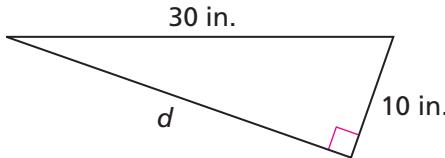


Applications

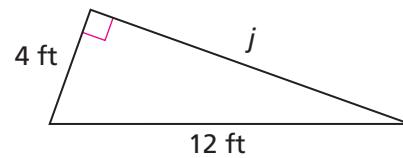
- The hypotenuse of a right triangle is 15 centimeters long. One leg is 9 centimeters long. How long is the other leg?
- The Wheel of Theodorus in Problem 4.1 includes only the first 11 triangles in the wheel. The wheel can go on forever.
 - Find the side lengths of the next three triangles.
 - Find the areas of the first five triangles in the wheel. Do you observe any pattern?
 - Suppose you continue adding triangles to the wheel. Which triangle will have a hypotenuse of length 5 units?

In Exercises 3 and 4, find the missing length.

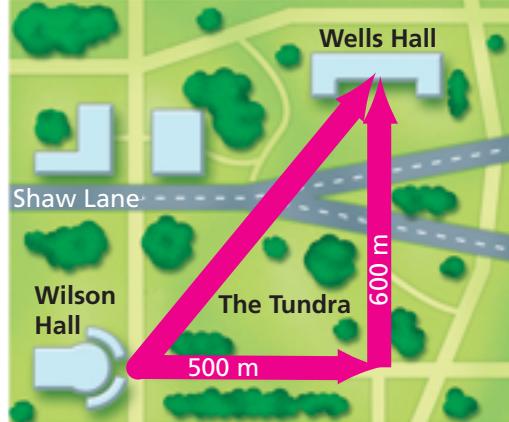
3.



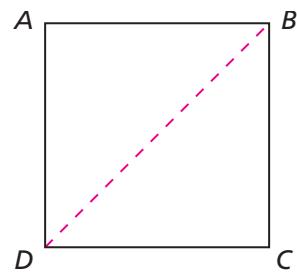
4.



- Moesha, a college student, needs to walk from her dorm room in Wilson Hall to her math class in Wells Hall. Normally, she walks 500 meters east and 600 meters north along the sidewalks, but today she is running late. She decides to take the shortcut through the Tundra.
- How many meters long is Moesha's shortcut?
- How much shorter is the shortcut than Moesha's usual route?

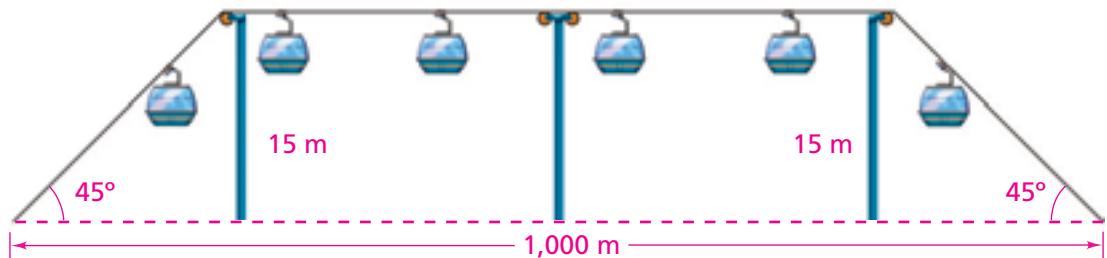


- 6.** Square $ABCD$ has sides of length 1 unit. The diagonal BD is a line of reflection.
- How do the triangles ABD and BDC compare?
 - Find the angle measures for one of the triangles. Explain how you found each measure.
 - What is the length of the diagonal? Explain.
 - Suppose square $ABCD$ had sides of length 5 units instead of 1 unit. How would this change your answers to parts (b) and (c)?

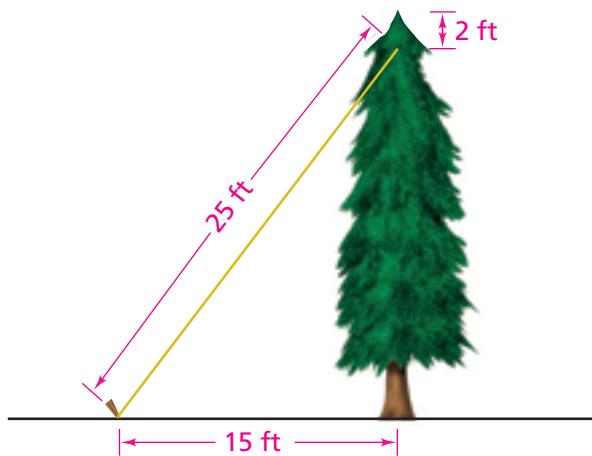


- 7.** A right triangle with a 45° angle is called a $45\text{-}45\text{-}90$ triangle.
- Are all $45\text{-}45\text{-}90$ triangles similar to each other? Explain.
 - Suppose one leg of a $45\text{-}45\text{-}90$ triangle is 5 units long. Find the perimeter of the triangle.
- 8.** The diagram shows an amusement park ride in which tram cars glide along a cable. How long, to the nearest tenth of a meter, is the cable for the ride?

Not drawn to scale

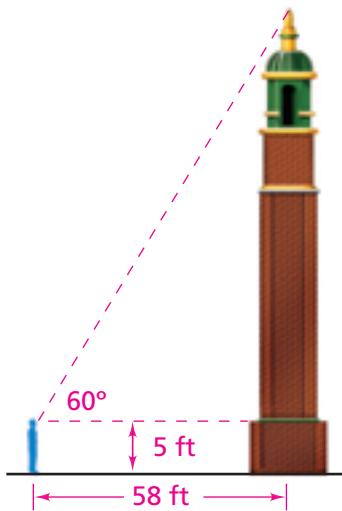


9. At Emmit's Evergreen Farm, the taller trees are braced by wires. A wire extends from 2 feet below the top of a tree to a stake in the ground. What is the tallest tree that can be braced with a 25-foot wire staked 15 feet from the base of the tree?



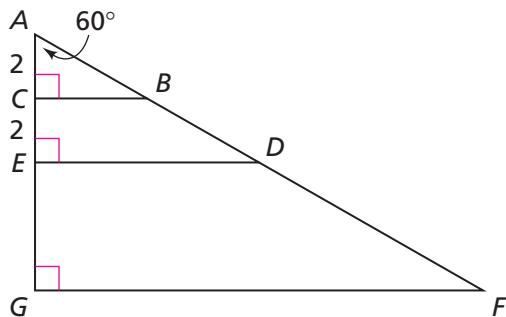
10. As part of his math assignment, Denzel has to estimate the height of a tower. He decides to use what he knows about 30-60-90 triangles.

Denzel makes the measurements shown below. About how tall is the tower? Explain.



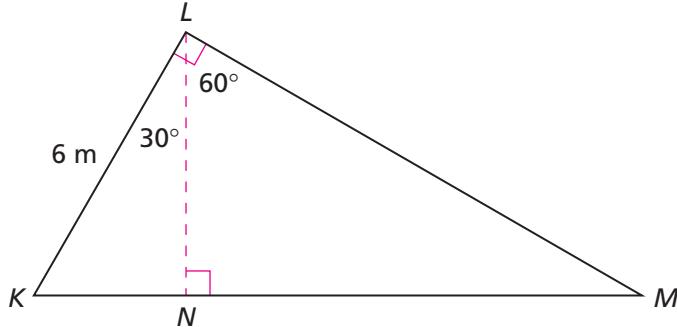
Not drawn to scale

- 11. a.** Name all the 30-60-90 triangles in the figure below. Are all of these triangles similar to each other? Explain.



- b.** Find the ratio of the length of segment BA to the length of segment AC . What can you say about the corresponding ratio in the other 30-60-90 triangles?
- c.** Find the ratio of the length of segment BC to the length of segment AC . What can you say about the corresponding ratios in the other 30-60-90 triangles?
- d.** Find the ratio of the length of segment BC to the length of segment AB . What can you say about the corresponding ratios in the other 30-60-90 triangles?
- e.** Suppose the shortest side of a 30-60-90 triangle is 12 units long. Find the lengths of its other sides.

- 12.** Find the perimeter of triangle KLM .



**Homework
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For: Help with Exercise 12
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Connections

Estimate the square root to one decimal place *without* using the $\sqrt{}$ key on your calculator. Then, tell whether the number is rational or irrational.

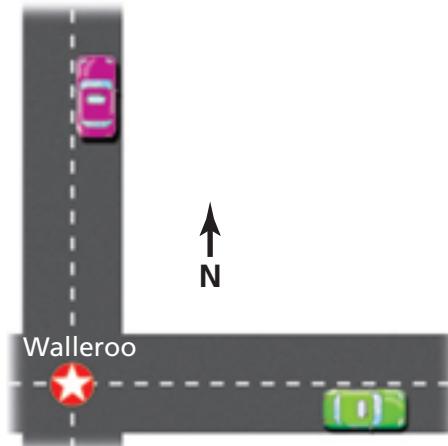
13. $\sqrt{121}$

14. $\sqrt{0.49}$

15. $\sqrt{15}$

16. $\sqrt{1,000}$

Two cars leave the city of Walleroo at noon. One car travels north and the other travels east. Use this information for Exercises 17 and 18.



17. Suppose the northbound car is traveling at 60 miles per hour and the eastbound car is traveling at 50 miles per hour. Make a table that shows the distance each car has traveled and the distance between the two cars after 1 hour, 2 hours, 3 hours, and so on. Describe how the distances are changing.
18. Suppose the northbound car is traveling at 40 miles per hour. After 2 hours, the cars are 100 miles apart. How fast is the other car going? Explain.

Write each fraction as a decimal and tell whether the decimal is terminating or repeating. If the decimal is repeating, tell which digits repeat.

19. $\frac{2}{5}$

20. $\frac{3}{8}$

21. $\frac{5}{6}$

22. $\frac{35}{10}$

23. $\frac{8}{99}$

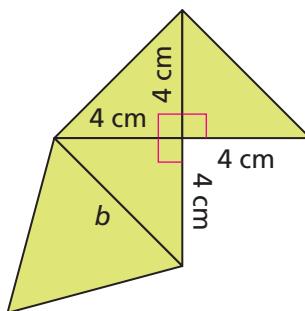
Tell whether a triangle with the given side lengths is a right triangle. Explain how you know.

24. 5 cm, 7 cm, $\sqrt{74}$ cm

25. $\sqrt{2}$ ft, $\sqrt{7}$ ft, 3 ft

- 26.** The figure at the right is a net for a pyramid.

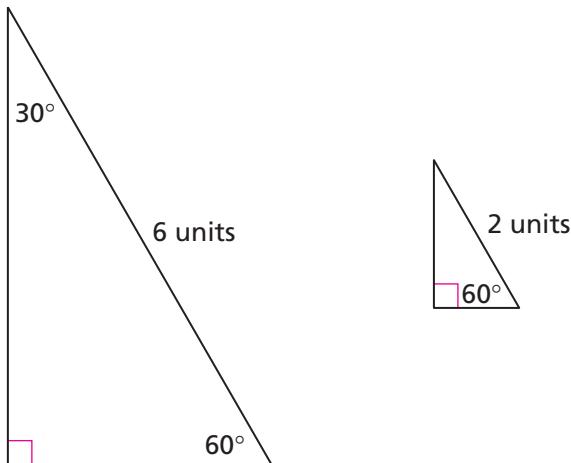
- a. What is the length of side b ?
- b. Sketch the pyramid.
- c. What is the surface area of the pyramid?



- 27. Multiple Choice** Which set of irrational numbers is in order from least to greatest?

- A. $\sqrt{2}, \sqrt{5}, \sqrt{11}, \pi$
- B. $\sqrt{2}, \sqrt{5}, \pi, \sqrt{11}$
- C. $\sqrt{2}, \pi, \sqrt{5}, \sqrt{11}$
- D. $\pi, \sqrt{2}, \sqrt{5}, \sqrt{11}$

- 28.** In Problem 4.3, you found the side lengths of the triangle on the left.



- a. Explain how you know the triangle on the right is similar to the triangle on the left.
- b. Use the side lengths of the larger triangle to find the side lengths of the smaller triangle. Explain.
- c. How are the areas of the triangles related?

Find a fraction equivalent to the terminating decimal.

29. 0.35

30. 2.1456

31. 89.050

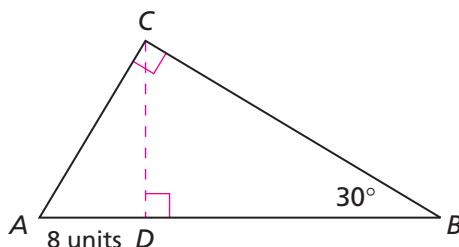
For Exercises 32–34, tell whether the statement is *true* or *false*.

32. $0.06 = \sqrt{0.36}$

33. $1.1 = \sqrt{1.21}$

34. $20 = \sqrt{40}$

- 35.** In Problem 4.4, you worked with this triangle.



- Find the perimeter of triangle ACD .
- How is the perimeter of triangle ACD related to the perimeter of triangle ABC ?
- How is the area of triangle ACD related to the area of triangle ABC ?

Find the two consecutive whole numbers the square root is between.

Explain.

36. $\sqrt{39}$

37. $\sqrt{600}$

Extensions

- 38. a.** Copy the table at the right. Write each fraction as a decimal.
- b.** Describe a pattern you see in your table.
- c.** Use the pattern to write decimal representations for $\frac{9}{9}$, $\frac{10}{9}$, and $\frac{15}{9}$. Use your calculator to check your answers.
- d.** Find fractions equivalent to $1.\bar{2}$ and $2.\bar{7}$, where the bar means the number under the bar repeats forever. (**Hint:** $1.\bar{2}$ can be written as $1 + 0.22222\ldots$. The bar on the 2 means the 2 repeats forever.)

Fraction	Decimal
$\frac{1}{9}$	
$\frac{2}{9}$	
$\frac{3}{9}$	
$\frac{4}{9}$	
$\frac{5}{9}$	
$\frac{6}{9}$	
$\frac{7}{9}$	
$\frac{8}{9}$	

39. Explore decimal representations of fractions with a denominator of 99. Look at fractions less than one, $\frac{1}{99}$, $\frac{2}{99}$, $\frac{3}{99}$, and so on. What patterns do you see?

40. Explore decimal representations of fractions with a denominator of 999. Look at fractions less than one, $\frac{1}{999}$, $\frac{2}{999}$, $\frac{3}{999}$, and so on. What patterns do you see?

Use the patterns you discovered in Exercises 38–40 to find a fraction or mixed number equivalent to each decimal.

41. $0.3333 \dots$

42. $0.050505 \dots$

43. $0.454545 \dots$

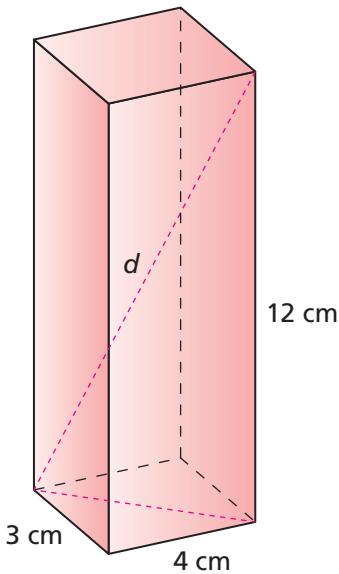
44. $0.045045 \dots$

45. $10.121212 \dots$

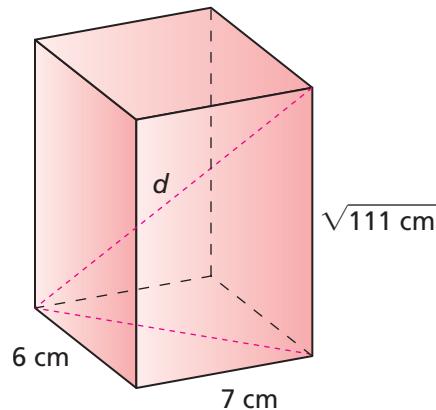
46. $3.9999 \dots$

For Exercises 47 and 48, find the length of the diagonal d .

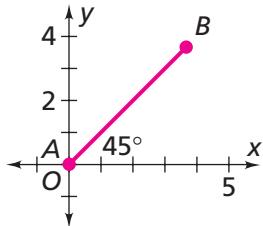
47.



48.



49. Segment AB below makes a 45° angle with the x -axis. The length of segment AB is 5 units.

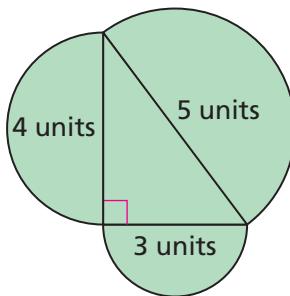


- Find the coordinates of point B to two decimal places.
- What is the slope of line AB ?

In Exercises 50–52, you will look for relationships among the areas of similar shapes other than squares drawn on the sides of a right triangle.

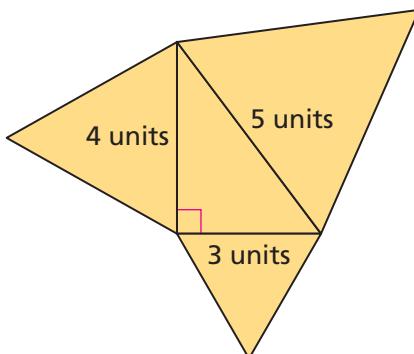
- 50.** Half-circles have been drawn on the sides of this right triangle.

- Find the area of each half-circle.
- How are the areas of the half-circles related?



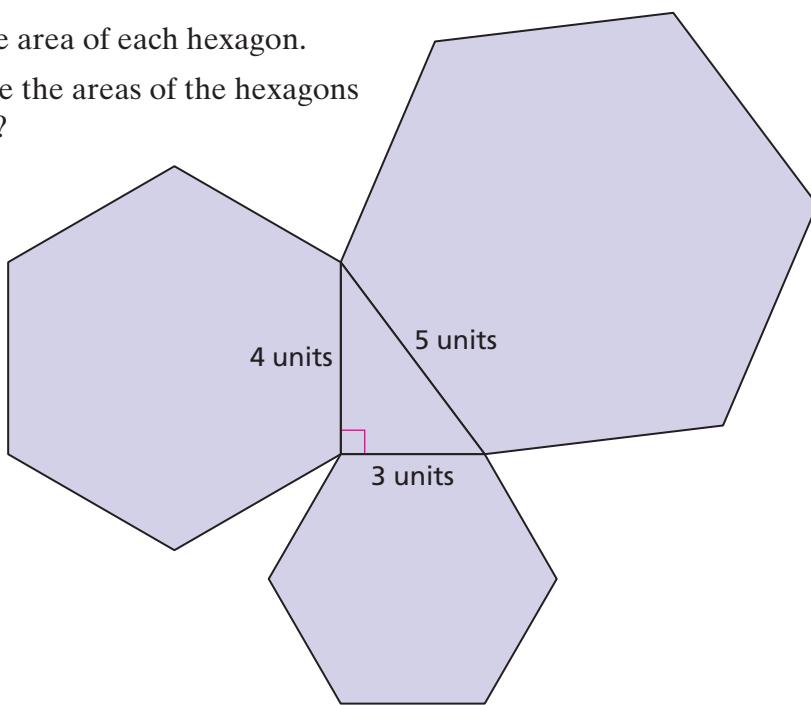
- 51.** Equilateral triangles have been drawn on the sides of this right triangle.

- Find the area of each equilateral triangle.
- How are the areas of the equilateral triangles related?



- 52.** Regular hexagons have been drawn on the sides of this right triangle.

- Find the area of each hexagon.
- How are the areas of the hexagons related?



- 53.** Find an irrational number between 6.23 and 6.35.

- 54.** You can use algebra to help you write a repeating decimal as a fraction. For example, suppose you want to write $0.\overline{121212}$ as a fraction.

Let $x = 0.\overline{121212} \dots$

$$100x = 12.\overline{121212} \dots \quad \text{Multiply both sides by 100.}$$

$$\begin{array}{r} - \\ x = 0.\overline{121212} \dots \\ \hline 99x = 12 \end{array} \quad \text{Subtract the first equation from the second.}$$

Divide both sides of the resulting equation, $99x = 12$, by 99 to get $x = \frac{12}{99}$. So, $0.\overline{121212} \dots = \frac{12}{99}$.

The key to this method is to multiply each side of the original equation by a power of 10 (such, as 10, 100, or 1,000) that shifts one group of repeating digits to the left of the decimal point. In the example above, multiplying by 100 shifted one “12” to the left of the decimal point.

Use the method described above to write each decimal as a fraction.

- a. $0.1\overline{515151} \dots$ b. $0.\overline{7777} \dots$ c. $0.123123123123 \dots$

- 55.** When building a barn, a farmer must make sure the sides are perpendicular to the ground.

- a. One method for checking whether a wall is perpendicular to the ground involves using a 10-foot pole. The farmer makes a mark exactly 6 feet high on the wall. She then places one end of the pole on the mark and the other end on the ground.

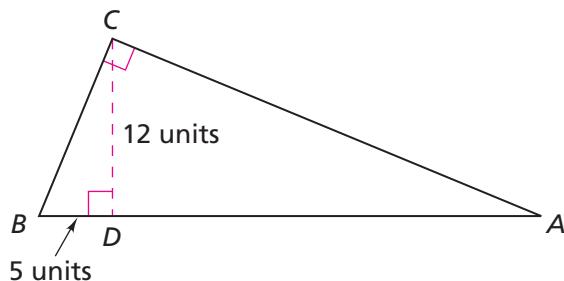


How far from the base of the wall will the pole touch the ground if the wall is perpendicular to the ground? Explain.

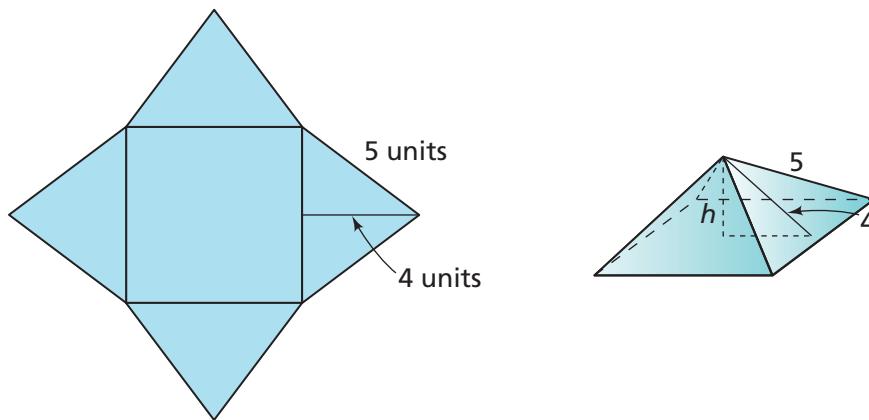
- b. You may have heard the saying, “I wouldn’t touch that with a 10-foot pole!” What would this saying mean to a farmer who had just built a barn?
- c. Suppose a farmer uses a 15-foot pole and makes a mark 12 feet high on the wall. How far from the base of the wall will the pole touch the ground if the wall is perpendicular to the ground?

- d.** Name another pole length a farmer could use. For this length how high should the mark on the wall be? How far from the base of the wall will the pole touch the ground?

- 56.** Find the perimeter of triangle ABC .



- 57.** Below is the net for a square pyramid and a sketch of the pyramid.



- a.** What is the area of the base of the pyramid?
b. What is the surface area of the pyramid?
c. What is the height of the pyramid?
d. What is the volume of the pyramid?
- 58.** The managers of Izzie's Ice Cream Shop are trying to decide on the best size for their cones.
- a.** Izzie thinks the cone should have a diameter of 4.5 inches and a height of 6 inches. What is the volume of the cone Izzie suggests?
- b.** Izzie's sister Becky thinks the cone should have a height of 6 inches and a slant height of 7 inches. (The slant height is labeled s in the diagram at the right.) What is the volume of the cone Becky suggests?

