Mathematics 10-3

Unit 4
Measurement Systems



Lesson B
Imperial and Metric Measurements

LEARNING ANYTIME ANYWHERE

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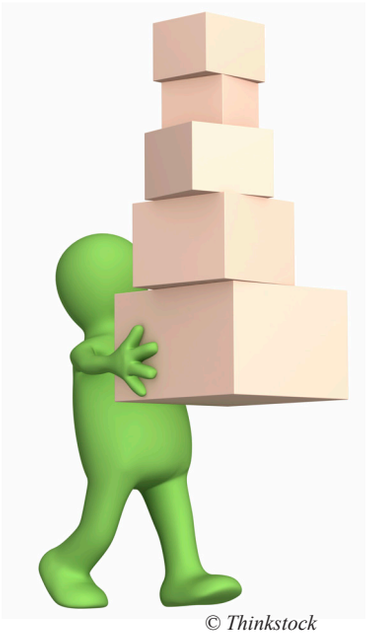
Mathematics 10-3

Unit 4
Measurement Systems



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Mathematics 10-3

Unit 4, Lesson B

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3. **Achieve a final course mark of at least 50%.**

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Lesson B
Imperial and Metric Measurements

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Lesson A:
Imperial and Metric Systems Introduction

Lesson B:
Imperial and Metric Measurements

Lesson C:
Conversions between Imperial and Metric Measurements

Icons

The following icons will guide you through the course.

Let's Get Messy

How Does It Work?

Digging Deeper

Practice Questions

Practice Solutions

Assignment

Treasure Chest

Coins

Discussions

Check It Out

How Did It Go?

Unit Quiz

Lesson B: Imperial and Metric Measurements

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Tristine's training for her first triathlon on Canada Day is going very well. Since she and her dad tuned up her bike, she has been riding it to school every day. She lives about 8 km from school, but in the triathlon, she must bike 15 km.

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At swim club every Wednesday after school, she usually does the front crawl for 500 m and then the butterfly for 150 m. For the swim in the triathlon, she must swim 500 m.

Her long-distance running is really putting the miles on her shoes. Every Saturday, she runs the country block with her dad. In a country block in the prairie provinces, the roads that run north and south are 2 miles long and the roads that run east and west are 1 mile long. The total that she runs when she goes around a country block is 6 miles.

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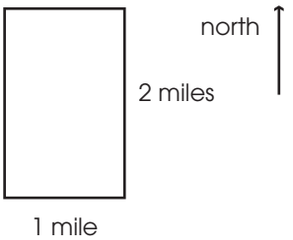
The perimeter of the rectangle created by the country roads is



$P = L + L + W + W$

$P = 2 \text{ miles} + 2 \text{ miles} + 1 \text{ mile} + 1 \text{ mile}$

$P = 6 \text{ miles}$

Although Canada uses the metric system of measurement (SI system), many of our measurements were made originally in the Imperial system as you learned in Lesson 4A. Often, we talk about both types of measurement systems.

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In the 1970s when Canada adopted the metric system of measurement, most of the roads through Alberta, Saskatchewan, and Manitoba were already set in the manner described.

Also, our neighbour to the south, the United States of America, uses the Imperial system. When Canadians buy or sell things with the US, we must understand how both systems work.

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Just as our Canadian dollar is different from the US dollar, our measurement system is different. To learn both systems is helpful.

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Here are the things that you will learn in this lesson.

- Prefix system in the SI system
- How base 10 is used in the SI system
- How and why decimals are used in the SI system
- How to change a linear measurement from one SI unit to another and how to solve problems involving linear metric conversions
- How and why fractions are used in the Imperial system
- How to change a linear measurement from one Imperial unit to another and how to solve problems involving linear Imperial conversions

Let's Get Messy

Here are the items you need for this activity:

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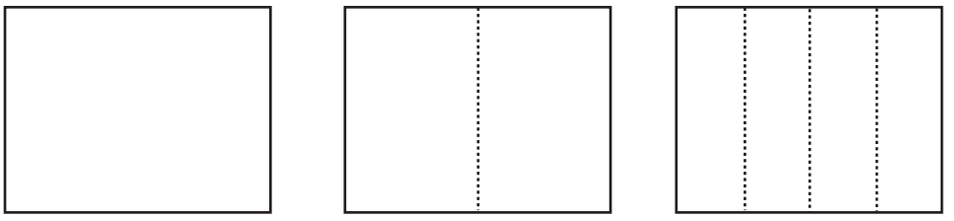
- 3 pieces of paper
- pencil
- calculator
- ruler with inches on it (Imperial units)
- ruler with centimetres on it (metric or SI units)

This 'Get Messy' activity is designed to help you understand how a small whole unit of measure might be divided into even smaller parts.

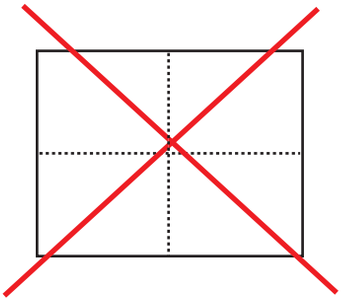
You will be folding the sheet of paper to make sections in it when it is unfolded.

As you follow the instructions, you will fold a sheet of paper and investigate the number of sections made with each new fold.



The folds must go the same way, as shown in these diagrams.

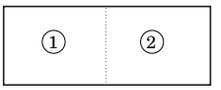
Do not fold like this!



Task 1

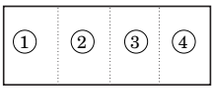
Fold one sheet of paper in half the long way (landscape), right side to left.

Open the paper to see that one fold creates two equal sections.

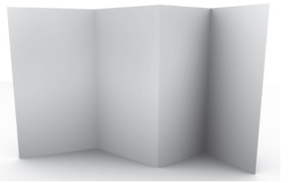


One section is $\frac{1}{2}$ or **1 section out of 2 sections** of the whole paper.

Close on the fold and fold the paper again. Open the paper.



Folding the paper **two** times made **3 fold lines** and **4 equal sections**.



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One section is $\frac{1}{4}$ of the whole paper.

Fold the paper three times. Again, open the paper.

a. Folding the paper three times made _____ fold lines.

.

b. Three folds made _____ equal sized sections.

c. One section is _____ of the whole paper.

When you folded the paper three times and opened it up again, there should have been 8 equal sections. The whole paper has been divided into 8 sections. Each section is a fraction (one-eighth) of the whole paper.

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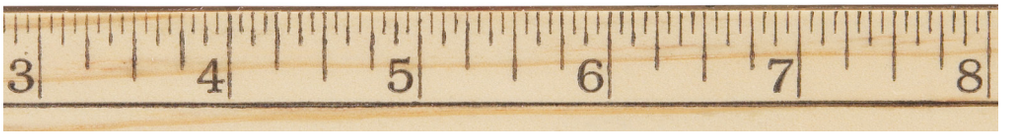
one-eighth = $\frac{1}{8}$

Task 2

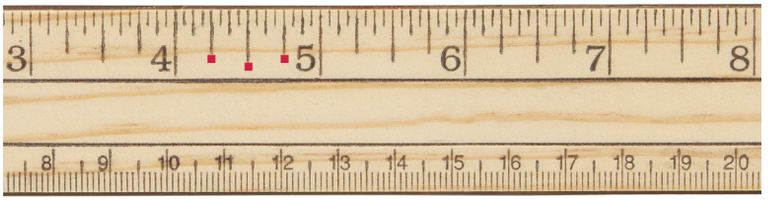
Look at your Imperial ruler. That's the one with the inches. The inch is the smallest whole unit of linear measurement in the Imperial system.



Between the whole numbers are tick marks on the ruler. Those tick marks divide the inch into sections or fractions. Some tick marks are longer than others are.

a. How many longer tick marks are there in one inch?
_____

b. Into how many sections do the large tick marks divide one inch?_____



Three longer tick marks cut one inch into 4 equal sections. One section equals ¼ inch.

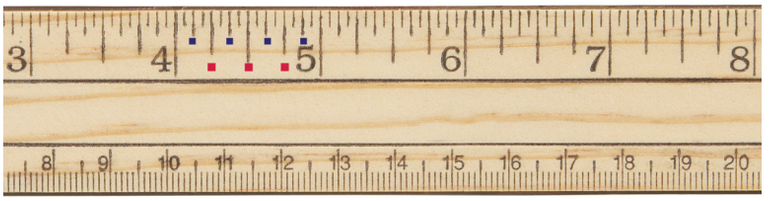
c. How many **long- and medium-length** tick marks are in one inch?_____

d. Into how many sections do the long- and medium-length tick marks cut one inch?_____

e. What fraction of one inch does one section equal?_____

There are 7 long and medium length tick marks in one inch and they cut the inch into 8 equal sections.

One section equals $\frac{1}{8}$ inch.



Task 3

Fold the paper one more time. So, in total, you have now folded it 4 times. When you open it up, you will have lots of skinny sections.

a. How many sections did the fourth fold make?

_____

b. What fraction of the paper is **one** section now?

_____

Compare your paper to the ruler with inches on it. Your paper has been folded enough times to make 16 skinny sections and one section is worth one-sixteenth of the whole paper.

A ruler shows an inch divided into 16 sections, too. The smallest portion of an inch on most rulers is $\frac{1}{16}$ inch.

So with the ruler shown here, you could measure to the nearest $\frac{1}{16}$ inch.

Task 4

Look at your metric ruler–the one with cm on it. The centimetres are on the bottom of the ruler pictured below.

Count the sections in one centimetre. You should see 10 sections.

a. What is the fraction of one centimetre that one section represents?_____

   There are 10 sections, so one section is one-tenth centimetre.

b. What is the decimal form of one-tenth? _____

   To find the decimal of one-tenth, remember that the **/** means divide.

   $\frac{1}{10} = 1 \div 10 = 0.10$

c. In the metric system, 10 centimetres = 1 decimetre so, 1 cm = one-tenth decimetre.

   What is the decimal form?

   1 cm = $\frac{1}{10}$ decimetre or 1 cm = 0.10 decimetre.

d. There are 100 cm in 1 m.
   1 cm = _____ m (as a fraction)
   or 1 cm = _____ m (as a decimal)

   1 cm = $\frac{1}{100}$ m

   1 cm = 0.01 m

Try this: What is 23 cm as a decimal in metres?

$23 \text{ cm} = \frac{23}{100} \text{ m}$

$23 \text{ cm} = 0.23 \text{ m}$

You may have noticed that, for the metric system, the fractions make decimals without too much difficulty. The numerator or the top number is the same as the numbers in the decimal answer. The decimal point just moved sideways.

Try this: In the Imperial system, the smallest section of an inch was one-sixteenth inch.

What is the decimal form of $\frac{1}{16}$?

$\frac{1}{16} = 0.0625$ (That's not easy to figure out in my head, so I had to used a calculator.)

Tristin needs to learn about two different measurements, the Metric (SI) System and the Imperial System, so she can train for her triathlon.

All Canadians need to know and understand both systems.

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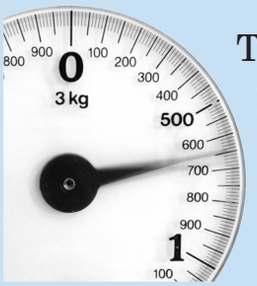
How Does It Work?

Metric (SI) System

In Unit 4 Lesson A you saw that the base unit name indicates the measurement category for that unit. Anything with **metre** in it has to do with distances. Anything with **gram** in it has to do with mass.

The first part of the name of the unit helps you to know how big it is. *Milli* means small. *Kilo* means big.



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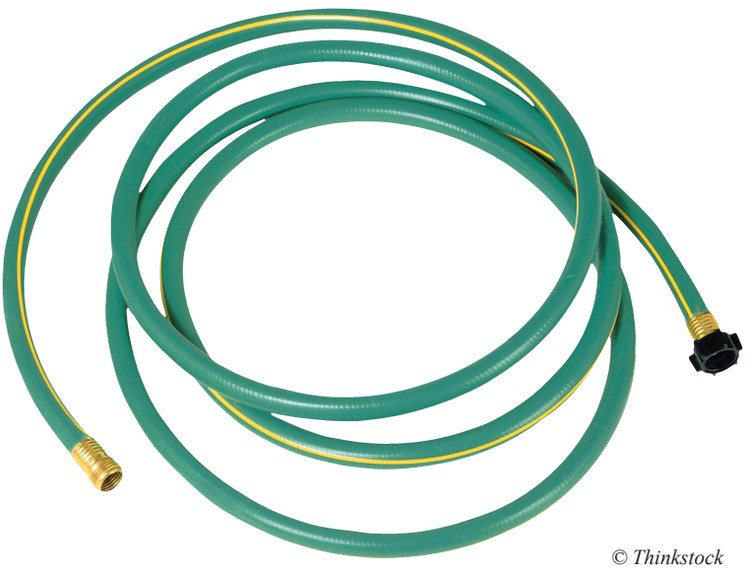
The first part of the unit name is called a **prefix**. In the metric system, the prefix represents a factor of 10. A factor of 10 means you either multiply or divide the measurement by factors of 10 to convert to another related unit.

If a garden hose measures 5 metres, its measurement could be stated in centimetres as well because metres and centimetres are related. They are both linear units.



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Here is a chart to help you remember the prefixes and the order they go in to show the size of the unit.

The chart shows

- all the prefixes in order from larger to smaller across the top
- linear or length units, volume units, and mass units down the side

	kilo (k)	hecto- (h)	deca-- (D)	Base Unit	Deci- (d)	Centi- (c)	milli (m)
Length	km	hm	Dm	m	dm	cm	mm
Volume	kL	hL	DL	L	dL	cL	mL
Mass	hg	hg	Dg	g	dg	cg	mg

For each category of measurement, the prefix is the same.

Each prefix step represents a factor of 10. Start at a base unit such as metre.

- 10 metres make a decametre.
- 10 decametres make a hectometre.
- 10 hectometres make a kilometre.

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To convert a larger unit to a smaller unit, you will multiply by 10. Each unit is 10 times larger than the next smaller unit.

Kilo- (k)	Hecto- (h)	Deca- (D)	Base Unit (m, g, l, etc.)	Deci- (d)	Centi- (c)	Milli (m)
2	20	200	2 000	20 000	200 000	2 000 000

× 10 × 10 × 10 × 10 × 10 × 10

2 kilometres = ___ hectometres.

= 2 × 10

= 20 hectometres

2 kilometres = ___ metres

= 2 × 10 × 10 × 10

= 2000 metres

To convert a smaller unit to a larger unit, you will divide by 10.

÷10 ÷10 ÷10 ÷10 ÷10 ÷10

Kilo- (k)	Hecto- (h)	Deca- (D)	Base Unit (m, g, l, etc.)	Deci- (d)	Centi- (c)	Milli (m)
2	20	200	2 000	20 000	200 000	2 000 000

Knowing the prefix for the unit helps to show how big an object is.

200 000 cm = _____ m

2 000 m = _____ km

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Two million (2 000 000) millimetres sounds like a very big number, but the prefix 'milli' means a very small unit of measure. You can use a millimetre to measure a millipede.

How old was Terry Fox when he began his run across Canada to raise money for cancer research?
a. 17
b. 18
c. 19

Call your instructor to give your treasure chest answer and earn coins towards bonus marks.

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Two kilometres is a big distance, but you likely could walk or run 2 km. A kilometre is a good unit of measure to describe how far students ran for a Terry Fox run.

Saying 2 000 000 millimetres is not a good way to describe the distance. *Milli* indicates a small unit of measure and should be used to measure very small things such as the thickness of a glass or contact lens.

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Example 1

Measure the wingspan of the butterfly using a metric ruler.

How big is the span in centimetres?

How big in millimetres?

Solution

From wing tip to wing tip, the butterfly measures **5 cm**.

The butterfly is not a large object and centimetres is a good choice for measuring its wingspan, but millimetres could be used as well.

Instead of counting all the little 1 mm tick marks on the ruler, you multiply by a 'factor of 10' step to figure out the number of millimetres in 5 cm.

There are 10 mm in every cm of the wingspan, so the wingspan would be

5 cm × 10 mm/cm = **50 mm (millimetres)**

Now we can use 0.0005 ton = 1 pound to convert pounds to tons.

How many tons is 12000 lbs?

Use $\frac{0.0005 \text{ tons}}{1 \text{ lb}}$ as a conversion factor.

$$1200 \text{ lbs} \times \frac{0.0005 \text{ tons}}{1 \text{ lb}}$$

$$= 0.6 \text{ ton (or 60\% of a ton!)}$$

Also 0.0625 pound = 1 ounce can be used as a conversion factor too.

How many pounds in 160 ounces?

$$160 \text{ ounces} \times \frac{0.0625 \text{ lbs}}{\text{ounce}}$$

$$= 10 \text{ lb}$$

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Example 2

How much liquid is in the measuring cup?

Solution

The number that the liquid reaches to is 800, and the units are shown at the top of the cup.

The cup contains 800 mL of fluid.

Example 3

What is 800 mL in litres?

Solution

Looking at the chart will help.

Kilo- (k)	Hecto- (h)	Deca- (D)	Base Unit (m, g, l, etc.)	Deci- (d)	Centi- (c)	Milli (m)
			????			800

÷10 ÷10 ÷10

The base unit is litres and the measurement is in millilitres. To convert from millilitres to litres is to go from a smaller unit to a larger one.

The number of millilitres must be divided by 10 three times to get the number of litres because it is three steps to the **left** on the prefix chart.

number of litres = 800 ÷ 10
÷ 10
÷ 10

Dividing by 10 three times is the same as dividing by 1000.

number of litres = 800 ÷ 1000

= 0.800

800 mL is 0.800 litres.

Imperial System

In comparison, the Imperial system does not use key words for the names of the units, and the number of smaller units to make the next bigger unit varies.

The system of naming the units may not be useful in remembering what type of measurement you are using, but charts can help.

Remember from Unit 4 Lesson A that the information in the chart can be used to expand the chart to fit the purpose needed.

Imperial Units of Conversion		
Length	**Capacity**	**Weight**
1 mile (mi) = 1 760 yards (yd)	1 gallon (gal) = 4 quarts (qt)	1 ton (T) =2 000 pounds (lb)
1 mile = 5 280 feet (ft)	1 gallon = 128 fluid ounces (fl oz)	1 pound = 16 ounces (oz)
1 yard (yd) = 3 feet	1 quart (qt) = 2 pints (pt)	
1 yard (yd) = 36 inches	1 pint = 2 cups (c)	
1 foot (ft) = 12 inches	1 cup = 8 fluid ounces (oz)	

Notice that this chart is arranged so that the largest unit in the category is at the top. It also shows how many other units make up one Imperial unit of each type of measurement.

Example 4

Expand the Imperial chart to show the amount of tons in one pound and the amount of pounds in one ounce.

Weight
1 ton (T) =2 000 pounds (lb)
1 pound = 16 ounces (oz)
? ton = 1 pound
? pound = 1 ounce

Solution

To expand the chart, determine unit rates for each. Use the given information in the chart expressed as a rate.

$$\frac{1 \text{ ton}}{2000 \text{ lbs}}$$

Now, divide to determine the unit rate or the amount of tons per one pound.

$$\frac{1 \text{ ton}}{2000 \text{ lbs}} = 1 \text{ ton} \div 2000 \text{ lbs}$$
$$= 0.0005 \text{ ton / lb}$$

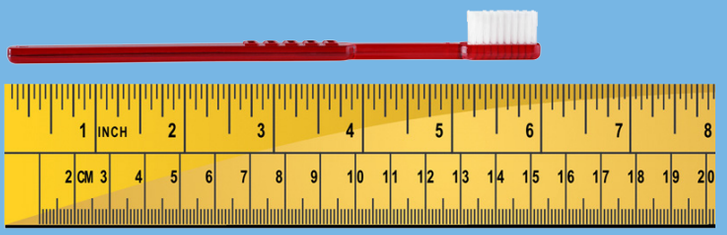
$$\text{Also, } \frac{1 \text{ lb}}{16 \text{ ounces}} = 1 \text{ lb} \div 16 \text{ ounces}$$
$$= 0.0625 \text{ lb/ounce}$$

Now, complete the chart.

0.0005 ton = 1 pound
0.0625 pound = 1 ounce

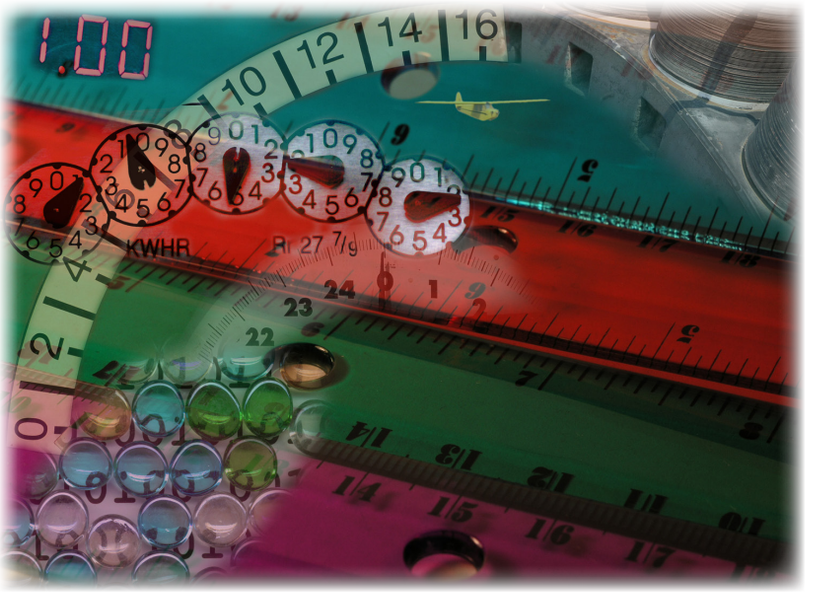
Example 5

Determine the length of the toothbrush in inches.



Solution

The toothbrush is 6 inches long.



How Does It Work? Practice Questions

1. To change metres to centimetres, how many times would the number of metres be multiplied by 10? Why?

_____

_____

_____

_____

2. Circle the unit that is bigger in the pair of related units.

a.	pint	gallon
b.	decimetre	kilometre
c.	foot	yard
d.	decametre	decimetre
e.	cup	pint

3. Explain how you decided which one was the larger unit for each pair.

_____

_____

4. Into how many equal sections is 1 centimetre divided?

_____

5. How many feet are in 1 mile?

_____

6. How many inches are in 1 yard.

_____

7. If one pound is 16 ounces, how many ounces is 3 pounds?

_____

8. How many tons is 450 pounds?

_____

9. What is the smallest division shown on the Imperial ruler?

_____

Practice Solutions

1. To change metres to centimetres, how many times would the number of metres be multiplied by 10? Why?

   There are 3 prefix 'steps' between centi and the base unit of metre. Going from metres at the base unit to centi is moving to the right.
   So, you would need to multiply by 10 three times.

2. Circle the unit that is bigger in the pair of related units.

   a. pint gallon
   b. decimetre kilometre
   c. foot yard
   d. decametre decimetre
   e. cup pint

3. Explain how you decided which one was the larger unit for each pair.

   For the Imperial units, I looked on the conversion chart to see which one was bigger. For example, 1 pint = 2 cups means that a pint is bigger than a cup because it takes 2 cups to fill one pint.

   For the metric units, I looked on the prefix chart and decided which was bigger.

   If the prefix was further to the left on the chart, it meant that unit was bigger.

4. Into how many equal sections is 1 centimetre divided?

   One centimetre is divided into 10 equal sections called millimetres.

5. How many feet are in 1 mile?

   5280 feet are in one mile.

6. How many inches are in 1 yard?

There are 12 inches in one foot.

There are three feet in one yard.

You can think of 12 inches/foot as a unit rate and 3 ft/yard as another unit rate.

When you multiply, the units cancel so we get 12 inches/foot × 3 ft/yd= 36 inches/yard.

There are 36 inches in one yard.

7. If one pound is 16 ounces, how many ounces are 3 pounds?

Set up the unit rates.

$$\frac{\text{16 ounces}}{\text{1 lb}}$$

Let x be the number of ounces in 3 pounds.

Now, make an equation.

$$\frac{\text{16 ounces}}{\text{1 lb}} = \frac{\text{x ounces}}{\text{3 lbs}}$$

Cross multiply by 3.

$$\frac{\text{16 ounces}}{\text{1 lb}} = \frac{\text{x ounces}}{\text{3 lbs}}$$

$3 \times 16 \div 1 =$ x ounces

$48 =$ x ounces

There are 48 ounces in 3 pounds.

8. How many tons is 450 pounds?

Read from the chart that

1 ton (T) =2 000 pounds (lb)

Write that as a unit rate.

$$\frac{\textbf{2000 lbs}}{\textbf{1 T}}$$

Let x be the number of tons in 450 pounds.
Set up an equation.

$$\frac{\textbf{2000 lbs}}{\textbf{1 T}} = \frac{\textbf{450 lbs}}{\textbf{x T}}$$

Cross multiply by x tons.

$$\frac{\textbf{2000 lbs}}{\textbf{1 T}} = \frac{\textbf{450 lbs}}{\textbf{x T}}$$

Divide both sides by 2000.
x = 0.225 T

There are 0.225 tons in 450 pounds.

9. What is the smallest division shown on the Imperial ruler?

A ruler shows an inch divided into 16 sections.

The smallest portion of an inch on most rulers is one-sixteenth $\left(\frac{1}{16}\right)$ of an inch.

Check it Out

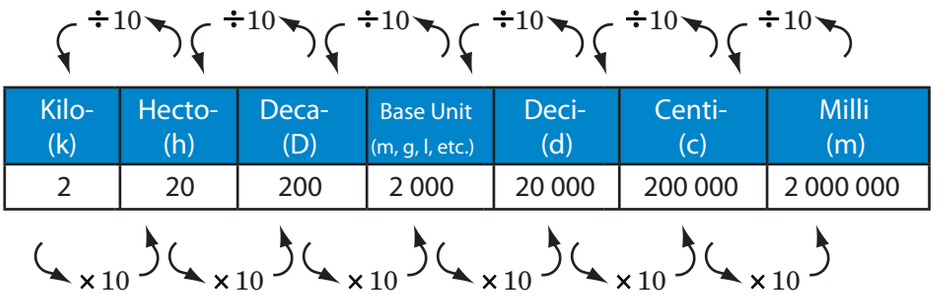
Have some fun learning more about charts and prefixes by playing

Imperial Chart Maze

Total
27

How Does It Work? Assignment

Now it's time to show your stuff!
Put lots of details into your work.



Imperial Units of Conversion		
Length	**Capacity**	**Weight**
1 mile (mi) = 1 760 yards (yd)	1 gallon (gal) = 4 quarts	1 ton (T) =2 000 pounds (lb)
1 mile = 5 280 feet (ft)	1 gallon = 128 fluid ounces (fl oz)	1 pound = 16 ounces
1 yard (yd) = 3 feet	1 quart (qt) = 2 pints (pt)	
1 yard (yd) = 36 inches	1 pint = 2 cups (c)	
1 foot (ft) = 12 inches	1 cup = 8 ounces (oz)	

(1) 1. To change 15 km to metres, how many times do you need to multiply by 10?

(2) 2. Herman offers to trade some lunch with you. He has a juice bottle that holds 525 mL. You have a juice bottle that holds 1.2 L. If you trade with Herman, who will get the most juice? Explain how you decided which bottle holds the most juice.

3. What is an appropriate unit of measure for the following objects? Write the units on the blanks; then, check the one you prefer to use.

(2) a. Distance around your yard?

Metric_____ Imperial_____

(2) b. How heavy is a tv?

Metric_____ Imperial_____

(2) c. The amount of water in a swimming pool?

Metric_____ Imperial_____

(3) 4. Explain how the factor of 10 is used in the metric system of measurement.

_____

_____

_____

_____

(2) 5. Determine how many millimetres 5.6 centimetres are.

(2) 6. On most Imperial rulers, how many equal sized sections is one inch divided into?

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(3) 7. What is your method of remembering the names of the capacity units for the imperial system? Explain what you would do to remember which units are used to measure capacity.

_____

_____

_____

_____

_____

8. Expand the Imperial chart to show

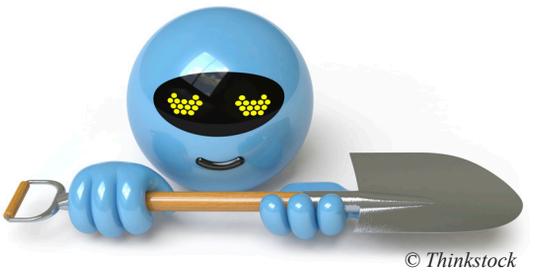
Imperial Units of Conversion		
Length	**Capacity**	**Weight**
1 mile (mi) = 1 760 yards (yd)	1 gallon (gal) = 4 quarts	1 ton (T) =2 000 pounds (lb)
1 mile = 5 280 feet (ft)	1 gallon = 128 fluid ounces (fl oz)	1 pound = 16 ounces
1 yard (yd) = 3 feet	1 quart (qt) = 2 pints (pt)	
1 yard (yd) = 36 inches	1 pint = 2 cups (c)	
1 foot (ft) = 12 inches	1 cup = 8 ounces (oz)	
_____ mile = 1 feet	1 ounce = _____ cups	

(2) a. the amount of miles in one foot

(2) b. the amount of cups in one ounce

(2) c. How many miles is 14 000 ft?

(2) d. How many cups is 40 ounces?



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You are ready to start Digging Deeper!

Digging Deeper

Beverly owns a jewellery company. Her job involves using small units of measure. Sometimes she needs cm and sometimes the better unit is mm or even a combination of both. A ring, for example, may be 1.8 cm in diameter or 1 cm and 8 millimetres or 18 millimetres. All three ways of saying the diameter are the same, but they use different metric units of measure.

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In the *How Does It Work?* section you learned that in the metric system, each prefix helps to describe the size of the object that was measured. It made sense to say 2 km and not 2 000 000 mm.

Large units of measure should be used to measure large objects and small units of measure should be used to measure small things.

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The carat is:

a. an orange vegetable
b. a unit to measure the weight of gems
c. a nickname for jewellry

Call your instructor to give your treasure chest answer and earn coins towards bonus marks.

Why would we need to change a measurement to a different unit? If I measured the butterfly in centimetres, why would I want to say its size in millimetres?

precise:
- *more exact*
- *more true to actual measurements*

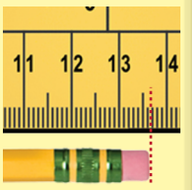
I know centimetres and millimetres are related because they are both linear metric units. What would be the purpose of changing from one unit to the other?

To do calculations with measurements, the units have to be the same. Also, not every measurement is a whole unit long. That is why the systems of measurement have smaller sections. We can get more ***precise*** descriptions of the measurement.

Example 6

Find the length of the pencil in cm and mm.

Solution



The pencil is longer than 13 cm, but it is not quite 14 cm. The smaller tick marks on the metric ruler show the 10 millimetres that make 1 cm. By counting the tick marks, we can see that the tip of the pencil is at about the seventh tick mark. That is 7 millimetres.

The length of the pencil is 13 cm and 7 mm.

Now, think about this. If you counted all the millimetre tick marks from the end of the eraser up to the tip of the pencil, you would have the pencil length in millimetres.

That would take a lot of work! Is there an easier way to get the length of the pencil in millimetres?

For every centimetre, there are 10 millimetres… right? So, there were 13 whole centimetres.

10 mm/cm × 13 cm = 130 mm

Remember the 7 extra millimetres.

130 mm + 7 mm = 137 mm

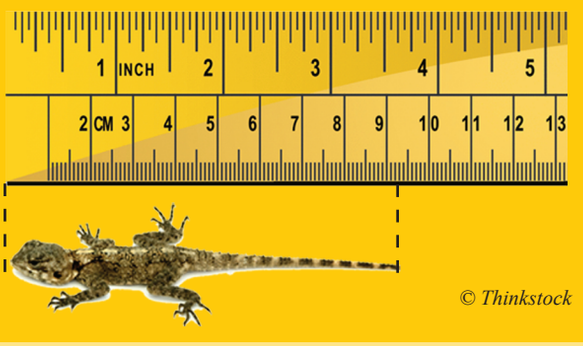
The length of the pencil is 137 millimetres.

Example 7

Measure the length of the lizard.

a. What is the length of the lizard in millimetres?

b. What is the length of the lizard in centimetres?



Solution a

In millimetres:

The total number of millimetres in the length can be determined by using factors of 10. Every small mark on the metric ruler represents 1 mm, and every large mark represents 10 mm or 1 cm.

The lizard is 9 cm + 3 mm.

Change 9 cm to mm by multiplying by a factor of 10.

9 cm × 10 mm/cm + 3 mm

= 90 + 3

= 93 mm

Solution b

In centimetres: method 1

We know that the lizard is 93 mm long. Convert 93 mm to cm only.

The largest whole cm that the nose of the lizard reaches to is 9 cm. Then there are 3 millimetres more until the actual tip is reached.

That's 9 whole cm + $\frac{3}{10}$ cm.

9 cm + $\frac{3}{10}$ cm

= 9 + 0.3

= 9.3 cm

Metric measurements are usually shown in decimal form.

In centimetres: method 2

Start with 93 mm and change 93 mm to cm. Millimetres are smaller than centimetres. To go from a smaller unit to a larger unit, divide by a factor of 10.

Remember that a centimetre is divided into millimetres. So to change millimetres to centimetres you will show how many times the cm was divided into millimetres.

93 mm= ? cm

Centi is one step bigger than *milli,* so divide by 10 one time

93 mm ÷ 10 = 9.3 cm

The prefix 'hecto' is:

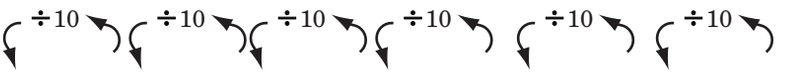
a. Latin for 'lots'
b. Greek for 'hundred'
c. Ukrainian for rotten wheat that was 'hucked away'

Call your instructor to give your treasure chest answer and earn coins towards bonus marks.

To change from a larger unit to a smaller unit in the metric system, count the number of prefix steps between the units. Then, ***multiply*** by 10 that number of times because each prefix represents a group of 10 of the next smaller unit.

Kilo (k)	Hecto- (h)	Deca- (D)	Base Unit (m, g, l, etc.)	Deci- (d)	Centi- (c)	Milli (m)

However, to change from a larger unit to a smaller unit, count the number of prefixes; then, ***divide*** by 10 that number of times.



Kilo (k)	Hecto- (h)	Deca- (D)	Base Unit (m, g, l, etc.)	Deci- (d)	Centi- (c)	Milli (m)

Example 8

Convert each using a prefix chart.

a. 7.3 kg to g
b. 4.5 m to cm
c. 1200 mL to L

Solution a

Going from kilograms to grams is going from a larger prefix to a smaller base unit.

Step 1: Determine how many prefix steps are between. Kilo to base unit is 3 prefix steps to the right.

Step 2: **Mulitply** the number of kilograms by 10 **three** times to get the number of grams

7.3 kg ×10 x10 ×10
= 7.3 × 1000
= 7300 g

Solution b

To change 4.5 m to cm, you are going from a base unit to a smaller prefix unit.

Step 1: Determine the number of prefix steps to the right. From metre to centimetre is 2 prefix steps.

Step 2: **Multiply** the number of metres by 10 twice to get the number of centimetres.

4.5 × 10 × 10
= 4.5 × 100
= 450 cm

Solution c

To change from 1200 mL to litres means going from a smaller prefix to a larger base unit.

Step 1: Determine the number of prefix steps to the left. From milli to litre is 3 prefix steps.

Step 2: **Divide** the number of millilitres by 10 three times.

$1200 \div 10 \div 10 \div 10$
= 1.2 litres

Did you notice that multiplying or dividing by factors of 10 just moves the decimal place in the number? A shortcut could be used. Move the decimal point the same number of steps as the number of prefix steps you counted.

1200 mL = 1.2 L

1200.0 mL shows where the decimal point is. Now 3 steps left on the prefix chart means move the decimal 3 steps left in the number.

1.200.

Therefore, 1200 mL = 1.2 L.

Powers of 10

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Power of 10 does not mean the same as the power it takes to break boards. A 'power' in Math is an **exponent**.

The number of prefix steps tells you how many times to multiply or divide the measurement by 10 to change it to another unit in the metric system.

There is a shortcut!

Recall that $10 \times 10 = 10^2$.

Or $10 \times 10 \times 10 = 10^3$.

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Instead of multiplying by 10 a bunch of times, count the number of prefix steps and multiply by 10 to that *power*.

The same process works for dividing by 10 if you are going from a smaller unit to a larger one.

The exponent on 10 is the number of prefix steps needed to do the conversion.

Multiply or divide by 10 to the power that is the number of prefix steps needed for the conversion.

Example 9

Convert the measurements using powers of 10. Use a calculator with a power button to do this calculation.

a. 2.31 kilometres to metres

b. 82 millimetres to decimetres

Solution a

Kilo to base unit is going from bigger to smaller so multiply by a power of 10.

Kilo is 3 prefix steps away; multiply by 10^3.

$2.31 \text{ km} \times 10^3 = 2310 \text{ m}$

Remember that $10^3 = 10 \times 10 \times 10 = 1000$.

Note: The decimal point moved 3 places to the **right**.

Solution b

Milli to deci is going from a smaller prefix to a larger one, so divide by a power of 10.

Milli is 2 prefix steps away; divide by 10^2.

$82 \text{ mm} \div 10^2 = 0.82 \text{ dm}$

$82 \text{ mm} \div 10^2 = 0.82 \text{ dm}$

Remember that $10^2 = 10 \times 10 = 100$.

Note: The decimal point moved 2 places to the **left**.

Call your instructor to describe what your exponent button on your calculator looks like and earn coins towards bonus marks.

There is an even **shorter way** when multiplying or dividing by factors of 10 or powers of 10!

Consider $2.5 \times 10 = 25$.

The decimal point moved to the right 1 place because you multiplied by 10 and it has 1 zero.

How about this one?

$3.48 \times 1000 = 3480$
3.480 becomes 3480.

The decimal point moved to the right 3 places because you multiplied by 1000 and it has 3 zeros.

$3.480 \longrightarrow 3480$

Now, use the powers the same way.

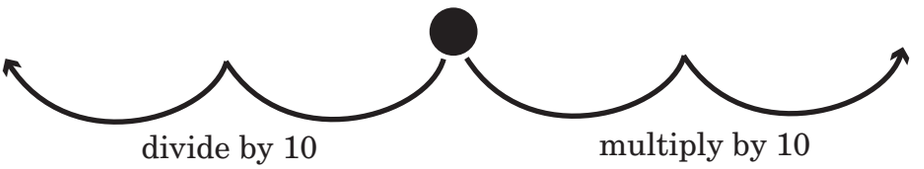
$23.4 \times 10^2 = 2340$

The decimal moved 2 places to the right because you multiplied by 10 to the power **2**.

$23.4 \times 10^2 \longrightarrow 23.4\,\mathbf{0}$ (Insert the '**0**' as a placeholder.)

Remember $10^2 = 100$ and it has **2** zeros in it.

Again! Did you notice that by multiplying or dividing by powers of 10 just moves the decimal place in the number? Multiplying by a power of 10 means that the decimal point moves to the **right**. Dividing by a power of 10 means that the decimal point moves to the **left**.



Conversion Tables

A conversion table is a handy way to change one metric unit to another. If you know how many millimetres fit into one centimetre, then you can do a calculation to determine the converted units.

Here is a small table for linear metric units.

Metric Conversion
1 centimetre = 10 millimetres
1 metre = 100 centimetres
1 kiloimetre = 1 000 metres

You can extend the table:

1 kilometre = _____cm

1 metre = _____mm

As you become more familiar with the system, you will remember how many of each unit fit into another unit, and you will not need the table.

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Example 10

Change 34 millimetres to centimetres.

Solution

÷10

Kilo (k)	Hecto- (h)	Deca- (D)	Base Unit (m, g, l, etc.)	Deci- (d)	Centi- (c)	Milli (m)
						34

1 cm = 10 mm
? cm = 34 mm

Referring to the prefix chart, notice that milli to centi is one prefix step to the left.

Divide by 10 to convert 34 millimetres to centimetres.

$$\frac{34\ \text{mm}}{10}$$
$$= 34 \div 10$$
$$= 3.4$$

The decimal point moved one place to the left.

34 mm is the same length as 3.4 cm.

Recall that measurements can be a mixture of units within the same category. Millimetres and centimetres both measure linear amounts.

We write that 34 mm = 3.4 cm, but we can state also that 3.4 cm is 3 centimetres and 4 millimetres.

Decimals are a useful type of number in the metric system. Base 10 is used in the metric system. That means larger units are made up of groups of 10 of smaller units. Multiplying and dividing by factors of 10 or powers of 10 moves the decimal place in the measurement.

Because multiplying or dividing by 10 can 'move the decimal', metric measurements are written usually in decimal form and not as fractions.

Imperial Units

Michael works for a cabinet company, and the skills he uses every day involve switching between units of measure depending on what he needs to measure. Sometimes he is using inches, and sometimes the measurements are in feet.

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To do calculations with measurements, the units must be the same.

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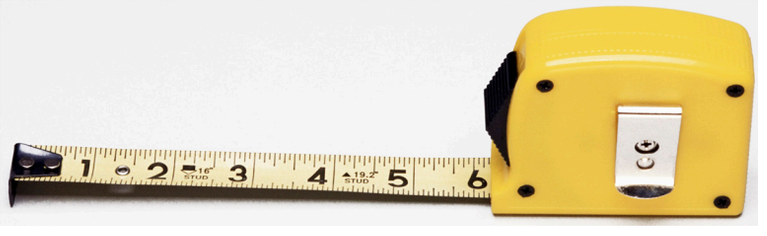
Michael may measure the height of a cupboard door in feet, but the crown moulding for it might be in inches. The total length of the moulding is found by adding the length of the door to the width of the door. He would have to add feet plus inches. He could change the measurement that was in feet to inches, and then add that to the measurement of the moulding to get the total length in inches.

Just as metric units can be converted within the metric system, Imperial units can also be converted to related Imperial units.



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You have already learned that 1 foot = 12 inches.

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If a nurse measures a newborn baby to be 21 inches long, she could tell the parents that the baby is 1 foot and 9 inches long.

1 foot = 12 inches
21 inches – 12 inches = 9 inches

After 12 of the inches were used to make 1 foot, 9 inches were left. The length of the baby is 1 foot and 9 inches.

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The Imperial conversion chart might be familiar by now. Keep it handy while working through problems involving Imperial conversions. We will use it to solve Example 11.

Imperial Units of Conversion		
Length	**Capacity**	**Weight**
1 mile (mi) = 1 760 yards (yd)	1 gallon (gal) = 4 quarts	1 ton (T) =2 000 pounds (lb)
1 mile = 5 280 feet (ft)	1 gallon = 128 fluid ounces (fl oz)	1 pound = 16 ounces
1 yard (yd) = 3 feet	1 quart (qt) = 2 pints (pt)	
1 yard (yd) = 36 inches	1 pint = 2 cups (c)	
1 foot (ft) = 12 inches	1 cup = 8 ounces (oz)	

Where did the name 'bushel' originate?

a. The old French word 'boiseau' that meant the amount of seed produced from one unit of land

b. The old German word that meant the amount of berries on one bush

c. The old Canadian word that meant a handful of shells

Call your instructor to give your treasure chest answer and earn coins towards bonus marks.

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Example 11

a. Jill made 7 gallons of Maple Syrup. How many quart jars can she fill?

b. George ground 80 ounces of wheat to make flour. How many pounds of flour did George make?

c. Lucus knows that the distance from his house to his school is 2.5 miles. How many feet is the distance to his school?

Solution a

Step 1: Identify the conversion factor.

1 gallon = 4 quarts, so the conversion factor is 4.

Step 2: Gallons to quarts is a larger-to-smaller conversion, so multiply.

$7 \times 4 = 28$ quarts.

Jill can fill 28 jars.

Solution b

Step 1: Identify the conversion factor.

1 pound = 16 ounces, so the conversion factor is 16.

Step 2: Ounces to pounds is a smaller-to-larger conversion, so divide.

80 ÷ 16 = 5 pounds.

George made 5 pounds of flour.

Solution c

2.5 miles is how many feet?

The conversion factor is 5280

2.5 × 5280 = 13 200 feet.

The distance from Lucus' house to his school is 13 200 feet.

Why was a 'conversion factor' of 5280 used? What does conversion factor mean? It means the factor or the number that matches the amount of one unit that fits into another. 5280 feet make 1 mile, so 5280 is the **conversion factor** to change miles to feet.

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In the 'How Does It Work?' section, Example 4, you extended the chart to include more information. You determined that 0.0005 ton = 1 pound. To convert pounds to tons, 0.0005 is the conversion factor.

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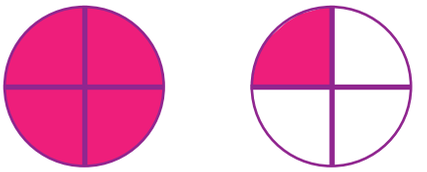
How tall are you? Do you know your height in Imperial units or in metric units? Many Canadians know their heights in feet and inches, which is a mixture of the Imperial units. Usually, we do not say we are 67 inches tall, and we do not usually say we are 5.9 feet tall. It is common to express our height in a mixture of Imperial units.
67 inches = 5 ft and 7 inches

Just as a fraction can be shown as an improper fraction or as a mixed number, measurements can be shown as a mixture of related units.

Recall that $\frac{5}{4}$ is an improper fraction.

It means 5 parts out of 4. How does that work?

An item is cut into 4 parts and 5 of them are used. It might look like this



$\frac{5}{4}$ means that one whole part is used,

and another $\frac{1}{4}$ is from another part.

Thus, $\frac{5}{4}$ as a mixed number is $1\frac{1}{4}$.

It is called a mixed number because it has a whole number and a fraction in it.

Check it Out

Have some fun with
Lesson 4B - Tip from Your Teacher
Mixed Numbers and Imperial Measurements.

Using two types of units to represent a measurement is similar to mixed numbers. 5 feet 7 inches really means 5 whole feet and 7 extra inches that did not make up another whole foot.

Because one whole foot has 12 inches, the measurement of 5 feet 7 inches could be written as 5 and $\frac{7}{12}$ feet.

As you saw with the metric system when adding, subtracting, multiplying, or dividing measurements, it helps if they are all in one type of unit.

It is okay to leave the $\frac{7}{12}$ as a fraction.

This is because the decimal form will not give as much information about the amount of inches as the fraction form does.

$\frac{7}{12}$ means 7 inches out of 12 inches in one whole foot.

But, $\frac{7}{12} = 7 \div 12$ and that is 0.58333333…

The decimal 0.58333 with the 3 repeating tells us that it represents a little more than 0.5 of a foot,
but $\frac{7}{12}$ tells us that it represents exactly 7 inches
of the possible 12 in another foot.

So that is why 67 inches is equal to 5 ft 7 inches.

Measurements in the Imperial system are written often in fraction form because this gives more information about the measurement.

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Example 12

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Kerry's toy car is 5 feet long.

a. How many yards **and** feet is 5 feet long?

b. How many yards is 5 feet?

Solution a

There are 3 feet in one yard.

Multiply by a conversion factor.

$$= 5 \times \frac{1 \text{ yard}}{3 \text{ feet}}$$
$$= 5 \times 1 \div 3$$
$$= 1.66\overline{6}$$

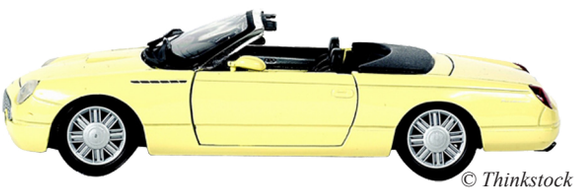
$1.66\overline{6}$ means 1 yard plus part of another or 1 yard plus $1.66\overline{6}$ yards.

From the 5 feet, 3 feet are used in the yard.

Determine how many feet are left over by subtracting.

5 - 3 (in one yard) = 2 feet leftover.

5 feet = 1 yard and 2 feet.



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Solution b

Now, express the length of the toy car in yards only.

5 feet = 1 yard and 2 feet.

The 2 feet can be multiplied by the conversion factor of 1 yard/3 feet

$$2 \text{ feet} \times \frac{1 \text{ yard}}{3 \text{ feet}} = \frac{2}{3} \text{yard}$$

5 feet = 1 yard and 2 feet

$$= 1 \frac{2}{3} \text{ yards.}$$

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Example 13

Yao Ming is a NBA basketball player born in Shanghai, China.

He is 7 ft 6 in tall.

What is Yao height in inches only?

Solution

Yao is 7 feet + 6 inches tall.

There are 12 inches in 1 foot.

Height = 7 feet × 12 inches/foot + 6 inches

Units cancel. You get rid of the feet units and have only inches left, which is the unit you want.

Height = 84 inches + 6 inches

= 90 inches

Yao is 90 inches tall.

Example 14

An airplane flies 3.5 miles above the ground. A mountain reaches 14 500. Will the plane clear the mountain?

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Solution:

Set up a ratio:

1 mile = 5280 ft

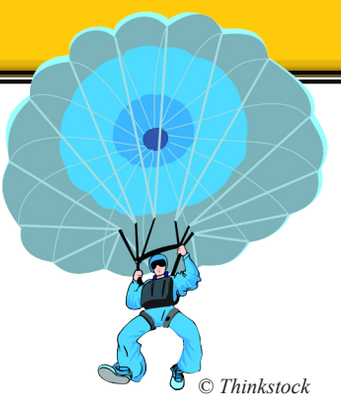
3.5 miles = ? feet

$\times 3.5$ ↷ 1 mile = 5280 feet
3.5 mile = ? feet

$\times 3.5$ ↷ 1 mile = 5280 feet ↶ $\times 3.5$
3.5 mile = ? feet

5280 ft /mile × 3.5 miles = 18 480 ft

The plane is flying at 18 480 feet above the ground. Yes, it will clear the mountain peak.



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The Imperial system has interesting names that developed over time to represent the units of measure in the system.

Groups of smaller units make up larger units, but there is no real pattern to predict how many smaller units will make a larger unit.

In the Imperial system, a conversion chart is very important to help you know how many smaller units fit into a larger unit because no pattern is evident in the names.

Usually, fractions are used to show the value of part units in the Imperial system because the denominator of the fraction or the bottom number shows how many smaller units make up the unit of measure.

1 inch = $\frac{1}{12}$ foot.

12 is the denominator.

12 inches in 1 foot.

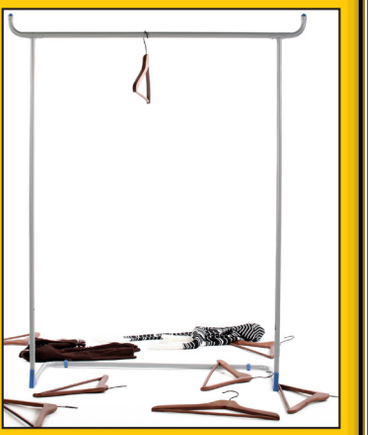
2 feet = $\frac{2}{3}$

3 is the denominator.

3 feet in 1 yard.

Example 15

Larry is installing a closet. The space he has is 6 feet long. He buys a closet pack that is 80 inches long. Will it fit?



Solution:

Convert the units so the comparison can be made.

$6 \text{ ft} = \underline{\quad\quad} \text{ inches}$

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

$$6 \text{ ft} \times \frac{12 \text{ inches}}{1 \text{ ft}}$$

$$= 72 \text{ inches}$$

The closet pack is 80 inches long.
It won't fit.

For the names of the units, the metric system uses prefixes that represent groups of 10. Every prefix means a group of 10 of the next smaller unit.

Base 10 in the metric system means that, when a measurement is changed to another unit, you can multiply or divide by factors or powers of 10.

10^3 is a power. 10 is the base and 3 is the exponent.

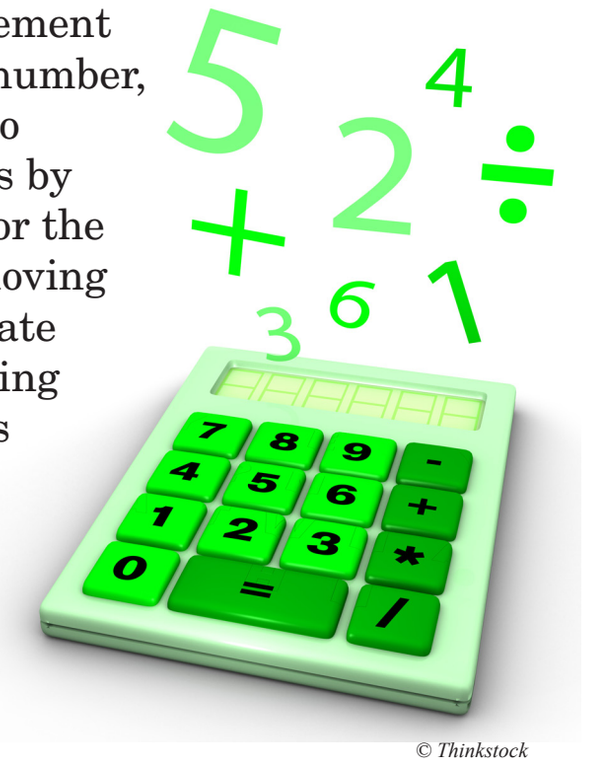
Fractions are **not** usually used in the metric system.

- 1 mm = $\frac{1}{10}$ cm means that in 1 cm there are 10 mm.

  The denominator tells how many smaller units the whole unit is sectioned into. However, we already know that there are 10 mm in 1 cm because of the prefix system.

- $\frac{1}{10}$ cm = 1 ÷ 10 = 0.10 cm.

  By changing the measurement to a decimal form of the number, we can convert it easily to millimetres or decimetres by using the prefix method or the powers of 10 or by just moving the decimal the appropriate number of places depending on how many prefix steps are made.



Digging Deeper
Practice Questions

1. Convert the following:

   a. 34 cm = _____ mm

   b. 120 mL = _____ L

   c. 8 kg = _____ g

   d. 7 mi = _____ yd

   e. 132 000 ft = _____ mi

   f. 368 oz = ____ lb

   g. 24 inches = ____ yard

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2. To change 653.7 metres to kilometres, move the decimal ____ places to the _____

3. To change 0.502 kilometres to centimetres, move the decimal ____ places to the _____.

In the British Imperial System of measurement, 1 stone = ___?
a. a rock
b. one pound
c. 14 pounds

Call your instructor to give your treasure chest answer and earn coins towards bonus marks.

4. Show by using factors of 10 and then powers of 10 how to change 4.5 m to cm.

5. Show by using factors of 10 and then powers of 10 how the change 235 ml to L.

6. Express 40 inches as a measurement in feet only.

7. Andy and Paul need to reach a light to change a bulb. Andy is 5 feet 9 inches tall, and Paul is 5 feet 11 inches tall. The light is in a chandelier that is 11 feet above the floor.

   If Andy stands on Paul's shoulders would they be able to reach the light to change the bulb?

8. Benny has a piece of baseboard that is 4.23 m long. There is a 152 cm section along his stairway that needs baseboard and another section in the hallway that is 276 cm long.

   Will the 4.23 m length of baseboard be long enough to do both sections?

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Practice Solutions

1. Convert the following:

a. 34 cm = _____ mm

Centi to milli is one step to the right, so multiply by 10.
34 cm × 10 mm/cm = 340 mm

b. 120 mL = _____ L

Going from milli to the base unit of litre means 3 prefix steps to the left. In powers, that is 10^3. Going left means to divide.

$120 \text{ mL}/10^3 = 0.120$

c. 8 kg = _____ g

There are 3 prefix steps to the right going from kilograms to grams.
Multiply by 10 three times, or move the decimal point 3 places to the right.
8 kg × 10 × 10 × 10
8 kg= 8 000 g

d. 7 mi = _____ yd

According to the conversion chart for Imperial units, there are 1760 yards in 1 mile.
1 mile = 1760 yards
7 miles = ? yards.

Set up a ratio:

$$\frac{? \text{ yd}}{7 \text{ miles}} = \frac{1760 \text{ yd}}{1 \text{ mile}}$$

Cross multiply by 7 miles.

$$\frac{? \text{ yd}}{7 \text{ miles}} = \frac{1760 \text{ yd}}{1 \text{ mile}}$$

$$? \text{ yd} = 7 \times 1760$$

$$= 12\,320$$

There are 12 320 yards in 7 miles.

e. 132 000 ft = _____ mi

According to the conversion chart, there are 5280 feet in 1 mile.
Set up a ratio:

$$\frac{\textbf{1 mile}}{\textbf{5280 ft}} = \frac{\textbf{? miles}}{\textbf{132 000 ft}}$$

Multiply both sides by 132 000 ft.

$$\textbf{132 000} \times \frac{\textbf{1 mile}}{\textbf{5280 ft}} = \frac{\textbf{? miles}}{\cancel{\textbf{132 000}}} \times \cancel{\textbf{132 000}}$$

$$\frac{\textbf{132 000 ft} \times \textbf{1 mile}}{\textbf{5280 ft}} = \textbf{? miles}$$

Remember the fraction line means to divide.

$$\textbf{132 000} \div \textbf{5280} = \textbf{? miles}$$

$$= \textbf{25 miles}$$

f. 368 oz = ____ lb

There are 16 ounces in a pound.

$$\frac{\textbf{1 lb}}{\textbf{16 oz}} = \frac{\textbf{? lb}}{\textbf{368 oz}}$$

Multiply both sides by 368.

$$\times 368 \frac{\textbf{1 lb}}{\textbf{16 oz}} = \frac{\textbf{? lbs}}{\cancel{\textbf{368 oz}}} \times \cancel{\textbf{368}}$$

$$\textbf{368 oz} \times \frac{\textbf{1 lb}}{\textbf{16 oz}} = \textbf{? lbs}$$

$$\textbf{368} \div \textbf{16} = \textbf{?lbs}$$

$$= \textbf{23 lbs}$$

g. 24 inches = ____ yard

There are 36 inches in 1 yard.

$$\frac{\textbf{1 yard}}{\textbf{36 inches}} = \frac{\textbf{? yds}}{\textbf{24 inches}}$$

Multiply both sides by 24 so it will cancel off the right.

$$\frac{\textbf{24 inches} \times \textbf{1 yard}}{\textbf{36 inches}}$$

$$= \frac{\textbf{24}}{\textbf{36}} \textbf{ yards}$$

As a reduced fraction... $\frac{\textbf{24}}{\textbf{36}} = \frac{\textbf{2}}{\textbf{3}}$

$$\textbf{24 inches} = \frac{\textbf{2}}{\textbf{3}} \textbf{ yard}$$

2. To change 653.7 metres to kilometres, move the decimal ____ places to the _____

To change 653.7 m to km, move the decimal 3 places to the left.

653.7 m = 0.6537 cm

3. To change 0.502 kilometre to centimetres, move the decimal ____ places to the _____.

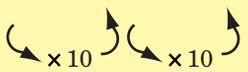
To change 0.502 kilometre to centimetres, move the decimal 5 places to the right.

0.502 km = 50 200 cm

4. Show by using factors of 10 and then powers of 10 how to change 4.5 m to cm.

Factors of 10

Kilo (k)	Hecto- (h)	Deca- (D)	Base Unit (m, g, l, etc.)	Deci- (d)	Centi- (c)	Milli (m)
			4.5 m		**?**	



To go from metres or the base unit to centimetres involves two steps to the right in the prefix chart. So multiply by a factor of 10 two times.

4.5 m × 10 × 10 = 450 cm

OR

Two factors of 10 moves the decimal two places to the right.

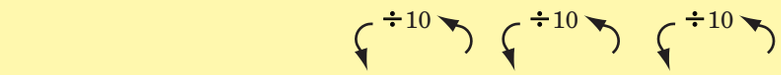
Powers of 10

To go from metres or the base unit to centimetres involves two steps in the prefix chart. That is 10 to the power of 2 or 10^2.

$4.5 \text{ m} \times 10^2 = 4.5 \times 100 = 450 \text{ cm}$

5. Show by using factors of 10 and then powers of 10 how to change 235 mL to L.

Factors of 10



Kilo (k)	Hecto- (h)	Deca- (D)	Base Unit (m, g, l, etc.)	Deci- (d)	Centi- (c)	Milli (m)
			? L			235

To go from millilitres to litres, the base unit, it involves three steps to the left in the prefix chart. Start at mL and go to L and move left in the chart three spaces to get to litres. So divide by a factor of 10 three times.

235 mL 10 ÷ 10 ÷ 10 = 0.235 L

<u>OR</u>

235 mL and three factors of 10 moves the decimal 3 places to the left.

Powers of 10

To go from milliliters to Litres in the chart involves 3 steps left in the prefix chart...that is 10 to the power of 3 or 10^3.

235 mL ÷ 10^3
= 235 ÷ 1000
= 0.235 L

6. Express 40 inches as a measurement in feet only.

There are 12 inches in 1 foot

$\frac{\text{1 foot}}{\text{12 inches}}$ **is a conversion factor.**

Set up a ratio.

$$\frac{\text{1 foot}}{\text{12 inches}} = \frac{\text{? ft}}{\text{40 inches}}$$

Multiply both sides by 40 inches so that it cancels off the right.

$$\times\ 40\ \text{inches}\frac{\text{1 foot}}{\text{12 inches}} = \frac{\text{? ft}}{\cancel{\text{40 inches}}} \times \cancel{\text{40 inches}}$$

$$40\ \text{inches} \times \frac{\text{1 foot}}{\text{12 inches}} = \text{? ft}$$

3 .333... ft (The dots show that the 3 is repeating forever after the decimal point.)

Usually imperial units are not shown as decimals. The decimal part should be shown in its fractional form.
3.333.... is a little tricky to write as a decimal!

*** Remember the Tip from Your Teacher, in this lesson? Go back to 40 ÷ 12 and determine how many times 12 goes into 40 and how much is left over**
12 goes into 40 three times...
12 × 3 = 36 and 12 × 4 = 48
So, 12 goes into 40, three times without going over 40. But there is a remainder.
12 goes into 40, three times, with a remainder of 4.

3 feet and $\frac{4}{12}$ **feet**

$\frac{4}{12}$ **reduces to** $\frac{1}{3}$ **because top and bottom can both be divided by 4.**
= 3 and 1/3 feet
40 inches in feet is 3 1/3 feet.

7. Andy and Paul need to reach a light to change a bulb. Andy is 5 feet 9 inches tall, and Paul is 5 feet 11 inches tall. The light is in a chandelier that is 11 feet above the floor. If Andy stands on Paul's shoulders would they be able to reach the light to change the bulb?

Even if they could reach the chandelier to change the bulb by standing on each other's shoulders, it wouldn't be a safe way to do it!

Total distance that they need to reach is 11 feet.

Step 1: Put 'like' units together.

5 ft 9 inches + 5 ft 11 inches
= (5 ft + 5 ft) + (9 inches + 11 inches)

= 10 ft and 18 inches.

Step 2: Convert 18 inches to 'inches' and 'feet' because 18 inches is more than one foot.

Remember that 1 foot is 12 inches.

$$18 \text{ inches} \times \frac{1 \text{ ft}}{12 \text{ inches}} = \frac{18}{12}$$

= 1.5 ft or 1 ft with 6 inches left over

18 inches = 1 ft 6 inches.
= 10 ft + (1 ft 6 inches)
= 11 ft 6 inches.

Step 3: Compare their combined height to the height of the chandelier.

Both boys measurements are from the floor to the top of their heads. One boy is standing on the other's shoulders, not his head. Even so, their combined height is 6 inches higher than the chandelier. So, they should be tall enough to change the bulb, but I still wouldn't recommend it! Get a ladder.

8. Benny has a piece of baseboard that is 4.23 m long. There is a 152 cm section along his stairway that needs baseboard and another section in the hallway that is 276 cm long. Will the 4.23 m length of baseboard be long enough to do both sections?

For this question, all the units must be changed to be the same. You can change everything to centimetres or everything to metres. Because there is only one measurement in metres, changing all to centimetres will be simplest.

Two prefix steps are between the base unit of metres and the prefix centi. That means 10 to the power of 2. To go from metres to centi is to go to the right, so that means multiply.

$$4.23 \text{ m} \times 10^2 = 423 \text{ cm}$$

Now, determine the total amount of baseboard that Benny needs.

$$152 \text{ cm} + 276 \text{ cm} = 428 \text{ cm}$$

He needs 428 cm and the piece he has is 423 cm long. The piece is 5 cm too short for the job he has.

Total
34

Digging Deeper Assignment

Now it's time to show your stuff!
Put lots of details into your work.

(2) 1. Change 348 m to cm using the prefix steps. Explain each step.

(2) 2. Now, change 348 m to cm using the power of 10 shortcut. Explain where the decimal point is in 348 and where it is in the cm answer.

How many places did the decimal point move, and why did it move that many places?

3. Convert the following:

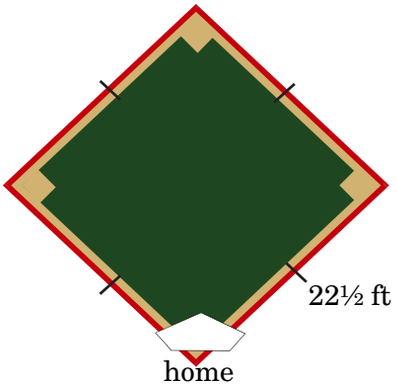
(2) a. 426 in = _____ ft

(2) b. 5280 ft = _____ yd

(2) c. 2.2 lbs = _____ oz

(2) d. 2 800 lb = _____ ton

(4) 4. Find the total distance along the bases in a baseball diamond in **yards**.



(2) 5. How many litres of milk would it take to fill a 12 000 mL jug?

(4) 6. The leadership squad needs 21 new badges, each of which requires 9 inches of a strip of sheet metal. Sheet metal is sold by the yard. How many yards of sheet metal strips are needed?

(4) 7. Pat bought 5 bottles of apple juice. Each bottle has 520 ml of juice. How many litres of juice did he buy?

(4) 8. Randy has a length of cord that is 33 cm long He needs to cut it into 3 equal sections for a dream catcher he is making. How many millimetres long will each section be?

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(4) 9. The maximum weight that a pulley can hold is 40 kg. Josey needs to hoist (lift) the following objects with the pulley.

- A parcel that is 22.5 kg
- 3 clothing bundles that are 750 g each
- A 10 kg box of books

Can she safely lift them all at the same time?

Lesson Summary

In this lesson, you learned that the two main systems that we work with, Imperial and metric, were developed in different ways. The Imperial system uses fractions because a fraction indicates how many parts the unit was sectioned into to make smaller units

You also learned that the metric system or SI system uses decimals because the decimal values are related to groups of 10. Because the system has groups of 10 small units making the bigger units, multiplying and dividing by 10 moves the decimal place.

Factors of 10 and powers of 10 can be used with the prefixes of the names for conversions within the metric system. You also solved problems that required conversion to common units so calculations could be completed.

Please attach your return address label to the back of this booklet and send this lesson to be marked.

You are now ready to proceed Unit 4 Lesson C.

ALBERTA DISTANCE LEARNING CENTRE

MAT1793

Math 10-3

Unit 4: Measurements Systems

Lesson B: Imperial and Metric Measurements

Student's Questions and Comments

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Summary

	Possible Marks	Your Marks	%
How Does It Work? Assignment	27		
Digging Deeper Assignment	34		

Teacher's Comments

_____

Teacher's Signature

June 2010