

**CHAPTER
1**

Measurement Systems and Similar Triangles

Get Set

Answer these questions to check your understanding of the Get Ready concepts on pages 4–5 of the *Foundations of Mathematics 10* textbook.

Fraction and Number Sense

1. Order the numbers in each set from least to greatest.

a) $\frac{1}{2}, \frac{1}{12}, \frac{1}{4}, \frac{1}{8}$

b) $1\frac{1}{2}, 2\frac{3}{8}, \frac{17}{8}, 1\frac{3}{4}, 2\frac{1}{4}$

c) $\frac{1}{2}, \frac{1}{5}, \frac{1}{3}, \frac{1}{6}$

2. Simplify. Express your answers in lowest terms.

a) $\frac{2}{3} + \frac{3}{4}$

b) $\frac{1}{8} \times 2$

c) $27 \div \frac{1}{3}$

d) $1\frac{1}{2} + 2\frac{3}{4}$

Ratio and Proportion

3. Write each ratio in simplest form.

a) 2:4

b) 18:6

c) 54:45

d) 22:121

4. Solve.

a) $\frac{m}{2} = \frac{3}{4}$

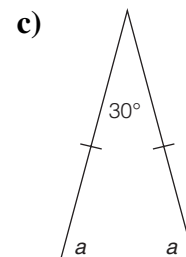
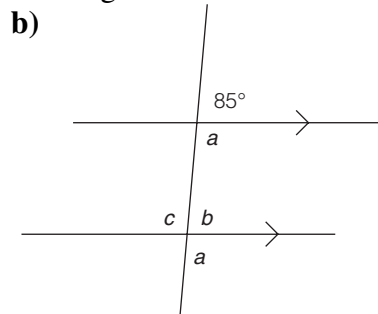
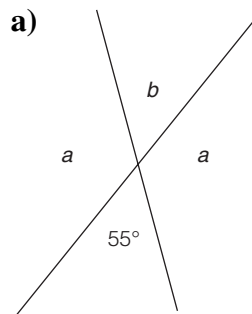
b) $y:15 = 4:60$

c) $3:2 = t:22$

d) $2.5:x = 10:84$

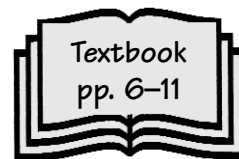
Angle Properties

5. Find the measure of each indicated angle.



1.1

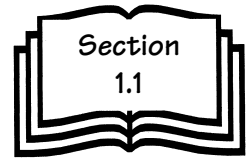
Imperial Measure



Warm-Up

<p>1. Units of Measure</p> <p>Identify each imperial unit as a measure of length, volume, or weight.</p> <p>a) mile b) pound c) inch d) quart</p>	<p>2. Number Sense</p> <p>There are 12 in. in 1 ft. Calculate the number of inches in</p> <p>a) 2 ft b) 5 ft</p>
<p>3. Mental Math</p> <p>If 1 yd = 3 ft, then 1 yd² = _____ ft².</p>	<p>4. Proportional Reasoning</p> <p>Convert the following:</p> <p>a) 5 yd = _____ ft b) _____ ft = 60 in. c) 24 in. = _____ ft</p>
<p>5. Math Literacy</p> <p>Give three examples in your everyday life where measurements would be given in the imperial system.</p>	<p>6. Multiply Fractions</p> <p>Simplify.</p> <p>a) $8 \times \frac{3}{4}$</p> <p>b) $\frac{1}{8} \times 24$</p>
<p>7. Number Sense</p> <p>Circle the imperial units you would use to measure the following:</p> <p>a) the size of a book: yards, inches, feet b) the volume of a glass: gallons, tablespoons, fluid ounces c) the mass of a cat: ounces, tons, pounds</p>	<p>8. Estimation</p> <p>Use imperial units to estimate each measure.</p> <p>a) the height of your classroom door</p> <p>b) the weight of a basketball</p>

Practise



Use the table to answer questions 1 to 2.

Unit	Imperial Equivalent	Metric Equivalent
Fluid ounce		29.57 mL
Pint	16 fl oz	473 mL
Quart	2 pt	946 mL
Gallon	4 qt	3.79 L

- Carmella has a 2-gal jug of cleaning fluid. How many 1-pt bottles can she fill?
- Steve has 6 qt of distilled water. Can he store the water in a 1-gal jug? Explain.

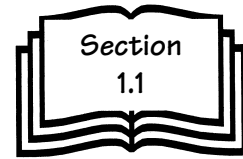
Use the table to complete questions 3 to 5.

Length	Mass	Volume
1 ft = 12 in.	1 lb = 16 oz	1 gal = 4 qt
1 yd = 3 ft	1 ton (tn) = 2000 lb	1 qt = 2 pt
1 mi = 1760 yd		1 pt = 16 fl oz

- Convert each measure to inches.
 - 3'
 - 2' 7"
 - 8.5'
- Convert each measure to feet and inches.
 - 71 in.
 - 66 in.
 - 216 in.
- Convert each measure to pounds.
 - 88 oz
 - 2.1 tn
 - 192 oz
- The school gymnasium floor needs to be resurfaced. Hardwood flooring costs \$6 per square foot plus \$2.50 per square foot for installation. The gym measures 180 ft by 220 ft.
 - How large is the gym in square feet?
 - How much would it cost to buy the hardwood flooring for the gym?
 - How much would it cost to install the hardwood flooring in the gym?

Date: _____

7. Ace's car holds a total of 12 gal of gasoline. How many quarts of gasoline will the tank hold?



8. Meghan and Paul hiked 7040 yd through the forest to the pond. How far did they hike in miles?

9. Eric is 5' 7'' tall. What would his height be in inches?

10. A $\frac{1}{2}$ pt of cream yields 2 c of whipped cream. How many cups of whipped cream would result from whipping $1\frac{1}{2}$ pt of cream?

11. Monica is putting a patio in her yard. Patio stones come in squares measuring 1 ft by 1 ft. She wants the patio to be 8 stones wide and 9 stones long.

a) How many square feet will the patio be when Monica is finished?

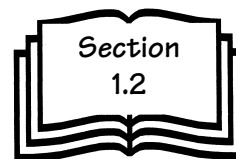
b) If the patio stones cost \$5.00 each, how much will the patio cost altogether?

Conversions Between Metric and Imperial Systems

Warm-Up

<p>1. Metric Units of Measure</p> <p>List the metric units for each.</p> <p>Length: _____</p> <p>Volume: _____</p> <p>Mass: _____</p>	<p>2. Number Sense</p> <p>Convert each measure using the indicated units.</p> <p>a) 42 mm centimetres</p> <p>b) 12 kg grams</p> <p>c) 1.8 m centimetres</p> <p>d) 2400 m kilometres</p> <p>e) 980 mg grams</p>
<p>3. Estimate</p> <p>Use an appropriate metric measure to estimate each measure.</p> <p>a) the length of your finger</p> <p>b) the mass of a nickel</p>	<p>4. Proportional Reasoning</p> <p>Convert each measure using the indicated units.</p> <p>a) 5 qt pints</p> <p>b) 4 ft inches</p> <p>c) 24 oz pounds</p> <p>d) 2 yd feet</p> <p>e) 3 gal quarts</p>
<p>5. Number Sense</p> <p>Circle the metric units you would use to measure the following:</p> <p>a) the length of your shoe: metres, kilometres, centimetres</p> <p>b) the mass of 5 sheets of paper: kilograms, litres, grams</p> <p>c) the volume of a pop can: millilitres, centimetres, litres</p>	<p>6. Math Literacy</p> <p>a) Describe a situation in which the metric system of measure is commonly used.</p> <p>b) Describe a situation in which the imperial system of measure is commonly used.</p>
<p>7. Mental Math</p> <p>Calculate mentally.</p> <p>a) $42 \times 10\,000$</p> <p>b) $560 \div 100$</p> <p>c) $2458 \div 1000$</p> <p>d) 65×0.1</p> <p>e) 425×0.01</p>	<p>8. Estimate Measures</p> <p>Use an appropriate imperial unit to estimate each measure.</p> <p>a) the temperature in your room</p> <p>b) the mass of your math textbook</p>

Practise: Metric and Imperial Conversions



Estimate Temperature Conversions

- To estimate the Fahrenheit temperature given a temperature in degrees Celsius, double the Celsius temperature, then add 30. Estimate each temperature in degrees Fahrenheit.
 - 22°C
 - 53°C
 - 24°C

- To estimate the Celsius temperature for a given temperature in degrees Fahrenheit, subtract 30, then divide by 2. Estimate each temperature in degrees Celsius.
 - 88°F
 - 20°F
 - 222°F

Estimate Metric to Imperial Conversions

Use these benchmarks to answer question 3.

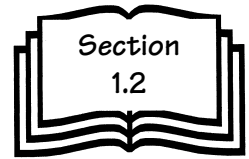
There are approximately 1.6 km in 1 mi.
 There are approximately 2.5 cm in 1 in.
 One yard is approximately equal to 1 mi.
 There are approximately 450 g in 1 lb.
 There are approximately 2.2 lb in 1 kg.
 There are approximately 4 L in 1 U.S. gallon.
 One tablespoon is approximately equal to 15 mL.
 There are approximately 30 mL in 1 fl oz.

- About how many tablespoons are in 60 mL?

 - About how many pounds are in 2.5 kg?

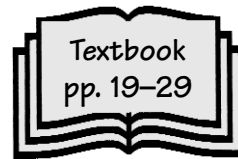
 - About how many centimetres are in 12 in.?

 - About how many millilitres are in 5.5 fl oz?

Applying Measurement Conversions

4. To accurately convert degrees Celsius to degrees Fahrenheit, multiply by $\frac{9}{5}$, then add 32.
- Explain why doubling the Celsius temperature then adding 30 is a good approximation.
 - When can you estimate and when must you be exact?
5. Jaycee's doctor recommends that she drink 2 L of water every day. How many cups of water is this?
6. Water boils at 100°C and freezes at 0°C .
- Calculate the temperature at which water boils in degrees Fahrenheit.
 - Calculate the temperature at which water freezes in degrees Fahrenheit.
7. Jeric and his family are taking a trip to the southern United States this winter break. Driving at an average speed of 50 mi per hour (mph), the trip will take 22 h.
- Calculate the number of miles to drive one way.
 - Convert the one-way distance from miles to kilometres.
 - Find the total distance of the round trip in kilometres.
 - The family car uses 6.3 L of gas per 100 km. How many litres of gas are needed for the round trip?

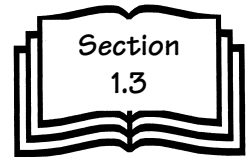
1.3 Similar Triangles



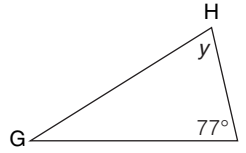
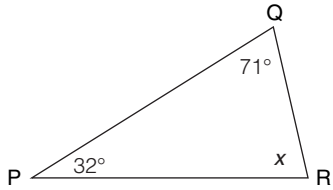
Warm-Up

<p>1. Parallel Lines</p> <p>Which angles have the same measure as $\angle a$?</p>	<p>2. Corresponding Angles</p> <p>Identify the corresponding angles.</p>
<p>3. Corresponding Sides</p> <p>Triangles ABC and DEF are congruent. Find the lengths of the sides of $\triangle ABC$.</p>	<p>4. Opposite Angles</p> <p>Name the opposite angles.</p>
<p>5. Math Literacy</p> <p>How can you tell if two triangles are congruent?</p>	<p>6. Congruent Triangles</p> <p>Triangles RST and VWX are congruent. Find the measures of $\angle S$ and $\angle X$.</p>
<p>7. Proportions</p> <p>Solve each proportion.</p> <p>a) $\frac{AB}{5} = \frac{12}{15}$</p> <p>b) $\frac{4}{16} = \frac{LM}{24}$</p>	<p>8. Parallel Lines</p> <p>Name two groups of equal angles.</p>

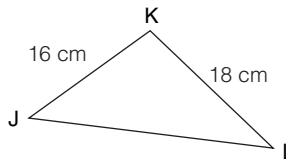
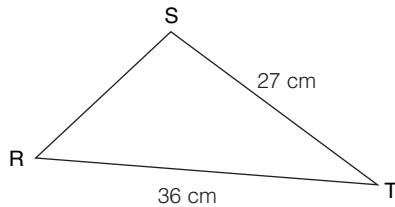
Practise: Corresponding Angles and Corresponding Sides



1. Given that $\triangle PQR \sim \triangle GHI$, find the measures of the indicated angles.



2. These triangles are similar.



- a) Side RS corresponds to _____, side ST corresponds to _____ and side RT corresponds to _____.

- b) Complete the proportionality statement:

Since \triangle _____ \sim \triangle _____, then the lengths of _____ are proportional.

- c) Find the lengths of the indicated sides.

$$\frac{RS}{JK} = \frac{ST}{KL}$$

$$\frac{RS}{16} = \frac{18}{18}$$

$$RS = \frac{16 \times 18}{18}$$

$$\doteq \underline{\hspace{2cm}}$$

Use Similar Triangles

3. Examine $\triangle ABF$ and $\triangle ECF$.

- a) Are the two triangles similar? How do you know?

- b) What is the length of side CE?

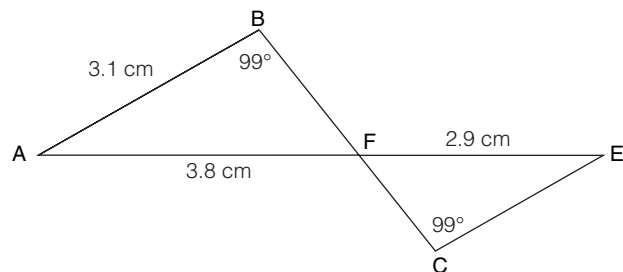
Round to one decimal place.

$$\frac{CE}{AF} = \frac{BF}{CF}$$

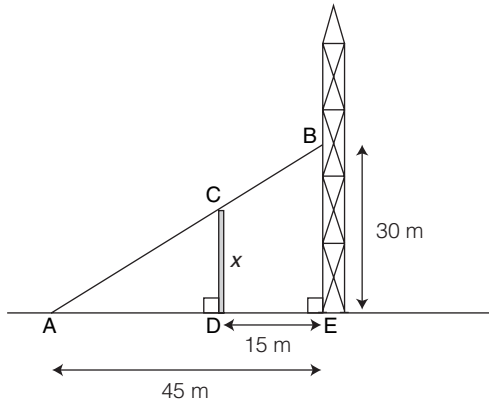
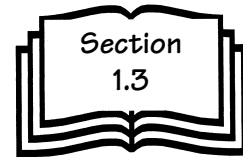
$$\frac{CE}{3.1} = \frac{3.8}{2.9}$$

$$CE = \frac{3.1 \times 3.8}{2.9}$$

$$\doteq \underline{\hspace{2cm}}$$

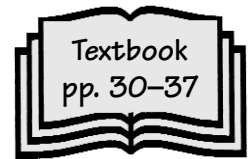


4. A support wire is attached to the ground 45 m from the base of a telecommunications tower. The wire is attached to the tower 30 m up from the ground. A post supports the wire at a point 15 m from the base of the tower.

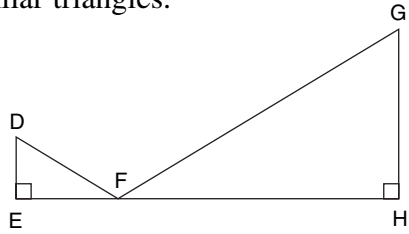
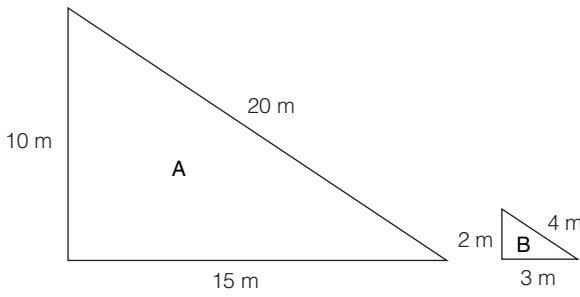
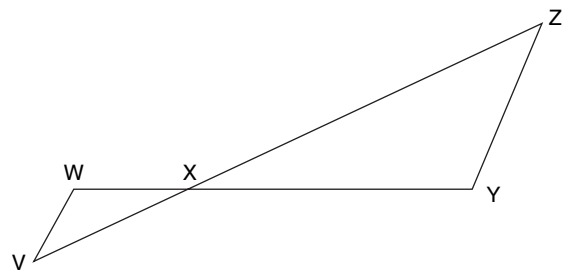
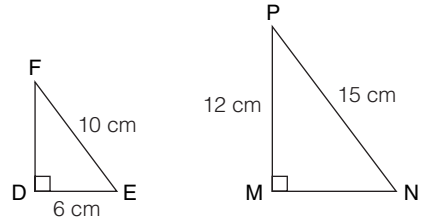


- a) Sketch and label triangles ABE and ACD.
- b) Are triangles ABE and ACD similar? How do you know?
- c) Find the height of the support post.

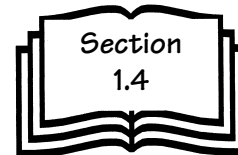
1.4

Solve Problems Using
Similar Triangles

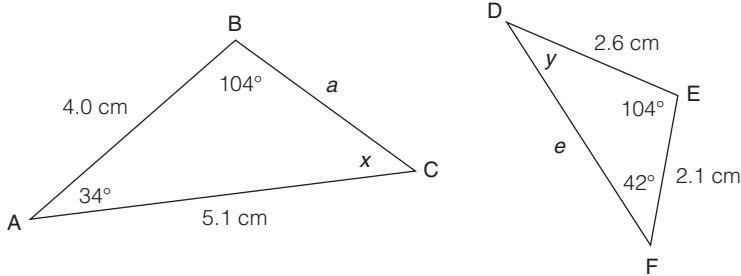
Warm-Up

<p>1. Similar Triangles</p> <p>Identify corresponding sides in these similar triangles.</p> 	<p>2. Similar Triangles</p> <p>In similar triangles,</p> <p>a) how many pairs of sides are corresponding? _____</p> <p>b) how many pairs of angles are corresponding? _____</p>
<p>3. Solve a Proportion</p> <p>Calculate the length of AB.</p> $\frac{AB}{15} = \frac{5}{3}$	<p>4. Math Literacy</p> <p>Give two real-life examples in which the properties of similar triangles are used.</p>
<p>5. Mental Math</p> <p>Determine how many times as long the side lengths of Triangle A are compared to those of Triangle B.</p> 	<p>6. Corresponding Angles</p> <p>Identify the corresponding angles in these similar triangles.</p> 
<p>7. Proportions</p> <p>Solve each proportion.</p> <p>a) $\frac{b}{3} = \frac{6}{12}$</p> <p>b) $\frac{8}{18} = \frac{m}{27}$</p>	<p>8. Find a Side Length</p> <p>Triangles DEF and MNP are similar. Find the length of MN.</p> 

Practise: Solve Problems Using Similar Triangles



1. a) Are $\triangle ABC$ and $\triangle DEF$ similar? How do you know?



b) Find the measures of the indicated sides and angles.

Since $\triangle \underline{\hspace{2cm}} \sim \triangle \underline{\hspace{2cm}}$, corresponding angles are $\underline{\hspace{2cm}}$.

Therefore, $\angle C = \angle \underline{\hspace{2cm}}$

$$= \underline{\hspace{2cm}}^\circ$$

and $\angle D = \angle \underline{\hspace{2cm}}$

$$= \underline{\hspace{2cm}}^\circ$$

$$\frac{BC}{2.1} = \frac{\underline{\hspace{2cm}}}{2.6}$$

$$\frac{BC}{2.1} = \frac{2.6}{4.0}$$

$$BC = \frac{2.1 \times \underline{\hspace{2cm}}}{2.6}$$

$$\doteq \underline{\hspace{2cm}}$$

$$\frac{DF}{2.6} = \frac{\underline{\hspace{2cm}}}{4.0}$$

$$\frac{DF}{2.6} = \frac{2.6}{4.0}$$

$$DF = \frac{\underline{\hspace{2cm}} \times 2.6}{4.0}$$

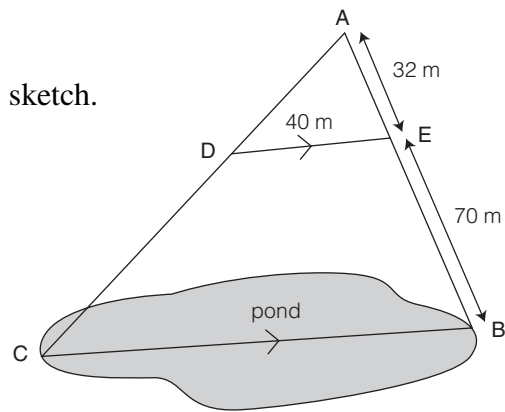
$$\doteq \underline{\hspace{2cm}}$$

Applying Similar Triangles to Find Unknowns

2. Tyler wishes to find the width of this pond.

He took some measurements and recorded them on a sketch.

a) Which triangles are similar? How do you know?



b) How wide is the pond? Give your answer to the nearest tenth of a metre.

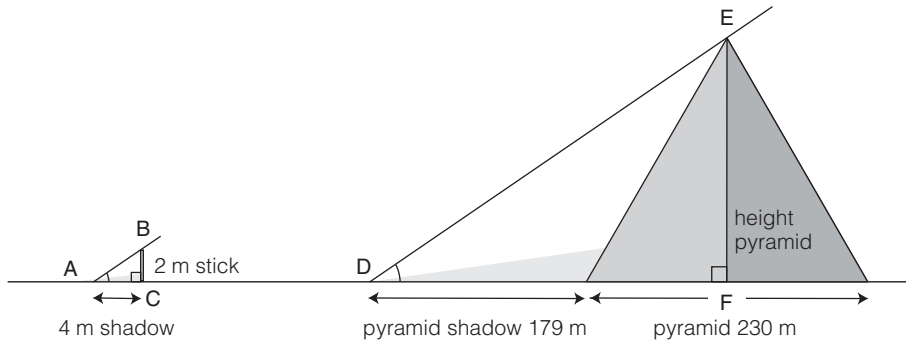
$$\frac{CB}{40} = \frac{\underline{\hspace{2cm}}}{32}$$

$$\frac{CB}{40} = \frac{32}{70}$$

$$CB = \frac{40 \times \underline{\hspace{2cm}}}{32}$$

$$\doteq \underline{\hspace{2cm}}$$

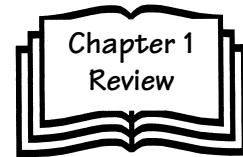
3. On a sunny day in Egypt, a stick is placed vertically so 2 m of it is above ground. The stick casts a shadow 4 m long. At the same time, one of the Great Pyramids of Egypt casts a shadow 179 m long. The shadow of the pyramid is measured from the base of the pyramid. The pyramid is 230 m wide.



- a) Are triangles ABC and DEF similar? How do you know?
- b) What is the length of DF?
- c) What is the height of the pyramid? Give your answer to the nearest tenth of a metre.

$$\begin{aligned} \overline{BC} &= \overline{AC} \\ 2 &= 4 \\ \text{---} &= \frac{2 \times}{4} \\ &= \text{---} \end{aligned}$$

Chapter 1 Review



1.1 Imperial Measure, textbook pages 6–11

1. Estimate each measure in imperial and metric units.

Measure	Imperial Units	Metric Units
the temperature in your room		
the mass of your math textbook		
the width of a basketball court		

1.2 Conversions Between Metric and Imperial Systems, textbook pages 12–18

2. Convert each measure using the indicated units. Round to one decimal place.
- a) 8 kg to pounds b) 15 qt to fluid ounces c) 135°F to degrees Celsius

- d) 3.5 gal to litres e) 36 ft to metres f) 515 yd to feet

3. Angie takes medication daily. Her dose is 32 mg per kilogram of body weight. Angie weighs 140 lb. Round your answer to the nearest tenth.

- a) Convert Angie's weight to kilograms.

- b) How much medication will Angie take in each dose?

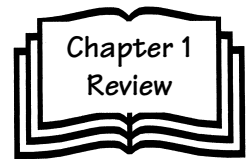
4. Some Canadians who live near the Canada-U.S. border fill their gas tanks in the U.S. One day, the price of gas is 86.9¢/L in Sarnia and \$2.67/gal in Port Huron, Michigan.

$$1 \text{ U.S. gallon} = 3.785 \text{ L}$$

$$\$1.00 \text{ U.S.} = \$1.10 \text{ Canadian}$$

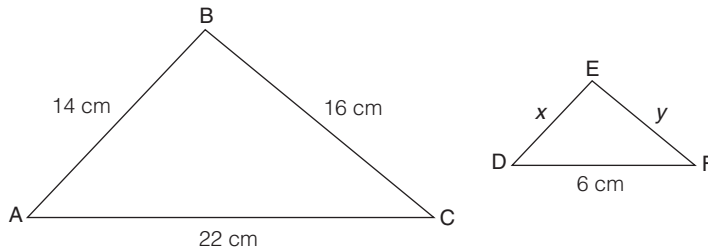
- a) What is the price for 1 U.S. gallon in Sarnia?

- b) Which location offers a better price for gas?



1.3 Similar Triangles, textbook pages 19–29

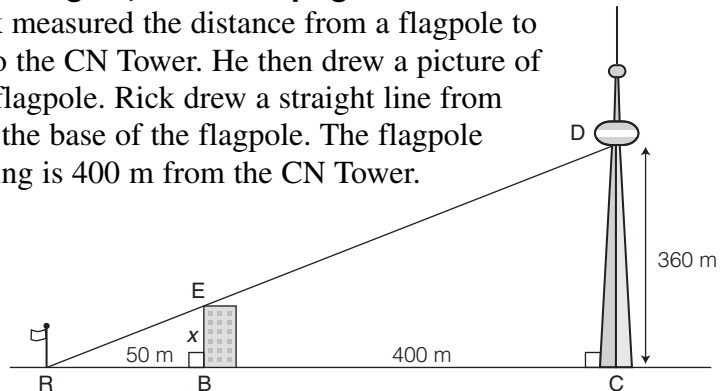
5. Triangle ABC is similar to triangle DEF. Round your answers to one decimal place.



Find the indicated side lengths.

1.4 Solve Problems Using Similar Triangles, textbook pages 30–37

6. To find the height of a building, Rick measured the distance from a flagpole to the building, and from the building to the CN Tower. He then drew a picture of the building, the CN Tower, and the flagpole. Rick drew a straight line from the 360-m mark on the CN Tower to the base of the flagpole. The flagpole is 50 m from the building. The building is 400 m from the CN Tower.



- How far is the flagpole from the base of the CN Tower?
- Which triangles are similar? How do you know?
- How tall is the building?

7. Use the measurements taken by a surveyor to find the width of the river to one decimal place.

