86	7.57	478.91 -	479.47	8.29
354.63 -	355.20	6.14	396.25 -	396.82	6.86	437.87 -	438.43	7.58	479.48 -	480.05	8.30
355.21 -	355.78	6.15	396.83 -	397.39	6.87	438.44 -	439.01	7.59	480.06 -	480.63	8.31
355.79 -	356.35	6.16	397.40 -	397.97	6.88	439.02 -	439.59	7.60	480.64 -	481.21	8.32
356.36 -	356.93	6.17	397.98 -	398.55	6.89	439.60 -	440.17	7.61	481.22 -	481.79	8.33
356.94 -	357.51	6.18	398.56 -	399.13	6.90	440.18 -	440.75	7.62	481.80 -	482.36	8.34
357.52 -	358.09	6.19	399.14 -	399.71	6.91	440.76 -	441.32	7.63	482.37 -	482.94	8.35
358.10 -	358.67	6.20	399.72 -	400.28	6.92	441.33 -	441.90	7.64	482.95 -	483.52	8.36
358.68 -	359.24	6.21	400.29 -	400.86	6.93	441.91 -	442.48	7.65	483.53 -	484.10	8.37
359.25 -	359.82	6.22	400.87 -	401.44	6.94	442.49 -	443.06	7.66	484.11 -	484.68	8.38
359.83 -	360.40	6.23	401.45 -	402.02	6.95	443.07 -	443.64	7.67	484.69 -	485.26	8.39
360.41 -	360.98	6.24	402.03 -	402.60	6.96	443.65 -	444.21	7.68	485.27 -	485.83	8.40
360.99 -	361.56	6.25	402.61 -	403.17	6.97	444.22 -	444.79	7.69	485.84 -	486.41	8.41
361.57 -	362.13	6.26	403.18 -	403.75	6.98	444.80 -	445.37	7.70	486.42 -	486.99	8.42
362.14 -	362.71	6.27	403.76 -	404.33	6.99	445.38 -	445.95	7.71	487.00 -	487.57	8.43
362.72 -	363.29	6.28	404.34 -	404.91	7.00	445.96 -	446.53	7.72	487.58 -	488.15	8.44
363.30 -	363.87	6.29	404.92 -	405.49	7.01	446.54 -	447.10	7.73	488.16 -	488.72	8.45
363.88 -	364.45	6.30	405.50 -	406.06	7.02	447.11 -	447.68	7.74	488.73 -	489.30	8.46
364.46 -	365.02	6.31	406.07 -	406.64	7.03	447.69 -	448.26	7.75	489.31 -	489.88	8.47
365.03 -	365.60	6.32	406.65 -	407.22	7.04	448.27 -	448.84	7.76	489.89 -	490.46	8.48
365.61 -	366.18	6.33	407.23 -	407.80	7.05	448.85 -	449.42	7.77	490.47 -	491.04	8.49
366.19 -	366.76	6.34	407.81 -	408.38	7.06	449.43 -	449.99	7.78	491.05 -	491.61	8.50
366.77 -	367.34	6.35	408.39 -	408.95	7.07	450.00 -	450.57	7.79	491.62 -	492.19	8.51
367.35 -	367.91	6.36	408.96 -	409.53	7.08	450.58 -	451.15	7.80	492.20 -	492.77	8.52
367.92 -	368.49	6.37	409.54 -	410.11	7.09	451.16 -	451.73	7.81	492.78 -	493.35	8.53
368.50 -	369.07	6.38	410.12 -	410.69	7.10	451.74 -	452.31	7.82	493.36 -	493.93	8.54
369.08 -	369.65	6.39	410.70 -	411.27	7.11	452.32 -	452.89	7.83	493.94 -	494.50	8.55
369.66 -	370.23	6.40	411.28 -	411.84	7.12	452.90 -	453.46	7.84	494.51 -	495.08	8.56
370.24 -	370.80	6.41	411.85 -	412.42	7.13	453.47 -	454.04	7.85	495.09 -	495.66	8.57
370.81 -	371.38	6.42	412.43 -	413.00	7.14	454.05 -	454.62	7.86	495.67 -	496.24	8.58
371.39 -	371.96	6.43	413.01 -	413.58	7.15	454.63 -	455.20	7.87	496.25 -	496.82	8.59
371.97 -	372.54	6.44	413.59 -	414.16	7.16	455.21 -	455.78	7.88	496.83 -	497.39	8.60
372.55 -	373.12	6.45	414.17 -	414.73	7.17	455.79 -	456.35	7.89	497.40 -	497.97	8.61
373.13 -	373.69	6.46	414.74 -	415.31	7.18	456.36 -	456.93	7.90	497.98 -	498.55	8.62
373.70 -	374.27	6.47	415.32 -	415.89	7.19	456.94 -	457.51	7.91	498.56 -	499.13	8.63
374.28 -	374.85	6.48	415.90 -	416.47	7.20	457.52 -	458.09	7.92	499.14 -	499.71	8.64

Yearly maximum insurable earnings are $42,300
Yearly maximum employee premiums are $731.79
The premium rate for 2009 is 1.73 %

Le maximum annuel de la rémunération assurable est de 42 300 $
La cotisation maximale annuelle de l'employé est de 731,79 $
Le taux de cotisation pour 2009 est de 1,73 %

Federal tax deductions
Effective January 1, 2009
Weekly (52 pay periods a year)
Also look up the tax deductions in the provincial table

Retenues d'impôt fédéral
En vigueur le 1er janvier 2009
Hebdomadaire (52 périodes de paie par année)
Cherchez aussi les retenues d'impôt dans la table provinciale

Pay Rémunération			Federal claim codes/Codes de demande fédéraux									
		0	1	2	3	4	5	6	7	8	9	10
From De	Less than Moins de	Deduct from each pay Retenez sur chaque paie										
335	339	44.65	15.55	12.70	7.00	1.30						
339	343	45.20	16.10	13.25	7.55	1.85						
343	347	45.80	16.65	13.80	8.10	2.45						
347	351	46.35	17.20	14.35	8.65	3.00						
351	355	46.90	17.75	14.90	9.25	3.55						
355	359	47.45	18.35	15.50	9.80	4.10						
359	363	48.00	18.90	16.05	10.35	4.65						
363	367	48.60	19.45	16.60	10.90	5.25						
367	371	49.15	20.00	17.15	11.45	5.80	.10					
371	375	49.70	20.55	17.70	12.05	6.35	.65					
375	379	50.25	21.15	18.30	12.60	6.90	1.20					
379	383	50.80	21.70	18.85	13.15	7.45	1.80					
383	387	51.40	22.25	19.40	13.70	8.00	2.35					
387	391	51.95	22.80	19.95	14.25	8.60	2.90					
391	395	52.50	23.35	20.50	14.85	9.15	3.45					
395	399	53.05	23.95	21.10	15.40	9.70	4.00					
399	403	53.60	24.50	21.65	15.95	10.25	4.60					
403	407	54.20	25.05	22.20	16.50	10.80	5.15					
407	411	54.75	25.60	22.75	17.05	11.40	5.70					
411	415	55.30	26.15	23.30	17.65	11.95	6.25	.55				
415	419	55.85	26.75	23.90	18.20	12.50	6.80	1.15				
419	423	56.40	27.30	24.45	18.75	13.05	7.40	1.70				
423	427	57.00	27.85	25.00	19.30	13.60	7.95	2.25				
427	431	57.55	28.40	25.55	19.85	14.20	8.50	2.80				
431	435	58.10	28.95	26.10	20.45	14.75	9.05	3.35				
435	439	58.65	29.50	26.70	21.00	15.30	9.60	3.95				
439	443	59.20	30.10	27.25	21.55	15.85	10.20	4.50				
443	447	59.80	30.65	27.80	22.10	16.40	10.75	5.05				
447	451	60.35	31.20	28.35	22.65	17.00	11.30	5.60				
451	455	60.90	31.75	28.90	23.25	17.55	11.85	6.15	.50			
455	459	61.45	32.30	29.50	23.80	18.10	12.40	6.75	1.05			
459	463	62.00	32.90	30.05	24.35	18.65	12.95	7.30	1.60			
463	467	62.60	33.45	30.60	24.90	19.20	13.55	7.85	2.15			
467	471	63.15	34.00	31.15	25.45	19.80	14.10	8.40	2.70			
471	475	63.70	34.55	31.70	26.05	20.35	14.65	8.95	3.30			
475	479	64.25	35.10	32.30	26.60	20.90	15.20	9.55	3.85			
479	483	64.80	35.70	32.85	27.15	21.45	15.75	10.10	4.40			
483	487	65.40	36.25	33.40	27.70	22.00	16.35	10.65	4.95			
487	491	65.95	36.80	33.95	28.25	22.60	16.90	11.20	5.50			
491	495	66.50	37.35	34.50	28.85	23.15	17.45	11.75	6.10	.40		
495	499	67.05	37.90	35.10	29.40	23.70	18.00	12.35	6.65	.95		
499	503	67.60	38.50	35.65	29.95	24.25	18.55	12.90	7.20	1.50		
503	507	68.20	39.05	36.20	30.50	24.80	19.15	13.45	7.75	2.05		
507	511	68.75	39.60	36.75	31.05	25.40	19.70	14.00	8.30	2.65		
511	515	69.30	40.15	37.30	31.65	25.95	20.25	14.55	8.90	3.20		
515	519	69.85	40.70	37.90	32.20	26.50	20.80	15.15	9.45	3.75		
519	523	70.40	41.30	38.45	32.75	27.05	21.35	15.70	10.00	4.30		
523	527	71.00	41.85	39.00	33.30	27.60	21.95	16.25	10.55	4.85		
527	531	71.55	42.40	39.55	33.85	28.20	22.50	16.80	11.10	5.45		
531	535	72.10	42.95	40.10	34.45	28.75	23.05	17.35	11.70	6.00	.30	
535	539	72.65	43.50	40.70	35.00	29.30	23.60	17.90	12.25	6.55	.85	
539	543	73.20	44.10	41.25	35.55	29.85	24.15	18.50	12.80	7.10	1.40	
543	547	73.80	44.65	41.80	36.10	30.40	24.75	19.05	13.35	7.65	2.00	
547	551	74.35	45.20	42.35	36.65	31.00	25.30	19.60	13.90	8.25	2.55	
551	555	74.90	45.75	42.90	37.25	31.55	25.85	20.15	14.50	8.80	3.10	

This table is available on TOD **D-2** **Vous pouvez obtenir cette table sur TSD**

British Columbia provincial tax deductions
Effective January 1, 2009
Weekly (52 pay periods a year)
Also look up the tax deductions in the federal table

Retenues d'impôt provincial de la Colombie-Britannique
En vigueur le 1er janvier 2009
Hebdomadaire (52 périodes de paie par année)
Cherchez aussi les retenues d'impôt dans la table fédérale

Pay / Rémunération		Provincial claim codes/Codes de demande provinciaux										
		0	1	2	3	4	5	6	7	8	9	10
From / De	Less than / Moins de	Deduct from each pay / Retenez sur chaque paie										
	343	*	.00									
343 -	345	9.30	.20									
345 -	347	9.45	.35									
347 -	349	9.60	.50									
349 -	351	9.80	.65									
351 -	353	9.95	.80									
353 -	355	10.10	.95									
355 -	357	10.25	1.15	.10								
357 -	359	10.40	1.30	.25								
359 -	361	10.55	1.45	.40								
361 -	363	10.75	1.60	.60								
363 -	365	10.90	1.75	.75								
365 -	367	11.05	1.90	.90								
367 -	369	11.20	2.10	1.05								
369 -	371	11.35	2.25	1.20								
371 -	373	11.50	2.40	1.35								
373 -	375	11.70	2.55	1.55								
375 -	377	11.85	2.70	1.70								
377 -	379	12.00	2.90	1.85								
379 -	381	12.15	3.05	2.00								
381 -	383	12.30	3.20	2.15	.10							
383 -	385	12.45	3.35	2.30	.25							
385 -	387	12.65	3.50	2.50	.45							
387 -	389	12.80	3.65	2.65	.60							
389 -	391	12.95	3.85	2.80	.75							
391 -	393	13.10	4.00	2.95	.90							
393 -	395	13.25	4.15	3.10	1.05							
395 -	397	13.40	4.30	3.30	1.20							
397 -	399	13.60	4.45	3.45	1.40							
399 -	401	13.75	4.60	3.60	1.55							
401 -	403	13.90	4.80	3.75	1.70							
403 -	405	14.05	4.95	3.90	1.85							
405 -	407	14.20	5.10	4.05	2.00							
407 -	409	14.35	5.25	4.25	2.15	.10						
409 -	411	14.55	5.40	4.40	2.35	.30						
411 -	413	14.70	5.55	4.55	2.50	.45						
413 -	415	14.85	5.75	4.70	2.65	.60						
415 -	417	15.00	5.90	4.85	2.80	.75						
417 -	419	15.15	6.05	5.00	2.95	.90						
419 -	421	15.30	6.20	5.20	3.10	1.05						
421 -	423	15.50	6.35	5.35	3.30	1.25						
423 -	425	15.65	6.50	5.50	3.45	1.40						
425 -	427	15.80	6.70	5.65	3.60	1.55						
427 -	429	15.95	6.85	5.80	3.75	1.70						
429 -	431	16.10	7.00	5.95	3.90	1.85						
431 -	433	16.25	7.15	6.15	4.10	2.00						
433 -	435	16.45	7.30	6.30	4.25	2.20	.15					
435 -	437	16.60	7.45	6.45	4.40	2.35	.30					
437 -	439	16.75	7.65	6.60	4.55	2.50	.45					
439 -	441	16.90	7.80	6.75	4.70	2.65	.60					
441 -	443	17.05	7.95	6.90	4.85	2.80	.75					
443 -	445	17.20	8.10	7.10	5.05	2.95	.90					
445 -	447	17.40	8.25	7.25	5.20	3.15	1.10					
447 -	449	17.55	8.40	7.40	5.35	3.30	1.25					
449 -	451	17.70	8.60	7.55	5.50	3.45	1.40					

*You normally use claim code "0" only for non-resident employees. However, if you have non-resident employees who earn less than the minimum amount shown in the "Pay" column, you may not be able to use these tables. Instead, refer to the "Step-by-step calculation of tax deductions" in Section "A" of this publication.

*Le code de demande «0» est normalement utilisé seulement pour les non-résidents. Cependant, si la rémunération de votre employé non résidant est inférieure au montant minimum indiqué dans la colonne «Rémunération», vous ne pourrez peut-être pas utiliser ces tables. Reportez-vous alors au «Calcul des retenues d'impôt, étape par étape» dans la section «A» de cette publication.

This table is available on TOD **E-1** **Vous pouvez obtenir cette table sur TSD**

Solutions

Lesson A: Length

Lesson A: Activity 1: Try This

1. Answers will vary. Answers should be between 10 and 14.

2. Answers will vary based on your answer from #1. For example, if you said that your foot was 11 thumb-widths long, then the fraction would be $\frac{1}{11}$. Your thumb width is one eleventh of the length of your foot.

Lesson A: Activity 2: Self-Check

1. $$\begin{aligned} \frac{3}{8}+1\frac{7}{16} &= \frac{3}{8}+\frac{23}{16} \\ &= \frac{3\times 2}{8\times 2}+\frac{23}{16} \\ &= \frac{6}{16}+\frac{23}{16} \\ &= \frac{29}{16} \\ &= 1\frac{13}{16} \end{aligned}$$

2. $$\begin{aligned} 2\frac{1}{2}-\frac{3}{4} &= \frac{5}{2}-\frac{3}{4} \\ &= \frac{5\times 2}{2\times 2}-\frac{3}{4} \\ &= \frac{10}{4}-\frac{3}{4} \\ &= \frac{7}{4} \\ &= 1\frac{3}{4} \end{aligned}$$

Lesson A: Activity 3: Try This

1. The longest lines are at whole inches. The slightly shorter lines are at the $\frac{1}{2}$-in mark.
2. The next shorter lines mark $\frac{1}{4}$ in.
3. The next shorter lines mark $\frac{1}{8}$ in.
4. a. $4\frac{1}{4}$ in

   b. $3\frac{7}{8}$ in

   c. $2\frac{15}{16}$ in

   d. $2\frac{1}{2}$ in
5. Answers will vary depending on the objects you chose. Ask a family member to check your work.

Lesson A: Activity 4: Self-Check

1. a. You can find the solution by looking at your ruler, or by subtracting. The solution below shows the subtraction method.

$$\begin{aligned} 5\frac{1}{2} - \frac{3}{16} &= 5\frac{1\times 8}{2\times 8} - \frac{3}{16} \\ &= 5\frac{8}{16} - \frac{3}{16} \\ &= 5\frac{5}{16} \end{aligned}$$

   The planed width will be $5\frac{5}{16}$ inches.

b. You can find the solution by looking at your ruler, or by subtracting. The solution below shows the subtraction method.

$$5\frac{1}{2} - \frac{5}{32} = 5\frac{1\times16}{2\times16} - \frac{5}{32}$$
$$= 5\frac{16}{32} - \frac{5}{32}$$
$$= 5\frac{11}{32}$$

The planed width will be $5\frac{11}{32}$ inches.

Lesson A: Activity 5: Self-Check

1. Divide 93 in by 12.

$$\frac{93}{12} = 7.75$$

She is more than 7 ft tall.

Continue the calculation:

$$7\text{ft} = (7\times12)\text{in}$$
$$= 84\text{ in}$$

$$93\text{ in} - 84\text{ in} = 9\text{ in}$$

So, $93\text{ in} = 84\text{ in} + 9\text{ in}$
$= 7\text{ ft } 9\text{ in}$
$= 7'\,9"$

De-Fen Yao is 7′9″ tall.

You could also do this conversion using long division.

$$12\overline{)93}\quad 7$$
$$\underline{84}$$
$$9$$

$$93\text{ in} = 7\frac{9}{12}\text{ ft} = 7\text{ft }9\text{in}$$

2. $16\text{ ft }6\frac{3}{4}\text{ in} = 16\times12\text{ in} + 6\frac{3}{4}\text{ in}$
$= 192\text{ in} + 6\text{ in}$
$= 198\frac{3}{4}\text{ in}$

The 2008 women's Olympic record in pole vaulting is $198\frac{3}{4}$ in.

3. First convert all measures to inches.

$$\begin{aligned} 7 \text{ ft} &= 7 \times 12 \text{ in} \\ &= 84 \text{ in} \end{aligned}$$

$$\begin{aligned} 1 \text{ ft } 3 \text{ in} &= 1 \times 12 \text{ in} + 3 \text{ in} \\ &= 12 \text{ in} + 3 \text{ in} \\ &= 15 \text{ in} \end{aligned}$$

84 in – 15 in = 69 in

Now convert 69 in to feet and inches.

$$\begin{array}{r} 5 \\ 12\overline{)69} \\ \underline{60} \\ 9 \end{array}$$

$$69 \text{ in} = 5\frac{9}{12} \text{ ft} = 5 \text{ ft } 9 \text{ in}$$

After the cut, the board is 5 ft 9 in long.

Another method involves subtracting the feet and then taking 3" off that difference:
7' – 1' = 6'

6' less 3" is the same as 5'12" less 3", which is 5'9".

4. 5 ft 7 in + 3 ft 4 in + 6 ft 5 in =14 ft 16 in

But,

16 in = 12 in + 4 in, or 1 ft 4 in

So,

$$\begin{aligned} 5 \text{ ft } 7 \text{ in} + 3 \text{ ft } 4 \text{ in} + 6 \text{ ft } 5 \text{ in} &= 14 \text{ ft} + 1 \text{ft } 4 \text{ in} \\ &= 15 \text{ ft } 4 \text{ in} \end{aligned}$$

Another method is to convert all measurements to inches, add these numbers of inches, and then express the measurement in feet and inches.

$$5 \text{ ft } 7 \text{ in} = 5 \times 12 \text{ in} + 7 \text{ in}$$
$$= 67 \text{ in}$$

$$3 \text{ ft } 4 \text{ in} = 3 \times 12 \text{ in} + 4 \text{ in}$$
$$= 40 \text{ in}$$

$$6 \text{ ft } 5 \text{ in} = 6 \times 12 \text{ in} + 5 \text{ in}$$
$$= 77 \text{ in}$$

$$67 \text{ in} + 40 \text{ in} + 77 \text{ in}$$
$$= 184 \text{ in}$$

$$\frac{184 \text{ in}}{12} = 15.33$$

184 in is more than 15 ft.

Continue the calculation:

$$15 \text{ ft} = 15 \times 12 \text{ in}$$
$$= 180 \text{ in}$$

$$184 \text{ in} = 180 \text{ in} + 4 \text{ in}$$
$$= 15 \text{ ft } 4 \text{ in}$$

Lesson A: Activity 6: Try This

1 mi = 1760 yd

1 yd = 3 ft

1 ft = 12 in

Lesson A: Activity 7: Self-Check

1. Let x be the length of the golf course in miles.

$$\frac{x}{6114 \text{ yd}} = \frac{1 \text{ mi}}{1760 \text{ yd}}$$

$$x(1760 \text{ yd}) = (1 \text{ mi})(6114 \text{ yd})$$

$$x = \frac{(1 \text{ mi})(6114 \text{ yd})}{(1760 \text{ yd})}$$

$$x = 3.4738...$$

The course is about 3.5 mi long.

2. $\frac{1}{4}\text{mile} = 0.25 \text{ mi}$
$= (0.25 \times 1760) \text{ yd}$
$= 440 \text{ yd}$

The conversion factor is 1760. You multiply because yards are smaller than yards so there will be more of them.

A quarter mile is 440 yd, so Marcie's friend lives 440 yd off the main road.

3. perimeter of quarter section $= 4 \times 0.5 \text{ mi}$
$= 2 \text{ mi}$
$2 \text{ mi} = (2 \times 5280) \text{ ft}$
$= 10\,560 \text{ ft}$

A total of 10 560 ft of fencing is need to enclose the quarter section.

4. $110 \text{ yd} = (110 \times 3) \text{ ft}$
$= 330 \text{ ft}$

There are 330 ft in 110 yd.

5. Barbara needs a quarter of a mile of fencing. (One quarter mile = 0.25 mi)
1 mile = 1760 yards and 1 yard = 3 feet

$0.25 \text{ mi} = (0.25 \times 1760) \text{ yd}$
$= 440 \text{ yd}$

Convert to yards first.

$440 \text{ yd} = (440 \times 3) \text{ ft}$
$= 1320 \text{ ft}$

Then convert to feet.

For the fencing, she will use three strands of wire. So,

1320 ft × 3 = 3960 ft

Barbara needs 3960 ft of wire.

Lesson A: Activity 8: Self-Check

1. 1 in = 2.54 cm
Let n be the diagonal of the television in centimetres.

$$\frac{n}{21 \text{ in}} = \frac{2.54 \text{ cm}}{1 \text{ in}}$$

$$n(1 \text{ in}) = (2.54 \text{ cm})(21 \text{ in})$$

$$n = \frac{(2.54 \text{ cm})(21 \text{ in})}{(1 \text{ in})}$$

$$n = 53.34 \text{ cm}$$

The screen measures 53.34 cm diagonal.

2. 1 in = 2.54 cm

So,

$$2 \text{ in} = (2 \times 2.54)\text{cm}$$
$$= 5.08 \text{ cm}$$
$$1 \text{ ft} = 30.48 \text{ cm}$$

So,

$$6 \text{ ft} = (6 \times 30.48)\text{cm}$$
$$= 182.88 \text{ cm}$$

Then,

$$6 \text{ ft } 2 \text{ in} = 182.88 \text{ cm} + 5.08 \text{ cm}$$
$$= 187.96 \text{ cm}$$

Jack's height is about 188 cm.

The following alternate solution is based on converting the measurement completely into inches and then into centimetres.

1 ft = 12 in

So,

$$6 \text{ ft} = 6 \times 12 \text{ in}$$
$$= 72 \text{ in}$$
$$6 \text{ ft } 2 \text{ in} = 72 \text{ in} + 2 \text{ in}$$
$$= 74 \text{ in}$$

Jack's height is 74". Now convert his height to centimetres.

1 in = 2.54 cm

So,

$$74 \text{ in} = 74 \times 2.54 \text{ cm}$$
$$= 187.96 \text{ cm}$$
$$= 188 \text{ cm}$$

Jack's height is about 188 cm.

3. 1 mi = 1.6 km

   Let n be the distance from Michael's house to the Red Pheasant First Nation in miles.

$$\frac{n}{12.3 \text{ km}} = \frac{1 \text{ mi}}{1.6 \text{ km}}$$

$$n(1.6 \text{ km}) = (1 \text{ mi})(12.3 \text{ km})$$

$$n = \frac{(1 \text{ mi})(12.3 \text{ km})}{(1.6 \text{ km})}$$

$$n = 7.6875 \text{ mi}$$

   Michael lives about 7.7 mi from Red Pheasant First Nation.

Lesson B: Area

Lesson B: Activity 1: Try This

1. They calculated the wrong answer. All of the steps are done correctly until the final calculation. Maybe they pressed the wrong key on their calculator!

2. Round 1760 yards to 2000 yards.
   Round 39 miles to 40 miles.

$$\text{let } x = \text{the distance in yards}$$

$$\frac{x}{40 \text{ mi}} = \frac{1800 \text{ yd}}{1 \text{ mi}}$$

$$x(1 \text{ mi}) = (1800 \text{ yd})(40 \text{ mi})$$

$$x = \frac{(1800 \text{ yd})(40 \text{ mi})}{(1 \text{ mi})}$$

$$x = 72\,000 \text{ yd}$$

   The answer should be around 72 000 yd. Since we rounded both numbers up, our actual answer will probably be a bit lower than our estimate.

3. let x = the distance in yards

$$\frac{x}{39 \text{ mi}} = \frac{1760 \text{ yd}}{1 \text{ mi}}$$

$$x(1 \text{ mi}) = (1760 \text{ yd})(39 \text{ mi})$$

$$x = \frac{(1760 \text{ yd})(39 \text{ mi})}{(1 \text{ mi})}$$

$$x = 68\,640 \text{ yd}$$

39 miles is equal to 68 640 yards.

4. If the student had estimated before solving the problem, he or she would have realized that the calculated solution was incorrect. Then the student could have gone back, found the error, and fixed it.

Lesson B: Activity 2: Try This

1. 31 × 5280

   estimate: 30 x 5000 = 150 000

   exact product: 31 × 5280 = 163 680

   The estimate and exact product are fairly close.

2. 480 × 12

   estimate: 500 × 10 = 5000

   exact product: 480 × 12 = 5760

   The estimate and exact product are fairly close.

3. 13 × 27

   estimate: 10 × 30 = 300

   exact product: 13 × 27 = 351

   The estimate and exact product are fairly close.

4. 162.5 × 144

   estimate: 200 × 100 = 20 000

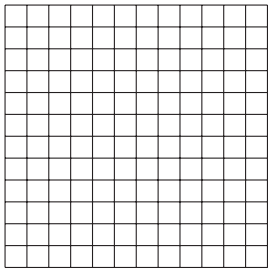
   exact product: 162.5 × 144 = 23 400

   The estimate and exact product are fairly close even though the factors change considerably when rounded.

Lesson B: Activity 3: Try This

1. a. Nine squares, each 1 ft on a side, are needed to form a larger square 1 yd on each side.
   b. One square yard equals 9 square feet.

2. a. There are 12 rows of 12 square inches, so there are 144 square inches in a square foot.
   b. Answers will vary. A sample answer is given.
   You may have used the square inch to see how many rows of square inches would fit in a square foot, and how many square inches would fit in a row. Or, you may have used your ruler to draw a grid that shows how many square inches fit in a square foot.



Lesson B: Activity 4: Self-Check

1. Estimate the answer.

   10 ft 9 in is close to 11 ft.
   11 ft 6 in is close to 12 ft.

   The required answer will be less but close to 11 ft × 12 ft or 132 ft².

   Next calculate a more precise answer.
   First make sure the dimensions are in feet (not inches). $10\,\text{ft}\,9\,\text{in} = 10\frac{9}{12}\,\text{ft}$

   Notice that we can reduce the fraction by dividing the numerator and the denominator by a common factor of 3.

$$10\frac{9}{12}\,\text{ft} = 10\frac{3}{4}\,\text{ft}$$

$$11\,\text{ft}\,6\,\text{in} = 11\frac{6}{12}\,\text{ft}$$

$$= 11\frac{1}{2}\,\text{ft}$$

   Now find the area. $A = l \times w$

$$= 10\frac{3}{4}\,\text{ft} \times 11\frac{1}{2}\,\text{ft}$$

$$= \frac{43}{4}\,\text{ft} \times \frac{23}{2}\,\text{ft}$$

$$= \frac{989}{8}\,\text{ft}^2$$

$$= 123\frac{5}{8}\,\text{ft}^2$$

   Jasper will need about 124 ft² of parquet flooring for his kitchen.

2. Find the area of a sheet of paper.

$$\begin{aligned} A &= l \times w \\ &= 8.5 \text{ in} \times 11 \text{ in} \\ &= 93.4 \text{ in}^2 \end{aligned}$$

Remember, 1 ft² = 144 in²
Darcy is incorrect. A sheet of printer paper is not close to a square foot. It is almost 50 in² smaller.

3. $$\begin{aligned} 1260 \text{ ft}^2 &= \frac{1260}{9} \text{ yd}^2 \\ &= 140 \text{ yd}^2 \end{aligned}$$

Paula's new house is 140 yd² in area.

4. Find the area of the lawn.

$$\begin{aligned} A &= l \times w \\ &= 50 \text{ ft} \times 30 \text{ ft} \\ &= 1500 \text{ ft}^2 \end{aligned}$$

$$1500 \text{ ft}^2 = 1000 \text{ ft}^2 + 500 \text{ ft}^2$$

500 ft^2 is $\frac{1}{2}$ of 1000 ft^2.

Boris will need 6 lb + $\frac{1}{2}$ × 6 lb = 6 + 3 or 9 lb of fertilizer.

5. Norma's two shoes cover 36 in² + 36 in² = 72 in².

Change 72 in² to square feet.
Remember, 1 ft² = 144 in².

So,

$$\begin{aligned} 72 \text{ in}^2 &= \frac{72}{144} \text{ft}^2 \\ &= \frac{1}{2} \text{ft}^2 \end{aligned}$$

Norma's two shoes cover half a square foot!

6. $$1 \text{ yd} = 36 \text{ in}$$

$$\begin{aligned} 1 \text{ yd}^2 &= 1 \text{ yd} \times 1 \text{ yd} \\ &= 36 \text{ in} \times 36 \text{ in} \\ &= 1296 \text{ in}^2 \end{aligned}$$

In 1 yd² there are 1296 in².

Lesson B: Activity 5: Self-Check

1. There are four quarters in a whole, so there are four quarter sections in one section.

   area of a section = 4 × 160 ac
   = 640 ac

   There are 640 ac in a section.

2. 1 mi^2 = 640 acres

   So,

   $$773\ 400 \text{ ac} = \left(\frac{773\ 400}{640}\right) \text{mi}^2$$
   $$= 1208.44 \text{ mi}^2$$

   The area of this land grant is 1208.44 mi^2.

3. 320.9 million ac = 320 900 000 ac

   1 mi^2 = 640 ac

   So,

   $$320\ 900\ 000 \text{ ac} = \left(\frac{320\ 900\ 000}{640}\right) \text{mi}^2$$
   $$= 501\ 406.25 \text{ mi}^2$$

   In 2009, American farmers planted 501 406.25 mi^2 to principal crops.

4. To find how long each side of a square is from its area, you must take the square root of its area.

   From Question 3, you know that the area of the square is 501 406.25 mi^2.

   $$\sqrt{501406.25} = 708.10045\ 19$$

   So, the side length of this square is 708.10045 19 mi.

   The side length of a square that enclosed 320.9 million ac is 708 mi, approximated to the nearest mile.

   Therefore, in 2009, the American farmers' planted acreage was equivalent to the area enclosed by a square having a side length of 708 mi.

Lesson B: Activity 6: Self-Check

1.

Imperial	Metric
1 in^2	6.4516 cm^2
1 ft^2	0.0929 m^2
1 yd^2	0.8361 m^2
1 ac	0.4047 ha
1 mi^2	2.5900 km^2

Lesson B: Activity 7: Self-Check

1. $1 \text{ ac} \doteq 0.4047 \text{ ha}$

$$\frac{x}{320 \text{ ac}} = \frac{0.4047 \text{ ha}}{1 \text{ ac}}$$
$$x(1 \text{ ac}) = (0.4047 \text{ ha})(320 \text{ ac})$$
$$x = \frac{(0.4047 \text{ ha})(320 \text{ ac})}{(1 \text{ ac})}$$
$$x = 129.505 \text{ ha}$$

Nick planted approximately 129.5 ha of canola.

2. $1 \text{ yd}^2 \doteq 0.8361 \text{ m}^2$

In this solution, let's multiply by the conversion factor.

$$100 \text{ yd}^2 \doteq (100 \times 0.8361) \text{ m}^2$$
$$\doteq 83.61 \text{ m}^2$$

Morris's front lawn is about 84 m^2.

3. $1 \text{ cm}^2 \doteq 0.1550 \text{ in}^2$

$$150 \text{ cm}^2 \doteq (150 \times 0.1550) \text{ in}^2$$
$$\doteq 23.25 \text{ in}^2$$

There are about 23.3 square inches of printed area on the invitation.

Lesson B: Activity 8: Mastering Concepts

141 000 homes × 1800 ft^2 per home = 253 800 000 ft^2

$$1 \text{ mi}^2 = 5280 \text{ ft} \times 5280 \text{ ft}$$
$$= 27\,878\,400 \text{ ft}^2$$

$$\text{new home area} = 253\,800\,000 \text{ ft}^2$$
$$= \left(\frac{253\,800\,000}{27\,878\,400}\right) \text{mi}^2$$
$$= 9.1038223... \text{ mi}^2$$

To the nearest square mile, the new homes constructed in 2009 would cover about 9 mi^2.

Lesson C: Volume and Capacity

Lesson C: Activity 1: Try This

Estimations may vary.

1. Round 41 to one non-zero digit.

   41 lies between 40 and 50. Because 41 is closer to 40 than 50, 41 rounds to 40.

   Now look at the 35 from the first two digits in the number **35** 146.

   What two-digit number closest to 35 is divisible by 4 a whole number of times?

   35 lies between 32 and 36, which are both divisible by 4, but 36 is closer to 35.

   Therefore, round 35 146 to 36 000.

   Now 36 000 ÷ 40 = 900.

   So, 35 146 ÷ 41 is about 900.

   Note that from your calculator, 35 146 ÷ 41 = 857.219 512..., so the estimate was quite close.

2. estimation: 6600 ÷ 300 = 22
   calculation: 6700 ÷ 301 = 22.2913621

3. estimation: 4000 ÷ 500 = 8
   calculation: 3758 ÷ 513 = 7.325536062

4. estimation: $925 \div 25 = 37$
   calculation: $916 \div 22.7 = 40.35242291$

5. estimation: $80\,000 \div 400 = 200$
   calculation: $81\,070 \div 403.98 = 200.6782514$

Lesson C: Activity 2: Try This

Answers will vary. Sample data is provided in the table and sample calculations are shown below.

Object	Length		Width		Height	
	(in)	(ft)	(in)	(ft)	(in)	(ft)
Microwave oven	20	2	15	1	11	1

Measurement in inches:

$$V = l \times w \times h$$
$$= 20 \text{ in} \times 15 \text{ in} \times 11 \text{ in}$$
$$= 3300 \text{ in}^3$$

Measurement in feet:

$$V = l \times w \times h$$
$$= 2 \text{ ft} \times 1 \text{ ft} \times 1 \text{ ft}$$
$$= 2 \text{ ft}^3$$

1. You would use cubic inches (in^3). When you calculate the volume you multiply inches × inches × inches which results in inches-cubed – or, cubic inches.

2. You would use cubic feet (ft^3). When you calculate the volume you multiply feet × feet × feet which results in feet -cubed – or, cubic feet.

Lesson C: Activity 3: Self-Check

1. Answers will vary depending on the object you chose for Activity 2. Sample answers are given below based on the sample answers given for Activity 2.
   a. Volume of your object in cubic inches: 3300 in^3
   Volume of your object in cubic feet: 2 ft^3
   b. Let n = the volume in cubic feet.

$$\frac{n}{3300\ \text{in}^3} = \frac{1\ \text{ft}^3}{1728\ \text{in}^3}$$

$$n(1728\ \text{in}^3) = (1\ \text{ft}^3)(3300\ \text{in}^3)$$

$$n = \frac{(1\ \text{ft}^3)(3300\ \text{in}^3)}{(1728\ \text{in}^3)}$$

$$n = 1.9\ \text{ft}^3$$

   c. The sample answers are quite close. If your answers were not so close, it may have been due to how the dimensions of your object were measured. In Activity 2 you were asked to measure to the nearest inch, and then to the nearest foot.

   - If you rounded all of the dimensions up, the volume you calculated would be higher than the actual volume.
   - If you rounded the dimensions down, then the calculated volume would be lower than the actual volume.

   Here, when you converted the volume given in cubic inches to cubic feet using a conversion factor, you will have ended up with a volume closer to the actual volume of the object. This is because measuring to the nearest inch is more accurate than measuring to the nearest foot.

2. Answers will vary. Sample answers are given.
   a. one cubic inch: dental floss dispenser, big toe
   b. one cubic foot: kitchen garbage can, small microwave
   c. one cubic yard: dishwasher, kitchen stove

3. $1 \text{ ft}^3 = 1728 \text{ in}^3$

   You can solve this by either setting up a proportion or dividing by the conversion factor. We'll divide by the conversion factor here. (Note: you divide because cubic feet are smaller than cubic inches, so there will be fewer of them.)

$$\begin{aligned} 281 \text{ in}^3 &= \frac{281}{1728} \text{ ft}^3 \\ &= 0.162\,615 \ldots \text{ ft}^3 \\ &= 0.16 \text{ ft}^3 \end{aligned}$$

   The engine displacement is about 0.16 ft^3.

4. Convert each dimension to feet.

   a. $$\begin{aligned} 24 \text{ in} &= \frac{24}{12} \text{ft} \\ &= 2 \text{ ft} \end{aligned}$$

$$\begin{aligned} 18 \text{ in} &= \frac{18}{12} \text{ft} \\ &= 1\frac{1}{2} \text{ ft} \end{aligned}$$

$$\begin{aligned} V &= l \times w \times h \\ &= 2 \text{ ft} \times 1\frac{1}{2} \text{ ft} \times 1\frac{1}{2} \text{ ft} \\ &= 2 \text{ ft} \times \frac{3}{2} \text{ ft} \times \frac{3}{2} \text{ ft} \\ &= \frac{18}{4} \text{ft}^3 \\ &= 4\frac{2}{4} \text{ft}^3 \\ &= 4\frac{1}{2} \text{ft}^3 \end{aligned}$$

   The volume of the box is 4.5 ft^3.

   b. $1 \text{ yd}^3 = 27 \text{ ft}^3$
   You can do the conversion by dividing by the conversion factor.

c. $4\frac{1}{2}\text{ft}^3 = \left(4\frac{1}{2} \div 27\right)\text{yd}^3$

$= \left(4\frac{1}{2} \times \frac{1}{27}\right)\text{yd}^3$

$= \left(\frac{9}{2} \times \frac{1}{27}\right)\text{yd}^3$

$= \frac{9}{54}\text{yd}^3$

Lesson C: Activity 4: Self-Check

1. a. There are 4 qt in 1 gal.

   b. Since there are 4 qarts in a gallon, and a gallon costs $3.00, you can find the cost of 1 quart by dividing the cost by 4.

   $$\text{cost of 1 qt of milk} = \frac{\$3.00}{4}$$
   $$= \$0.75$$

2. There are 4 qt in 1 gal.

   So, 2 qt is $\frac{2}{4}$ or 0.5 gal.

   1 gal covers 250 ft^2.

   0.5 gal covers 0.5 × 250 ft^2 or 125 ft^2.

   The area of the garage door is 16 ft × 7 ft = 112 ft^2.

   Bill has enough paint to cover his garage door.

Lesson C: Activity 5: Self-Check

1. 1 L ≈ 0.26 US gal

   To solve this, let's set up a proportion.
   Let x = the amount of paint in litres.

   $$\frac{x}{5\text{ US gal}} = \frac{1\text{ L}}{0.26\text{ US gal}}$$
   $$x(0.26\text{ US gal}) = (1\text{ L})(5\text{ US gal})$$
   $$x = \frac{(1\text{ L})(5\text{ US gal})}{(0.26\text{ US gal})}$$
   $$x = 19.2\text{ L}$$

   There are about 19.2 L in five US gallons.

2. 1 L ≈ 1.06 US qt
   Let's solve this one by dividing by a conversion factor. Remember, you divide because litres are smaller than US quarts.

$$3 \text{ US qt} = \left(\frac{3}{1.06}\right)\text{L}$$
$$= 2.8 \text{ L}$$

   Bill bought about 2.8 L of milk.

3. To solve this one, use the conversion tables from the lesson.
   1 gal ≈ 4.55 L
   1 L costs $0.936.
   So, 4.55 L costs 4.55 × $0.936 or $4.2588.
   An imperial gallon costs around $4.26.

4. To solve this one, use the conversion tables from the lesson.
   1 m^3 ≈ 35.31 ft^3
   So,
   2 m^3 = (2 × 35.31) ft^3
   = 70.62 ft^3
   There are about 70.6 ft^3 in 2 m^3 of concrete.

Lesson C: Activity 6: Mastering Concepts

Convert 8 in to feet.

$$8 \text{ in} = \frac{8}{12} \text{ ft}$$

$$\text{volume of topsoil} = l \times w \times h$$
$$= 21 \text{ ft} \times 3 \text{ ft} \times \frac{8}{12}\text{ft}$$
$$= 42 \text{ ft}^3$$

1 yd^3 = 27 ft^3

$$\text{So, } 42 \text{ ft}^3 = \frac{42}{27} \text{ yd}^3$$
$$= \frac{14}{9} \text{ yd}^3$$
$$= 1\frac{5}{9} \text{ yd}^3$$

Since Aaron needs more than $1\frac{1}{2}$ yd^3, he should order 2 yd^3.

Lesson D: Mass

Lesson D: Activity 1: Try This

1. Answers will vary. A student's answer should reflect any discrepancy between the actual weight of the suitcase and the target weight of 50 lb.

2. Answers will vary. An estimate is not reliable in the face of possible surcharges for an overweight suitcase. Where a penalty is possible, the suitcase should be weighed properly using a scale.

Lesson D: Activity 2: Try This

1. Answers will vary. Sample items are given in the table below.

2. The measured weights depend on the items selected. The table below lists items that weigh close to the target masses.

Target Mass (pounds)	Item 1		Item 2	
	Selected Item	Measured Mass (pounds)	Selected Item	Measured Mass (pounds)
1	pound of butter		pint of milk	
2	pair of runners		textbook	
5	small bag of sugar (2 kg)		family pet dog	
10	bag of flour (4.5 kg)		large pike	
20	toddler		2 gal of water	
50	heavy suitcase		sheet of drywall	
100	petite woman		large sack of potatoes	

3. Some of the items may have been selected according to the weight shown on their label. Other items may have been lifted to gain a sense of their weight. Also, you may have relied on your experience in handling items to make selections.

4. Scales are important in accurately determining the masses of objects. By relying on your impression or sense of how much an object weighs, one can easily make errors. If the situation you are in requires only a rough estimate, then scales aren't necessary. If your situation requires an accurate measurement, you should use a scale.

Lesson D: Activity 3: Self-Check

1. 1 dozen eggs = 12 eggs

   2 dozen eggs = 2 × 12 or 24 eggs

   1 egg = 2 oz

   24 eggs = 24 × 2 oz

   = 48 oz

   1 lb = 16 oz

   $48 \text{ oz} = \frac{48}{16} \text{ lb}$

   $= 3 \text{ lb}$

   Two dozen eggs would weigh 3 lb.

2. $1 \text{ lb} = 16 \text{ oz}$

   $5 \text{ lb} = 5 \times 16 \text{ oz}$

   $= 80 \text{ oz}$

   The whole ham weighs 80 oz. Since the butcher is cutting it into 160 slices, divide the mass by 160.

   $$\text{mass of one slice} = \frac{80 \text{ oz}}{160}$$
   $$= \frac{1}{2} \text{ oz}$$

   Each slice weighs a half ounce.

Lesson D: Activity 4: Self-Check

1. $1 \text{ ton} = 2000 \text{ lb}$

   $5.2 \text{ tons} = (5.2 \times 2000) \text{ lb}$

   $= 10\,400 \text{ lb}$

   $200 \text{ bushels} = 10\,400 \text{ lb}$

   $1 \text{ bushel} = \left(\frac{10\,400}{200}\right) \text{lb}$

   $= 52 \text{ lb}$ One bushel of wheat weighed 52 lb.

2. 1 ton = 2000 lb

   1.5 tons = (1.5 × 2000) lb

   = 3000 lb

   1 yd^3 = 27 ft^3

   1 yd^3 = 3000 lb

   $1 \text{ ft}^3 = \left(\frac{3000}{27}\right)\text{lb}$

   $= 111.111...$

   So, 1 ft^3 of gravel weighs about 111 lb.

Lesson D: Activity 5: Self-Check

1. 1 kg = 2.20 lb

   1 lb costs $0.79.

   So, 1 kg costs

   $0.79 × 2.20 = $1.738

   The cost per kilogram is about $1.74.

2. 1 g = 0.04 oz.

   So,

   7.3 g = (7.3 × 0.04) oz

   = 0.292 oz

   ≈ 0.3 oz

   The two-dollar coin weighs about 0.26 oz.

3. 1 gal = 4.55 L

   1 L weighs 1 kg.

   So, 1 gallon weighs 4.55 kg.

   1 kg = 2.20 lb

   Therefore,

   4.55 kg = (4.55 × 2.20) lb

   = 10.01 6 lb.

   To the nearest pound, 1 gallon of water weighs 10 pounds.

Lesson D: Activity 6: Mastering Concepts

1. Convert 4 inches to feet.

$4 \text{ in} = \frac{4}{12} \text{ ft}$

$\text{volume of concrete} = l \times w \times h$

$= 60 \text{ ft} \times 15 \text{ ft} \times \frac{4}{12} \text{ ft}$

$= 300 \text{ ft}^3$

$1 \text{ yd}^3 = 27 \text{ ft}^3$

So,

$300 \text{ ft}^3 = \left(\frac{300}{27}\right) \text{yd}^3$

$= 11.111... \text{yd}^3$

$1 \text{ yd}^3 = 4000 \text{ lb}$

$= \frac{4000}{2000} \text{ tons}$

$= 2 \text{ tons}$

So,

$11.111... \text{yd}^3 = 2 \times 11.111... \text{ tons}$

$= 22.222... \text{ tons}$

$= 22.2 \text{ tons}$

The concrete needed for the job weighs about 22.2 tons.

Lesson E: Temperature

Lesson E: Activity 1: Try This

Situation	Temperature on the Celsius (°C) scale	Temperature on the Fahrenheit (oF) scale
Freezing/Melting Point of Water	0°C	32°F
Ice/Salt Mixture	–18°C (approximately)	0°F
Body Temperature	37°C	close to 98°F or 99°F
Boiling Water	100°C	212°F

1. You can conclude from these results that
   - 0°C equals about 32°F
   - –18°C equals about 0°F
   - 37°C equals about 98°F
   - 100°C equals about 212°F

Lesson E: Activity 2: Try This

1. There are 100 Celsius degrees between 0°C (freezing) and 100°C (boiling).

2. There are 180 Fahrenheit degrees between 32°F and 212°F since 212 – 32 = 180.

3. Because there are more Fahrenheit degrees than Celsius degrees between freezing and boiling, the Celsius degree is larger.

4. a. $$\frac{\text{number of Fahrenheit degrees between boiling and freezing}}{\text{number of Celsius degrees between boiling and freezing}} = \frac{180}{100} = \frac{9}{5}$$

   b. $$\frac{\text{number of Celsius degrees between boiling and freezing}}{\text{number of Fahrenheit degrees between boiling and freezing}} = \frac{100}{180} = \frac{5}{9}$$

5. a. 1 Celsius degree $= \frac{9}{5} \times 1$ Fahrenheit degree (since the Celsius degree is larger)

   b. 1 Fahrenheit degree $= \frac{5}{9} \times 1$ Celsius degree (since the Fahrenheit degree is smaller)

Lesson E: Activity 3: Self-Check

1. Normal body temperature is 98.6˚F. Martin's temperature is 101.3 – 98.6 or 2.7 Fahrenheit degrees above normal.

2. $$\begin{aligned} F &= \frac{9}{5} \times C + 32 \\ &= \frac{9}{5} \times (-63) + 32 \\ &= -113.4 + 32 \\ &= -81.4 \end{aligned}$$

   Canada's coldest temperature of –63˚C is –81.4˚F.

3. $$\begin{aligned} C &= \frac{5}{9} \times (F - 32) \\ &= \frac{5}{9} \times (134 - 32) \\ &= \frac{5}{9} \times (102) \\ &= 56.666... \end{aligned}$$

   Death Valley was 134˚F or about 56.7˚C.

4. $$\begin{aligned} F &= \frac{9}{5} \times C + 32 \\ &= \frac{9}{5} \times 160 + 32 \\ &= 320 \end{aligned}$$

   An oven temperature of 160˚C is 320˚F.

Lesson E: Activity 4: Mastering Concepts

1. $$F = \frac{9}{5} \times C + 32$$
$$= \frac{9}{5} \times (-273.15) + 32$$
$$= -491.67 + 32$$
$$= -459.67$$

   The approximate temperature at which molecular motion is at a minimum is –459.67˚F.

2. Body temperature is about 37°C.

   The coldest temperature possible is –273.15˚C.

   The difference between these temperatures is

   37 – (–273.15) = 37 + 273.15

   = 310.15 Celsius degrees

   Body temperature on the Kelvin scale is approximately 310 K.

3. Body temperature is 98.6˚F.

   The coldest temperature possible is –459.67˚F.

   The difference between these temperatures is

   98.6 – (–459.67) = 98.6 + 459.67

   = 558.27 Fahrenheit degrees

   So, body temperature would be 558.27˚R.

Glossary

acre (ac)
a unit of area in the imperial system

An acre is 22 yd wide by 220 yd long or 4840 yd^2.

area
a measurement of how many square units into which a surface may be divided

For example, if your living room carpet can be divided into 10 square metres, its area is 10 m^2.

capacity
a measurement of how much a container can hold

Commonly, capacity refers to the amount of liquid that can be poured into a container, but it can also be used to refer to an amount of solid that can be placed into a container.

Celsius
a temperature scale commonly used in every major country throughout the world, except the United States

compatible numbers
numbers that are easy to use in a mental computation, especially division

cubic foot (ft^3)
a unit of volume in the imperial system

A cubic foot is the volume of a cube having an edge length of 1 ft.

cubic inch (in^3)
a unit of volume in the imperial system

A cubic inch is the volume of a cube having an edge length of 1 in.

cubic yard (yd^3)
a unit of volume in the imperial system

A cubic yard is the volume of a cube having an edge length of 1 yd.

foot
a unit of length in the imperial system equal to 12 in

A measure of one foot can be expressed as 1 ft or 1′.

gallon (gal)
a measure of capacity in the imperial system

A gallon is 4 qt in size.

hectare
the area of a square 100 m on a side. The symbol for one hectare is 1 ha.

inch
a unit of length in the imperial system

A measure of 1 inch can be written as 1 in or 1″.

kilogram (kg)
the base unit of mass in the metric system

A kilogram is equal to the mass of a certain cylinder of platinum-iridium alloy kept at the International Bureau of Weights and Measures in France.

litre (L)
the capacity of a container having a volume of 1000 cm^3

Since 1 L = 1000 mL, 1 mL = 1 cm^3.

long ton
a unit of weight (mass) in the imperial system

1 long ton = 2240 lb

mass
a measure of the quantity of matter in an object

metre
the base unit of length (or linear measure) in SI

mile(mi)
a unit of length in the imperial system

The mile is defined today as exactly 5280 ft.

ounce (oz)
a unit of weight (mass) in the imperial system

There are 16 oz in 1lb.

1 lb = 16 oz

pint (pt)
a measure of capacity in the imperial system

A pint is roughly equal to 0.5 L.

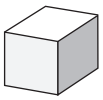
pound (lb)
a unit of weight (mass) in the imperial system

One pound is defined as exactly 0.453 592 37 kg.

prism
in geometry, a 3-D object that has two congruent and parallel faces (the top and bottom bases) and lateral faces that are parallelograms

Such a 3-D object is also known as a rectangular box.

The following is a 3-D object known in geometry as a prism.



proportion
a statement showing one ratio equal to another

For example, $\frac{1}{12} = \frac{3}{36}$ is a proportion statement.

quart(qt)
a measure of capacity in the imperial system

There are 2 pt in a quart.

A quart is approximately equal to 1 L.

short ton
a unit of weight (mass) in the imperial system (also called a ton)

1 short ton = 2000 lb

square foot (ft^2)
a unit of area in the imperial system

A square foot is the area of a square 1ft on a side.

square inch (in^2)
a unit of area in the imperial system

A square inch is the area of a square 1 in on a side.

square mile(mi^2)
a unit of area in the imperial system

A square mile is the area of a square 1 mi on a side.

square yard (yd^2)
a unit of area in the imperial system

A square yard is the area of a square 1yd on a side.

ton
a unit of weight (mass) in the imperial system (also called a short ton)

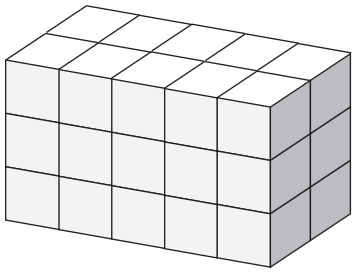
1 ton = 2000 lb

tonne (t)
in the metric system, a unit of mass equal to a 1000 kg

1 t = 1000 kg.

volume
a measurement of how many cubic units into which a object or space may be divided

For example, if your living room is 5 m long by 3 m wide by 3 m high, its volume is 5 m × 3 m × 3 m = 45 m^3.



weight
a measure of the force of gravity on an object

yard (yd)
a unit of length in the imperial system

One yard equals 3 ft or 0.9411 m.