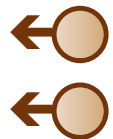


4.1 - Systems of Measurement



Make Connections

In 1976, Canada adopted SI units to measure length. However, construction and manufacturing industries continue to use **imperial units**. Many Canadians use imperial units to measure their height.



What is your height?

Look around the classroom.

Which object has a length of about one foot?

Which object has a length of about one inch?

Which object has a length of about one yard?

Activate Prior Learning: SI Units



Common SI units of length are the metre, centimetre, and millimetre.

What are referents for these SI units?

| Unit | Referent |
|------------|----------|
| millimetre | |
| centimetre | |
| metre | |



1.2 Math Lab: Measuring Length and Distance

Systeme international d'unites (SI)

This is a measurement system commonly used in Canada. It is a decimal system based on multiples of 10. This means you can convert to other SI units simply by multiplying or dividing by a multiple of 10!

What are multiples of 10?

TABLE 1.5 Selected Prefixes Used in the Metric System

| Prefix | Abbreviation | Meaning | Example |
|--------|--------------|------------|--|
| Giga | G | 10^9 | 1 gigameter (Gm) = 1×10^9 m |
| Mega | M | 10^6 | 1 megameter (Mm) = 1×10^6 m |
| Kilo | k | 10^3 | 1 kilometer (km) = 1×10^3 m |
| Deci | d | 10^{-1} | 1 decimeter (dm) = 0.1 m |
| Centi | c | 10^{-2} | 1 centimeter (cm) = 0.01 m |
| Milli | m | 10^{-3} | 1 millimeter (mm) = 0.001 m |
| Micro | μ^a | 10^{-6} | 1 micrometer (μ m) = 1×10^{-6} m |
| Nano | n | 10^{-9} | 1 nanometer (nm) = 1×10^{-9} m |
| Pico | p | 10^{-12} | 1 picometer (pm) = 1×10^{-12} m |
| Femto | f | 10^{-15} | 1 femtometer (fm) = 1×10^{-15} m |

^aThis is the Greek letter mu (pronounced "mew").

The imperial unit for measuring long distances is the mile. The length of one mile was first established as the distance a Roman soldier could walk in 1000 paces. One pace is 2 steps.

| Imperial Unit | Abbreviation | Referent | Relationship between Units |
|---------------|--------------|----------|----------------------------|
| Inch | in. | ? | ? |
| Foot | ft. | | |
| Yard | yd. | | |
| Mile | mi. | | |

Base Unit: a unit of measurement on which other units are based.
ex: length - meter (m); volume - litre (L); mass - gram (g)

Volume: the amount of space a solid occupies.

Measurements using Imperial Units

What units would you use if you were to tell me your height and weight?

Imperial units are still used in many industries in Canada even though we have adopted SI units, also known as the metric system. The **imperial system** is *not* a decimal system as the measurements were all developed at different times to meet certain needs. Therefore, you must use a **conversion factor** to convert one imperial unit to another.

FIGURE 4.1
Some Common Imperial Units

| Length | |
|-------------|---------------------|
| <i>Unit</i> | <i>Abbreviation</i> |
| inch | in or " |
| foot | ft or ' |
| yard | yd |
| mile | mi |

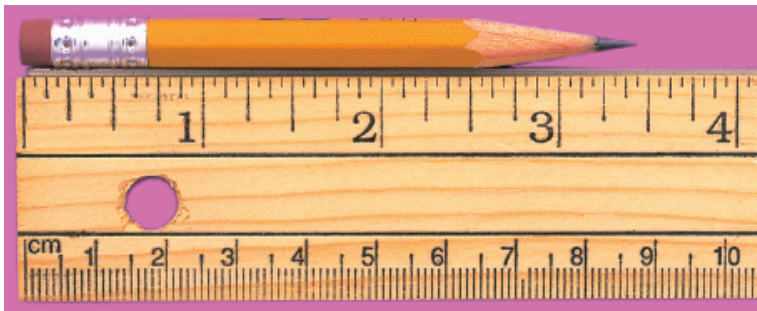
DISCUSSION...

Which imperial unit is the most appropriate unit to measure each item? Justify your choice.

- a) the height of your desk
- b) the thickness of a mattress
- c) the width of a car
- d) the length of a flat panel TV
- e) the distance from the school to your home



To measure the length of an object, first determine the smallest indicated unit by counting the number of divisions between two adjacent inch marks. The ruler below has ? divisions between two adjacent inch marks



The pencil point is closest to ?

?



A fraction of an imperial measure of length is usually written in fraction form, not decimal form.

Imperial Conversions

We will be working with units for length. The smallest unit we will use is the inch, followed by a foot, followed by a yard, and finally a mile. Read the top of page 143 and then copy and complete the table below.

IMPERIAL CONVERSION TABLE

1 foot = _____ inches

1 yard = _____ feet = _____ inches

1 mile = 1760 yards = _____ feet

Example 1 Converting between Imperial Units

a) Convert 5 yd. to:

i) feet 5 yd. = 15 ft.

ii) inches $51 \text{ in.} = 4 \text{ ft. } 3 \text{ in.}$

180 in

b) Convert 51 in. to:

i) feet and inches

ii) yards, feet, and inches

51 in. = 4 ft. 3 in.

51 in. = 1 yd. 1 ft. 3 in.

 **SOLUTION**

(Erase to reveal)



CHECK YOUR UNDERSTANDING

$$a) 5 \text{ yd} \times \frac{3 \text{ ft}}{1 \text{ yd}} = 15 \text{ '}$$
$$5 \text{ yd} \times \frac{3 \text{ ft}}{1 \text{ yd}} \times \frac{12 \text{ in}}{1 \text{ ft}} = 180 \text{ in}$$

$$b) 51 \text{ in} = 4 \text{ ' } 3 \text{ ''}$$
$$51 \text{ ''} = 1 \text{ yd } 1 \text{ ' } 3 \text{ ''}$$

TRY THIS ONE...

Pierre-Marc converted 21 ft. 9 in. into yards, feet, and inches. His answer was 7 yd. 1 ft. 6 in. Is his answer correct? If your answer is no, show the correct conversion.



12. No; 21 ft. 9 in. = 7 yd. 9 in.

$$\begin{aligned} 21 \text{ ft } 9 \text{ in} \\ = 7 \text{ yd } 9 \text{ in} \end{aligned}$$

Example 2

Solving a Problem Involving Converting between Units

Anne is framing a picture. * Perimeter - distance around the figure
The perimeter of the framed picture will be 136 in.

- a) What will be the perimeter of the framed picture in feet and inches? The perimeter of the framed picture will be 11 ft. 4 in.
- b) The framing material is sold by the foot. It costs \$1.89/ft. What will be the cost of material before taxes?

SOLUTION

(Erase to reveal)

a) $136 \text{ in} = 11' 4''$

$$\frac{136}{12} = 11 \dots$$

b) $12 \times 1.89 = \$22.68$

$11 \frac{1}{3} \times 1.89 = \21.42



CHECK YOUR UNDERSTANDING



TRY THIS ONE...

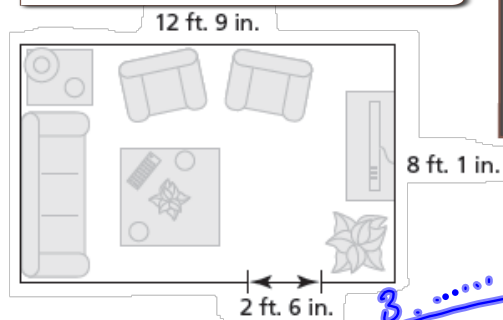


14. a) 39 ft. 2 in.
c) \$49.96

b) 4 rolls

A wallpaper border is to be pasted halfway up the wall around a child's bedroom.

- a) What is the total length of border needed?
- b) The border is purchased in 12-ft. rolls. How many rolls are required?
- c) Each roll of border costs \$12.49. How much will the border cost, before taxes?



$$\begin{array}{r}
 12'9'' \\
 12'9'' \\
 8'1'' \\
 8'1'' \\
 \hline
 40'20''
 \end{array}$$

$$\begin{array}{r}
 40'20'' \\
 - 2'6'' \\
 \hline
 38'14'' \\
 \hookrightarrow 39'2''
 \end{array}$$

b) $12 \overline{) 39'2''}$
 3.....
 4 rolls

c) $\$12.49 \times 4 = \49.96

Example 3

Solving a Problem Involving Two Unit Conversions

The school council has 6 yd. of fabric that will be cut into strips 5 in. wide to make decorative banners for the school dance.

- a) How many banners can be made? 43 banners can be made.



SOLUTION

(Erase to reveal)



CHECK YOUR UNDERSTANDING

Example 4 Solving a Problem Involving Scale Diagrams

A map of Alaska has a scale of 1:4 750 000. The distance on the map between Paxson and the Canadian border is $3\frac{11}{16}$ in. What is this distance to the nearest mile?



SOLUTION

(Erase to reveal)

The distance between Paxson and the Canadian border is approximately 276 mi.



CHECK YOUR UNDERSTANDING

$$\begin{aligned} \left(3\frac{11}{16}\right)'' (4\,750\,000) &= 17\,515\,625'' \\ 17\,515\,625'' \times \frac{1\text{ ft}}{12''} \times \frac{1\text{ yd}}{3\text{ ft}} \times \frac{1\text{ mi}}{1760\text{ yd}} \\ &= 276\text{ mi} \end{aligned}$$

TRY THIS ONE...

A 3-D puzzle of the Eiffel Tower has a scale of 1:360. In the puzzle, the tower is $35\frac{2}{5}$ in. tall. What is the height of the Eiffel Tower in feet?



16. 1062 ft.



1

What is the length of the paper clip?



A

1 in.

B

$1\frac{1}{8}$ in.

C

$1\frac{1}{2}$ in.



HOMework...

Worksheet - Intro. to Imperial Measurement.docx

Work on page 150 if you finish the worksheets.

- Page 150

Do questions: #1-5; 8

Attachments

Worksheet - Intro. to Imperial Measurement.docx