Name: Key

Chapter 1: Measurement System

1.1 SI Measurement

Also known as Metric System.

Outcomes: 1. Solve problems that involve linear measurements, using:
- SI units of measure
- Estimation strategies
- Measurement strategies

2. Apply proportional reasoning to problems that involve conversions between SI and imperial units of measure

Definitions:

SI (Systéme International d'Unités): a system of measurement in which all units are based on multiples of ten

Used in Canada

- The metre is the basic unit of length

Referent: an item that an individual uses as a measurement unit for estimating

Examples: the height of a doorknob above the floor is roughly 1 metre
the thickness of a dime is about 1 mm

Activity:

With a partner, measure the following body parts using only SI System of units:

- Length from your foot to your knee: _____
- Width of your thumb: _____
- Length of your wrist to your elbow: _____
- Your total height: _____

Linking the ideas: You can use different parts of your body as a **referent** to estimate the measurement of an object.

Example 1:

Estimate the height of the marker tray on a whiteboard using an appropriate referent. Then, measure this height.

hip level $\approx$ (roughly) 1 m

Kitties Hate Dogs But Don't Catch Many
kilo hecta deca base deci centi milli
(km) (hm) (dkm) (m) (dm) (cm) (mm)

Example 2:

Convert each measurement to a more appropriate SI unit.

a) A tube of toothpaste is 205 mm long

$\frac{1\text{ cm}}{10\text{mm}} = \frac{x}{205\text{mm}}$ $x = 20.5\text{cm}$

K H D B D C M

205. mm

$x = 20.5\text{cm}$

b) The circumference of a highlighter measure 0.06m

$\frac{1\text{m}}{100\text{cm}} = \frac{0.06\text{m}}{x}$ $x = 6\text{ cm}$

0.06 = 6cm

c) You travel 590 000 m from Regina to Winnipeg

$\frac{1\text{ km}}{1000\text{m}} = \frac{x}{590\,000\text{m}}$ $x = 590\text{ km}$

590,000.m = 590 km

d) The top of a door is 2110 mm high

1) $\frac{1\text{ cm}}{10\text{mm}} = \frac{x}{2110\text{mm}}$ $x = 211\text{cm}$

2) $\frac{1\text{m}}{100\text{cm}} = \frac{y}{211\text{cm}}$ $y = 2.11\text{m}$

(cm-mm) (m-cm)

$10 \times 100 = 1000$

$\frac{1\text{m}}{1000\text{mm}} = \frac{x}{2110\text{mm}}$ $x = 2.1\text{m}$

OR use K H D B D C M

Example 3:

A moose can stand about 2 m to 2.5 m high at the shoulder. What is the height range of the moose in cm? mm?

2m → cm

$\frac{1\text{m}}{100\text{cm}} = \frac{2\text{m}}{x}$ $x = 200\text{cm}$

2m → mm

$\frac{1\text{m}}{1000\text{mm}} = \frac{2\text{m}}{x}$ $x = 2000\text{mm}$

2.5m → cm

$\frac{1\text{m}}{100\text{cm}} = \frac{2.5\text{m}}{Y}$ $y = 250\text{cm}$

2.5m → mm

$\frac{1\text{m}}{1000\text{mm}} = \frac{2.5\text{m}}{y}$ $y = 2500\text{mm}$

Key Ideas

- Each unit in the SI measurement system is a multiple of 10.
- The kilometre is a large unit (1 km = 1000m) and is suitable for measuring large distances
- The millimetre is a small unit (1 mm = $\frac{1}{1000}$ m) and is suitable for measuring smaller distances
- A referent is a personal measurement unit that you can use to estimate measurements in standard units, such as SI units.

Textbook Questions: Pg. 16 #1, 3 - 13

Extra

A circle has a radius of 5cm. What is the circumference of the circle? What is the circumference in m? $C = 2\pi r$ or $C = \pi d$ the same ($d = 2r$)

$C = 2\pi r$

$C = 2\pi(5)$

$C = \pi(10)$

$C = 31.42\text{ cm}$

K H D B D C M

31.42 = 0.3142 m

When finding area, volume where units are squared or cubed (cm^2, m^3, etc) you can't use K H D B D C M!!

Solution: convert the dimensions FIRST

1.2 Imperial Measurements

Outcomes: 1. Solve problems that involve linear measurements, using:

- Imperial units of measure
- Estimation strategies
- Measurement strategies

2. Apply proportional reasoning to problems that involve conversions between SI and imperial units of measure

Definitions:

Imperial System: a system of measurement based on British Units

Example: foot, inch, yard, etc.

Imperial Units Conversion		
Feet to Inch	**Yard to Feet**	**Mile to Yard**
$1ft = 12in$	$1yd = 3ft$	$1mi = 1760yds$

Example 1:

Convert each measurement to a more appropriate imperial unit.

a) 36in to feet

$$\frac{1ft}{12in} = \frac{x}{36in} \qquad x = 3ft$$

b) 4.25 miles to yard

$$\frac{1mi}{1760yd} = \frac{4.25mi}{x} \qquad x = 7480yds$$

c) 90.23 feet to yards

$$\frac{1yd}{3ft} = \frac{x}{90.23ft} \qquad x = 30.08yds$$

Example 2:

The photograph of a muskox uses a scale of 1:30. Calculate the height of the muskox and the distance between the tips of it's horns. State each answer in feet and inches.

$h = 1.25 \times 30 = 37.5\text{in}$

$d = 0.625 \times 30 = 18.75\text{in}$

$h = 1\ 1/4$ in

$d_t = 5/8$ in

Convert

1) how many times can 12 fit into 37.5?

$12 \times 3 = 36$; 3 times = 3ft

remainder? $37.5 - 36 = 1.5$ in

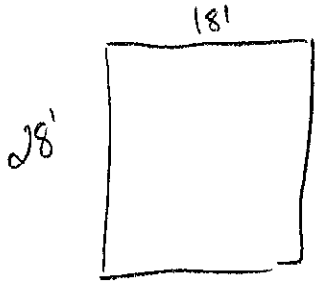
Thus, height is 3 ft and 1 ½ in

2) $18.75 - 12 = 6.75$ in

Thus we have 1ft and $6\ 3/4$ in = d_t

Example 3:

A homeowner is laying sod in her lawn. The lawn is a rectangle with dimensions of 28' × 18'. What is the area of her lawn in inches?



Convert

$\frac{1\text{ft}}{12\text{in}} = \frac{28\text{ft}}{l}$ $\quad l = 336$ in

$\frac{1\text{ft}}{12\text{in}} = \frac{18\text{ft}}{w}$ $\quad w = 216$ in

$A = lw$

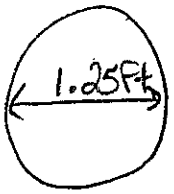
$A = 336 \times 216$

$A = 72576\ \text{in}^2$

Example 4:

A round Inuit drum needs to have its skin restretched and then lashed into place with sinew. For each inch of the fram, 3 ½ inch, of sinew are needed. The diameter of the frame is 1 ¼ ft. What length of sinew is needed? Express your answer to the nearest inch.

1 in : in length = 3 ½ in sinew



1) convert ft → in

$$\frac{1ft}{12in} = \frac{1.25ft}{d} \qquad d = 15in$$

2) $C = \pi d$

$C = \pi (15)$

$C = 47.124\ in$

3) Sinew

$$\frac{1in}{3.5in} = \frac{47.124in}{s}$$

$s = 164.934in$

165 in of sinew

Key Ideas

• In the imperial system, common units for linear measurement are the inch (in.), foot (ft.), yard (yd), and mile (mi). The imperial units for length are related according to the following conversions.
  ○ 1 mi = 1760 yd
  ○ 1 yd = 3 ft
  ○ 1 ft = 12 in
• The imperial system of measurement is widely used in the United States for measuring distances
• Even though SI is Canada's official measurement system, some Canadian industries still use imperial units.

Textbook Questions: Pg. 29 # 2, 3, 5, 7, 8 - 11, 14

Use formula sheet.

1.3 Converting Between SI and Imperial Systems

Outcomes: 1. Solve problems that involve linear measurements, using:

- SI and imperial units of measure
- Estimation strategies
- Measurement strategies

2. Apply proportional reasoning to problems that involve conversions between SI and imperial units of measure

Comparing SI and Imperial Measurements:

1. Pull a measuring tape out to its full extent (or look at a metre stick) and write the value of the largest unit in each of the two systems.

Metric: Imperial:

Now fill in the actual Conversion Table

Metric to Imperial:	**Imperial to Metric:**
1 cm = 0.394 in	1 in = 2.54 cm
1 m = 1.094 yds	1 ft = 0.3048 m
1 mi = 1.609 km	1 km = 0.621 mi

Example 1:

Identify the equivalent for each of the following :

a) 5m = 500 cm

$$\frac{1\text{ m}}{100\text{ cm}} = \frac{5\text{m}}{x} \qquad x = 500\text{ cm}$$

b) 4.2 yards = 3.84 m

$$\frac{1\text{ m}}{1.094\text{ yd}} = \frac{x}{4.2\text{ yd}} \qquad x = 3.84\text{ m}$$

c) 5 miles = 8.045 km

$\frac{1\text{ mi}}{1.609\text{ km}} = \frac{5\text{mi}}{x}$ $x = 8.045\text{ km}$

d) 3 feet = 0.9144 m

$\frac{1\text{ ft}}{0.3048\text{m}} = \frac{3\text{ft}}{x}$ $x = 0.9144\text{ m}$

e) 7'11" = 241.3 cm

$\frac{1\text{ ft}}{12\text{in}} = \frac{7\text{ft}}{x}$ $x = 84\text{in} + 11\text{in}$ $x = 95\text{in}$ → $\frac{1\text{in}}{2.54\text{cm}} = \frac{95\text{in}}{y}$ $y = 241.3\text{cm}$

Example 2:

A traditional Inuit dogsled is called a komatik. A komatik uses teams of qimmiq or sled dogs on separate lines. The lines are tied directly to the komatik. Each dog as a harness with an average length of 3 ½ ft. Suppose a dogsled team includes 13 dogs.

a. What is the approximate **total** length of rope needed to harness the team?

$13 \times 3.5\text{ft} = 45.5\text{ ft}$

b. What is the total length needed in **SI units**?

$\frac{1\text{ ft}}{0.3048\text{m}} = \frac{45.5\text{ ft}}{x}$

$x = 13.8684\text{m}$

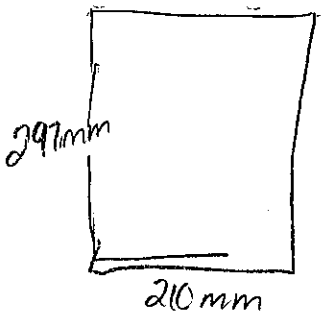
c. Explain why you chose the units you did.

→ Cm are too small and km are too big of a unit

→ metre is equivalent to a foot when going SI to imperial

Example 3:

A standard piece of paper in Canada and the United States is 8½" by 11". In Europe, however, the standard piece of paper is 210 mm by 297 mm. Which piece of paper has a larger area?



1) Convert mm → cm

$\frac{1cm}{10mm} = \frac{\ell}{297mm}$ $\ell = 29.7cm$

$\frac{1cm}{10mm} = \frac{w}{210mm}$ $w = 21cm$

1) $A = \ell w$

$A = (11)(8.5)$

$A = 93.5in^2$

2) $A = \ell w$

$A = (29.7)(21)$

$A = 623.7\ cm^2$

2) $\left(\frac{1in}{2.54cm}\right)^2 = \frac{93.5in^2}{x}$

$\frac{1in^2}{6.4516cm^2} = \frac{93.5in^2}{x}$

$x = 603.2246cm^2$

∴ Europe has a larger area

Example 4: Five students measure their height using different units. Andrew is 176 cm, Brittney is 5'4", Calvin is 1.8 yards, Don is 54 inches, and Elisha is 1.6 metres. Arrange the students from shortest to tallest

Andrew = 176cm

Elisha = 1.6 m → $\frac{1m}{100cm} = \frac{1.6m}{E}$ $E = 160cm$

Don = 54in → $\frac{1in}{2.54cm} = \frac{54in}{D}$ $D = 137.16cm$

Calvin = 1.8 yds

$\frac{1m}{1.094yd} = \frac{C}{1.8yds}$ $C = 1.645m$ → $\frac{1m}{100cm} = \frac{1.645m}{C}$

$C = 164.5cm$

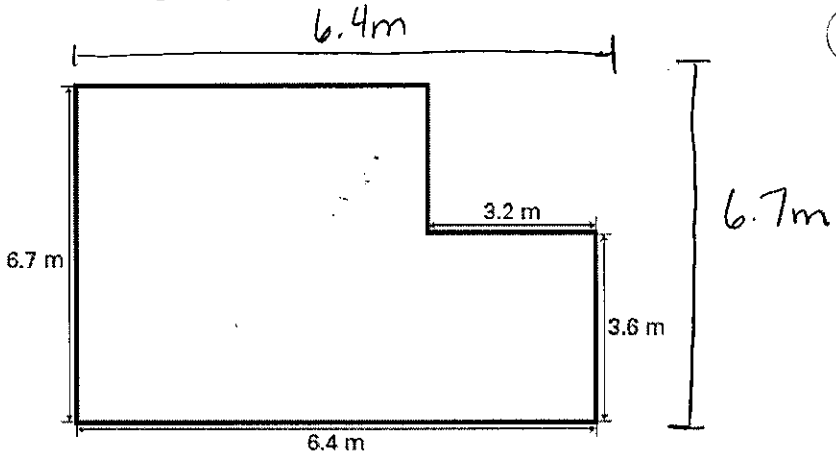
Brittney = 5' 4"

$\frac{1Ft}{12in} = \frac{5Ft}{B}$ $B = 60" + 4" = 64"$ → $\frac{1in}{2.54cm} = \frac{64in}{B}$

$B = 162.56cm$

Don, Elisha, Brittney, Calvin, Andrew

Example 5: Determine the perimeter of the following shape, in feet.



1) Convert dimensions first!

$$\frac{1ft}{0.3048m} = \frac{w}{6.4m}$$

$w = 20.997ft$

$$\frac{1ft}{0.3048m} = \frac{l}{6.7m}$$

$l = 21.982ft$

2) $P = 2l + 2w$

$P = 2(21.982ft) + 2(20.997ft)$

$P = 43.964ft + 41.994ft$

$P = 85.96ft$

Key Ideas
• When solving problems involving measurement, it is crucial to work with the same units. You may need to convert units within one measurement system (for example, inches to feet) or between imperial and SI units. • If an exact conversion between systems is required, use unit conversions between the required units. • Sometimes you use approximate values, such as 1 in ≃ 2.5 cm or 1.6 km ≃ 1 mile, when estimating between measurement systems.

Textbook Questions: Pg. 42 #1 - 12, 15