## 7.1 Investigate Properties of Similar Triangles

***Principles of Mathematics 10*, pages 330–341**

**A**

**1.** Identify at least two examples inside the classroom where you see

**a)** congruent figures

**b)** similar figures

**2.** For each situation, identify whether you would use similar figures, congruent figures, or neither. Justify your answers.

**a)** a tile pattern on a wall

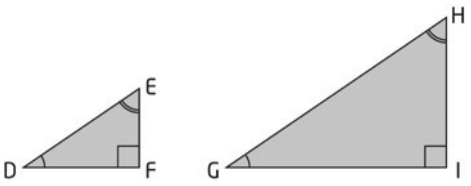
**b)** an organization's logo for a poster and for the organization's letterhead

**c)** a photograph and a painting both hanging on the same wall

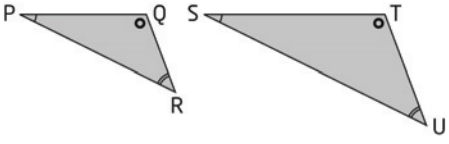
**d)** a three-dimensional model of a living room

**3.** Name the similar triangles in each case. Write the letters so that equal angles appear in corresponding order.

**a)**

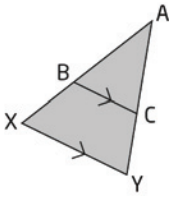



**b)**

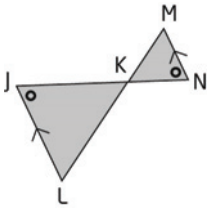



**4.** Name the similar triangles in each case. Write the letters so that equal angles appear in corresponding order.

**a)**




**b)**

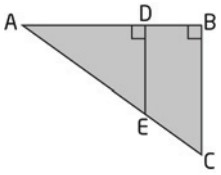



**B**

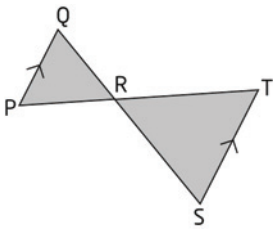
**5.** For each pair of similar triangles in question 4, write the equivalent ratios of side lengths.

**6.** Name a pair of similar triangles in each diagram and explain why they are similar.

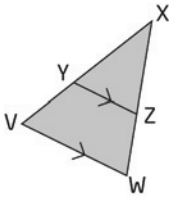
**a)**




**b)**

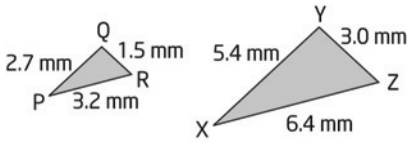



**c)**

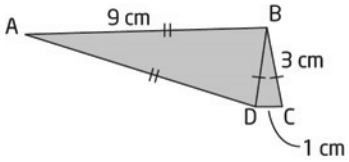


**7.** Name a pair of similar triangles in each diagram and explain why they are similar.

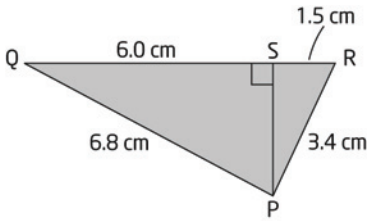
**a)**




**b)**




**c)**




**8.** For each pair of similar triangles in question 7, list all the pairs of corresponding angles and corresponding sides.

**9.** **a)** Draw a scalene triangle.

**b)** Draw a scalene triangle that is

- congruent to the one you drew
- similar to the one you drew
- neither congruent nor similar to the one you drew

**C**

**10.** Are all isosceles right triangles similar? Justify your answer.

**11.** Aly wants to enlarge a 5 cm by 8 cm piece of artwork so that the width and length remain in the same proportion.

**a)** Find the dimensions of the piece of artwork if the width and length are doubled.

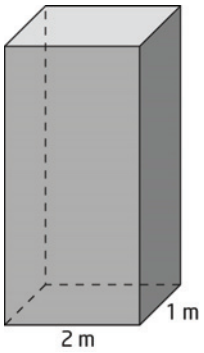
**b)** Find the dimensions of the piece of artwork if the width and length are tripled.

**c)** How are the areas of the different sizes of photos related?

**12.** A snow sculpture of a building is melting in such a way that it retains its shape. Its length, width, and height all remain in the same proportion for the first few days that it is melting. The width, $w$, and the length, $l$, of the snow sculpture are shown. The height, $h$, of this snow sculpture is twice the length of its base. If the height of the snow sculpture reduces in size by one half each day for three days, find the dimensions of this snow sculpture after

**a)** one day

**b)** two days



## 7.2 Use Similar Triangles to Solve Problems

***Principles of Mathematics 10*, pages 342–351**

**A**

**1.** A right triangle has side lengths 7 cm, 24 cm, and 25 cm.

**a)** Draw the triangle.

**b)** A similar triangle has a hypotenuse 75 cm long. What is the scale factor?

**c)** What are the lengths of the legs?

**d)** Draw the similar triangle.

**2.** Refer to question 1.

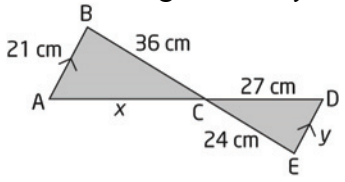
**a)** Find the area of each triangle.

**b)** How are these areas related?

**c)** How do the areas help to confirm that the triangles are similar?

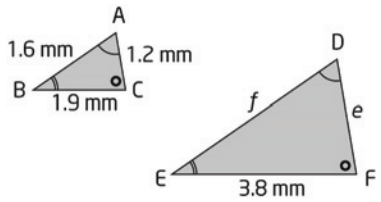
**3.** **a)** Show why $\Delta ABC$ is similar to $\Delta DEC$.

**b)** Find the lengths $x$ and $y$.

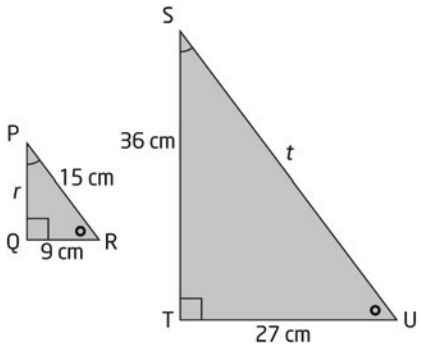



**4.** The triangles in each pair are similar. Find the unknown side lengths.

**a)**

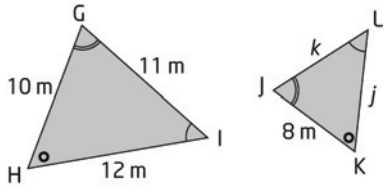



**b)**

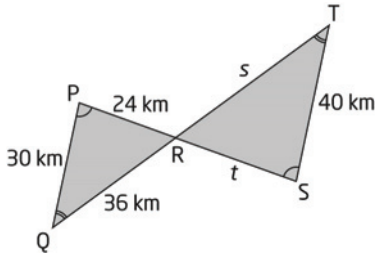



**5.** The triangles in each pair are similar. Find the unknown side lengths.

**a)**



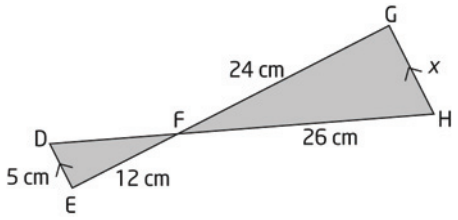

**b)**



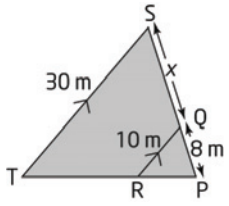

**B**

**6.** Find the length of $x$ in each.

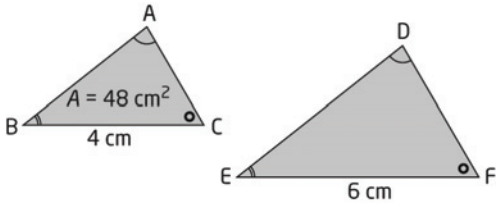
**a)**



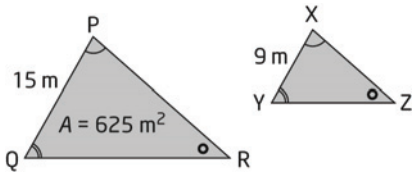

**b)**



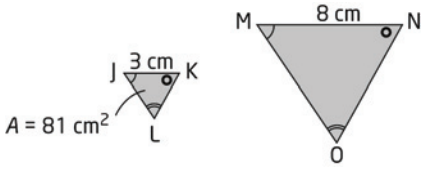
**7.** **a)** $\Delta DEF \sim \Delta ABC$. Find the area of $\Delta DEF$.



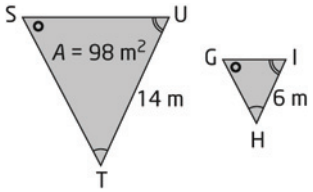

**b)** $\Delta XYZ \sim \Delta PQR$. Find the area of $\Delta XYZ$.




**c)** $\Delta MNO \sim \Delta JKL$. Find the area of $\Delta MNO$.

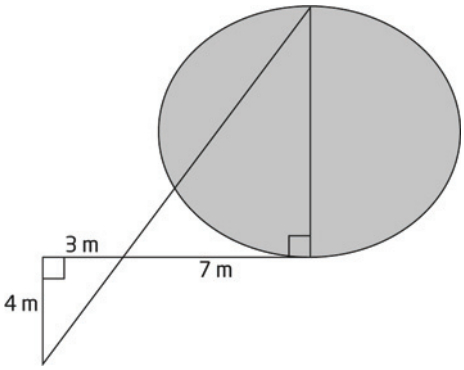



**d)** $\Delta GHI \sim \Delta STU$. Find the area of $\Delta GHI$.

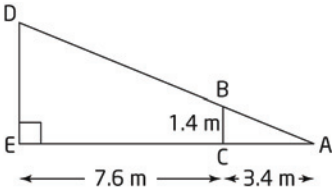



**C**

**8.** Use the given measures to find the width of the pond, to the nearest tenth of a metre.




**9.** To measure the height of a garage, Brandon has his brother Vaughan stand so that the tip of his shadow coincides with the tip of the building's shadow, at point A.




Brandon's brother, who is 1.4 m tall, is 3.4 m from Brandon, who is standing at A, and 7.6 m from the base of the building. Find the height of the building, DE, to the nearest tenth of a metre.

**10.** The areas of two similar triangles are 36 $cm^2$ and 100 $cm^2$. What is the ratio of the lengths of their corresponding sides?

**11.** The areas of two similar triangles are 64 $cm^2$ and 36 $cm^2$. What is the ratio of the lengths of their corresponding sides?

**12.** Use similar triangles to measure the height of the flagpole in front of your school. Write a brief report on how you solved this problem. Include diagrams. Discuss how accurate you think your answer is. Suggest ways to improve your method to get a more accurate height.

**13.** The scale on a city map shows that 1 cm represents 2 km. A city park has an area of 2 $cm^2$ on the map. What is the actual area of the city park, to the nearest square kilometre?

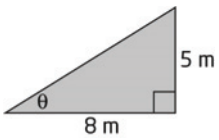
## 7.3 The Tangent Ratio

***Principles of Mathematics 10*, pages 352–365**

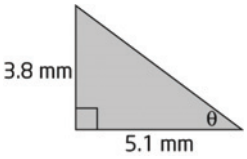
**A**

**1.** Find the tangent of the angle indicated, to four decimal places.

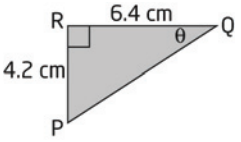
**a)**



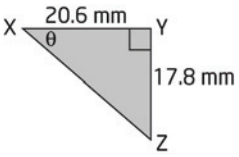

**b)**



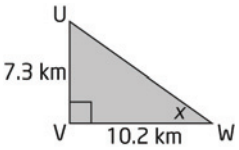

**c)**



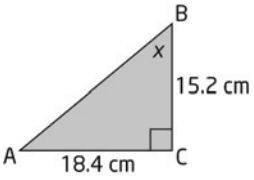

**d)**




**e)**




**f)**




**B**

**2.** Refer to question 1. Find the tangent of the other acute angle, to four decimal places.

**3.** Evaluate with a calculator. Round your answer to the nearest ten thousandth.

**a)** tan 52° **b)** tan 83°

**c)** tan 8° **d)** tan 60°

**e)** tan 28.3° **f)** tan 41.2°

**g)** tan 78.4° **h)** tan 22.5°

**4.** Find the measure of each angle, to the nearest degree.

**a)** tan A = 0.5123 **b)** tan Q = 1.2

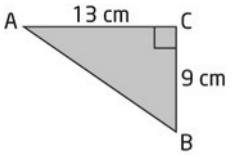
**c)** tan R = 3.1478 **d)** tan B = 0.7425

**e)** $\tan X = \frac{3}{5}$ **f)** $\tan Y = \frac{5}{12}$

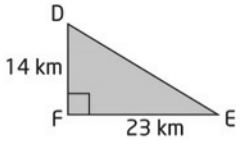
**g)** $\tan S = \frac{11}{3}$ **h)** $\tan D = \frac{13}{7}$

**5.** Find the measures of both acute angles in each triangle to the nearest degree.

**a)**

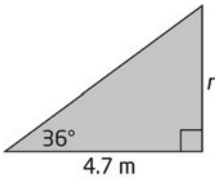



**b)**

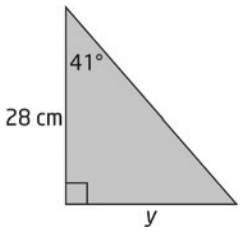


**6.** Find the length of the unknown side, to the nearest tenth.

**a)**

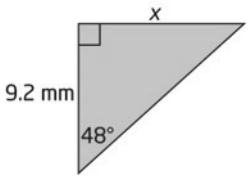



**b)**

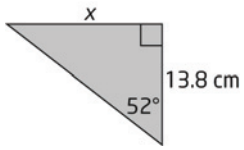



**7.** Find the length of $x$, to the nearest tenth.

**a)**

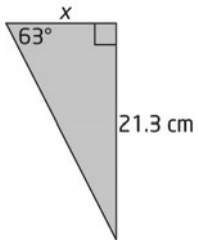



**b)**

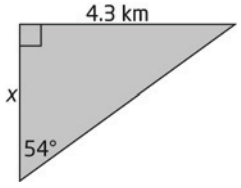



**8.** Find the length of $x$, to the nearest tenth.

**a)**




**b)**



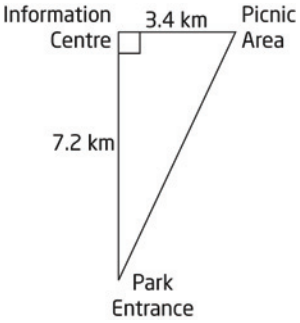

**C**

**9.** In order to measure the height of a building, Kelsey has calculated that its shadow is 23 m long and that the line joining the top of the building to the tip of the shadow forms an angle of 47° with the flat ground.

**a)** Draw a diagram to illustrate this problem.

**b)** Find the height of the building, to the nearest tenth of a metre.

**10.** Laurie and Andrea are hiking in a park. The location of the entrance to the park, information centre, and picnic area are shown.




**a)** At what angle to the line connecting the park entrance and the information centre should Laurie and Andrea hike to reach the picnic area in the shortest distance? Round to the nearest degree.

**b)** Describe any assumptions you make in your solution.

**11.** A set of stairs in a cottage has a slope of $\frac{7}{9}$. What angle do the stairs make with the horizontal, to the nearest degree?

**12.** Megan walked diagonally across a rectangular field measuring 58 m by 74 m. To the nearest degree, at what angle with respect to the shorter side did she walk?

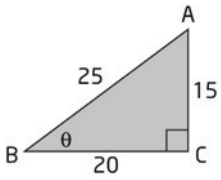
## 7.4 The Sine and Cosine Ratios

***Principles of Mathematics 10*, pages 366–377**

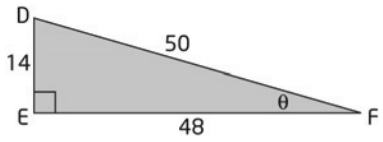
**A**

**1.** Find sin θ, cos θ, and tan θ for each triangle, expressed as fractions in lowest terms.

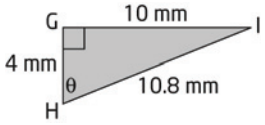
**a)**



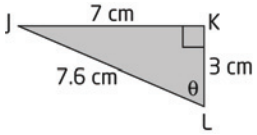

**b)**



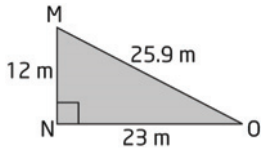

**c)**



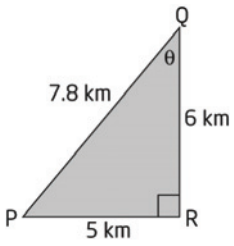

**d)**




**e)**



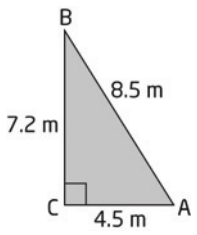

**f)**



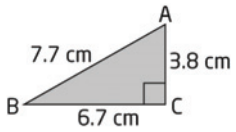

**B**

**2.** Find the three primary trigonometric ratios for ∠A, to four decimal places.

**a)**




**b)**




**3.** Evaluate each of the following with a calculator, rounded to four decimal places.

**a)** sin 38° **b)** sin 62°
**c)** sin 25° **d)** sin 87°
**e)** sin 90° **f)** sin 40°
**g)** sin 54° **h)** sin 71°

**4.** Evaluate each of the following with a calculator, rounded to four decimal places.

**a)** cos 29° **b)** cos 8°
**c)** cos 65° **d)** cos 34°
**e)** cos 82° **f)** cos 50°
**g)** cos 43° **h)** cos 68°

**5.** Find the measure of each angle, to the nearest degree.

**a)** $\sin\theta = 0.7824$ **b)** $\sin Q = 0.2315$

**c)** $\sin T = 0.4568$ **d)** $\sin H = 0.9231$

**e)** $\sin\theta = \frac{4}{9}$ **f)** $\sin K = \frac{7}{23}$

**g)** $\sin M = \frac{3}{4}$ **h)** $\sin D = \frac{14}{19}$

**6.** Find the measure of each angle, to the nearest degree.

**a)** $\cos\theta = 0.5143$ **b)** $\cos N = 0.2197$

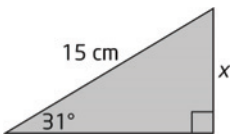
**c)** $\cos C = 0.7824$ **d)** $\cos R = 0.5683$

**e)** $\cos\theta = \frac{3}{10}$ **f)** $\cos H = \frac{8}{13}$

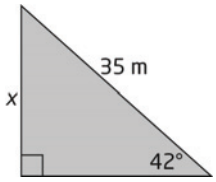
**g)** $\cos P = \frac{1}{7}$ **h)** $\cos S = \frac{17}{20}$

**7.** Find the value of $x$, to the nearest tenth of a unit, by applying the sine ratio.

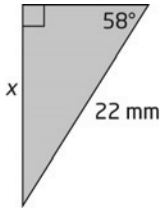
**a)**



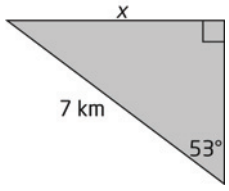

**b)**




**c)**

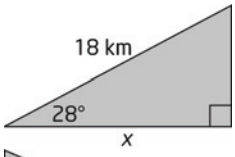



**d)**

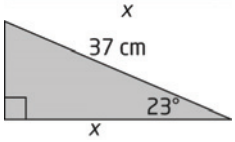



**8.** Find the value of $x$, to the nearest tenth of a unit, by applying the cosine ratio.

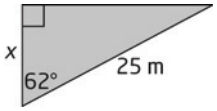
**a)**



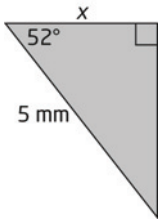

**b)**




**c)**



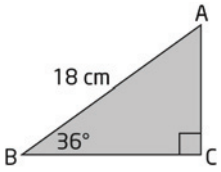

**d)**



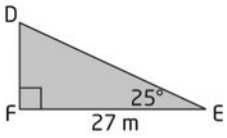

**C**

**9.** Solve each of the following triangles. Round side lengths to the nearest tenth of a unit and angles to the nearest degree.

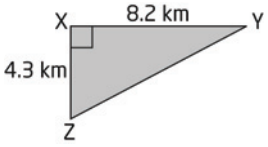
**a)**




**b)**




**c)**




**10.** In $\Delta ABC$, AB = 5 cm, AC = 8 cm, and $\angle B = 90°$. Solve $\Delta ABC$.

**11.** The guy wire to an antenna is 15 m long. The angle the guy wire makes with the ground is 48°. Find the height of the antenna, to the nearest tenth of a metre.

## 7.5 Solve Problems Involving Right Triangles

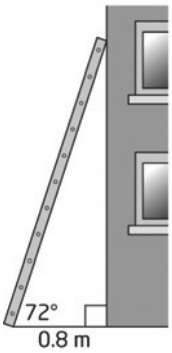
***Principles of Mathematics 10*, pages 378–385**

**A**

**1.** A ladder is leaning against the side of a building, as shown. The bottom of the ladder makes an angle of 72° with the ground and is 0.8 m from the bottom of the building.

**a)** Find how high up the building the ladder reaches, to the nearest tenth of a metre.

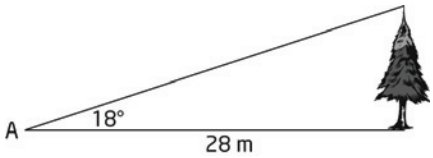
**b)** Find the length of the ladder, to the nearest tenth of a metre.




**2.** From a point A, 28 m from the base of a tree trunk, the angle of elevation of the top of the tree is 18°.

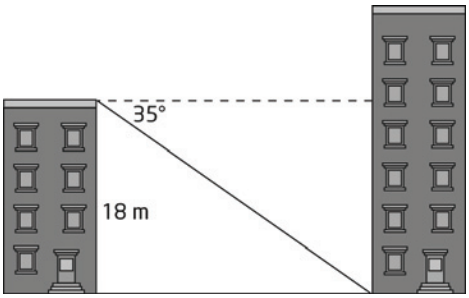
**a)** Find the height of the tree, to the nearest tenth of a metre.

**b)** Find the distance from point A to the top of the tree, to the nearest tenth of a metre.

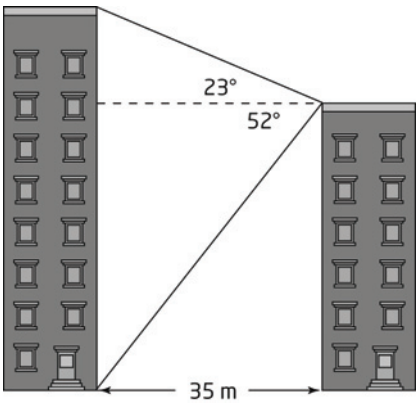



**B**

**3.** From the top of a building that is 18 m in height, the angle of depression of the bottom of a nearby building is 35°. What is the distance between the two buildings? Round your answer to the nearest tenth of a metre.

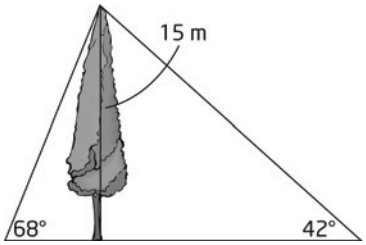



**4.** From the top of a building the angle of elevation of the top of a nearby building is 23° and the angle of depression of the bottom of the nearby building is 52°. The distance between the two buildings is 35 m. What is the height of the second building? Round your answer to the nearest tenth of a metre.



**5.** Amber and Joey are looking up at their school from the area beside the school library. From Amber's point of view, the top of the school is at an angle of elevation of 48°. From Joey's point of view, directly closer to the school, it is 68°. The school is 30 m high. How far apart are the two students? Round your answer to the nearest tenth of a metre.

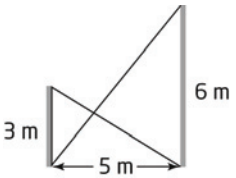
**6.** Kristen and Stephen are facing each other on opposite sides of a 15-m oak tree. From Kristen's point of view, the top of the oak tree is at an angle of elevation of 68°. From Stephen's point of view, the top of the oak tree is at an angle of elevation of 42°. How far apart are Kristen and Stephen? Round your answer to the nearest tenth of a metre.




**7.** Beside the visitor information centre in the provincial park there are two vertical posts. One is 3 m tall, and the other is 6 m tall. The ground between the posts is level, and the bases of the posts are 5 m apart. The posts are connected by two straight wires.

**a)** What angle does each wire make with the ground? Round your answers to the nearest degree.

**b)** What is the length of each wire? Round your answer to the nearest tenth of a metre.




**8.** From a point 40 m from the base of an office building and level with the base, the angle of elevation of the top of the building is 67.2°. Find the height of the office building, to the nearest tenth of a metre.

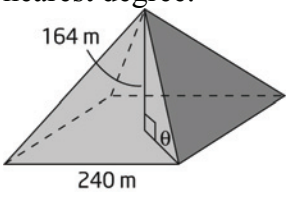
**C**

**9.** A wooden boat is 4 km west of a buoy. A canoe is 5 km south of the buoy.

**a)** How far, to the nearest tenth of a kilometre, is the wooden boat from the canoe?

**b)** At what angle south of due east, to the nearest degree, should the wooden boat travel to reach the canoe?

**10.** A square-based pyramid has a height of 164 m and a base length of 240 m. Find the angle, to the nearest degree, that one of the edges of the pyramid makes with the base. Round your answer to the nearest degree.




**11.** The angle of elevation of the top of a building is 28°. From a point 15 m directly toward the building, the angle of elevation changes to 42°.

**a)** Draw a diagram to represent this information.

**b)** Find the height of the building, to the nearest metre.

# Chapter 7 Review

***Principles of Mathematics 10*, pages 386–389**

**1.** **a)** Draw two rectangles that are congruent.

**b)** Draw two parallelograms that are similar.

**c)** Draw two kites that are congruent.

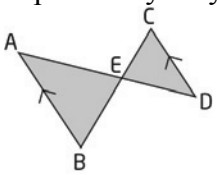
**d)** Draw two hexagons that are similar.

**e)** Draw two pentagons that are congruent.

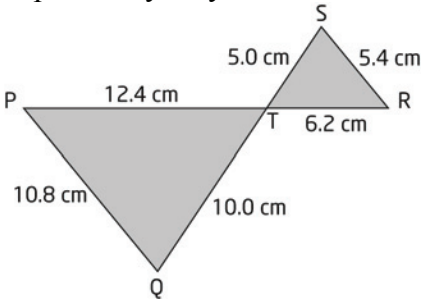
**f)** Draw two squares that are similar.

**2.** Are all squares similar? Justify your answer.

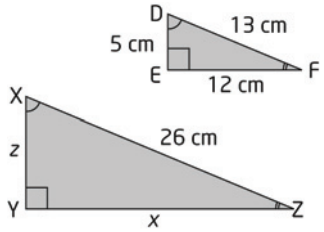
**3.** Name the two similar triangles and explain why they are similar.



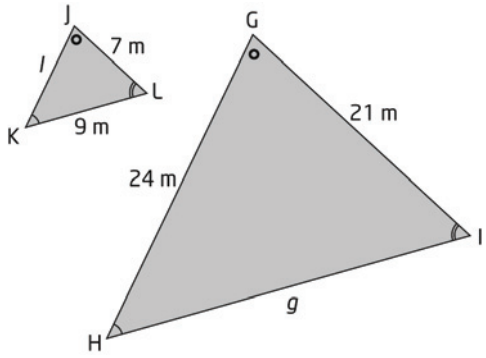

**4.** Name the two similar triangles and explain why they are similar.



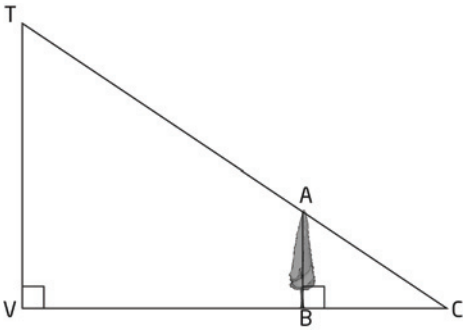

**5.** The pair of triangles is similar. Find the unknown side lengths.




**6.** The pair of triangles is similar. Find the unknown side lengths.



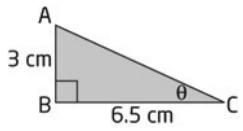

**7.** The tips of the shadows of a short-wave radio antenna and a 2.5-m tree meet at the point C. The following measurements are taken:
VB = 7.4 m
BC = 3.8 m
Use this information to find the height of the short-wave radio antenna, to the nearest tenth of a metre.



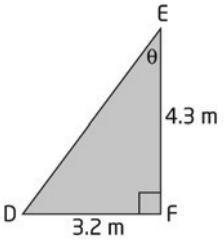

**8.** Alex has designed a dock in the shape of a right triangle with side lengths 3 m, 4 m, and 5 m. If he enlarges the dock to a similar shape whose side lengths are doubled, what will the area of the new dock be?

**9.** Find the tangent of the angle indicated, to four decimal places.

**a)**




**b)**



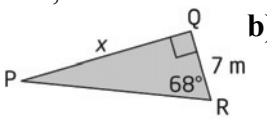

**10.** Find the measure of each angle, to the nearest degree.

**a)** $\tan \theta = 0.7128$ **b)** $\tan K = 1.3175$

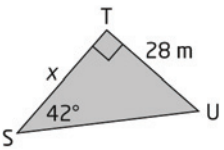
**c)** $\tan \theta = \frac{21}{32}$ **d)** $\tan V = \frac{17}{9}$

**11.** Find $x$, to the nearest tenth of a metre.

**a)**

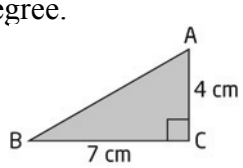



**b)**

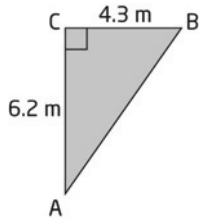



**12.** Find the measure of $\angle B$, to the nearest degree.

**a)**



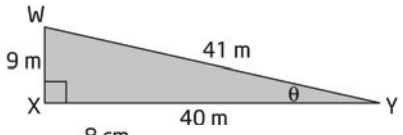

**b)**



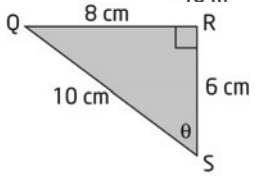

**13.** The angle of elevation of the top of a sail on a sailboat is 72°. The horizontal length of the sail is 0.8 m. What is the vertical height of the sail, to the nearest tenth of a metre?

**14.** Find $\sin \theta$, $\cos \theta$, and $\tan \theta$ for each triangle, expressed as fractions in lowest terms.

**a)**




**b)**



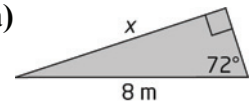

**15.** Find the measure of each angle, to the nearest degree.

**a)** $\sin F = 0.8156$ **b)** $\sin U = \frac{5}{11}$

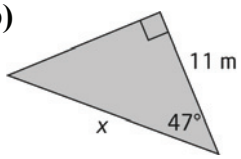
**c)** $\cos Z = 0.4923$ **d)** $\cos S = \frac{3}{7}$

**16.** Find $x$, to the nearest tenth of a metre.

**a)**

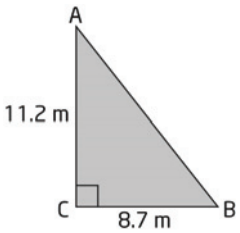



**b)**

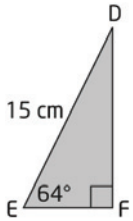



**17.** Solve each triangle. Round side lengths to the nearest tenth of a unit and angles to the nearest degree.

**a)**




**b)**




**18.** Kevin is standing 15 m from the base of a building. From the point where he is standing, the angle of elevation of the top of the building is 32°. How tall is the building, to the nearest tenth of a metre?

**19.** Dan and Christa are standing at the points A and B on the opposite sides of a hydro pole. From point A the angle of elevation of the top of the hydro pole is 28°, and from point B the angle of elevation of the top of the hydro pole is 34°. The hydro pole is 7 m in height. How far apart are Dan and Christa, to the nearest tenth of a metre?