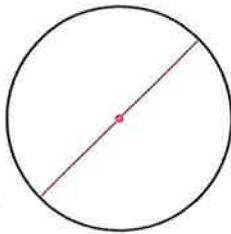




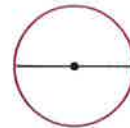
# Applications

For Exercises 1–4, identify the part of the circle drawn in red as its circumference, diameter, or radius. Then, measure that part in centimeters.

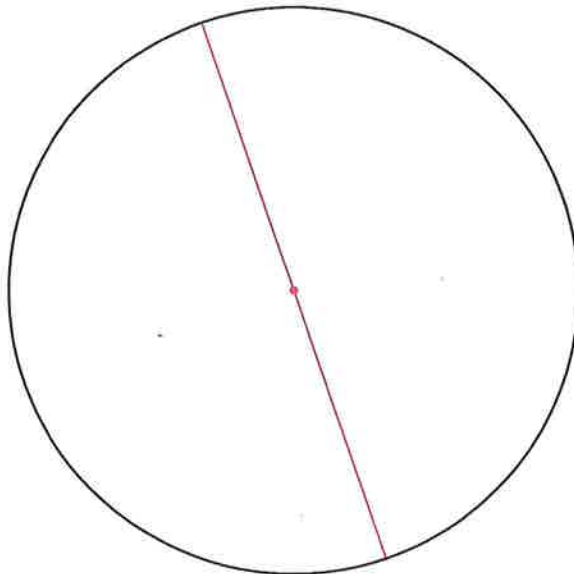
1.



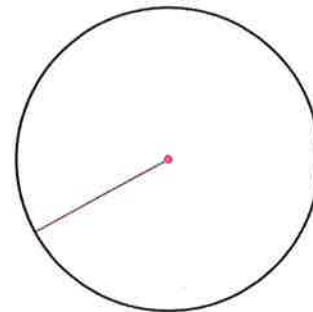
2.



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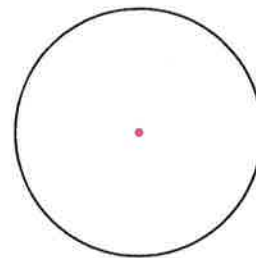
4.



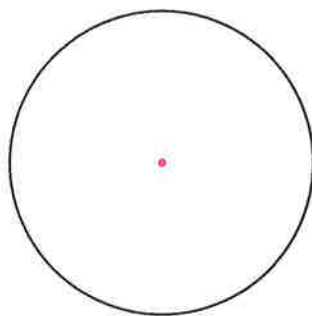
5. Use your measurements from Exercises 1–4 to find the measure of the part of each circle in black.

6. Trace the circle at the right and draw three different diameters.

- What is the measure, in centimeters, of each diameter?
- What can you say about the measures of diameters in a circle?
- Estimate the circumference of this circle using the diameter measurements you found.



7. Trace this circle and draw three different radii. (RAY dee eye, the plural for radius).



- What is the measure, in centimeters, of each radius?
  - What can you say about the measures of the radii in the same circle?
  - Estimate the circumference of this circle using the radius measurements you found.
8. Terrell says that when you know the radius of a circle, you can find the diameter by doubling the radius. Do you agree? Why or why not?
9. Enrique says that when you know the diameter of a circle you can find the radius. How can he find the length of a radius if he knows the length of the diameter?
10. **Multiple Choice** A juice can is about 2.25 inches in diameter. What is its circumference?
- |              |                         |
|--------------|-------------------------|
| A. 3.53 in.  | B. $3.97 \text{ in.}^2$ |
| C. 7.065 in. | D. 14.13 in.            |

11. A pizzeria sells three different sizes of pizza. The small size has a radius of 4 inches, the medium size has a radius of 5 inches, and the large size has a radius of 6 inches.
- a. Copy and complete the table. Explain how you found the areas of the pizzas.

**Pizza Measurements**

Pizza Size	Diameter (in.)	Radius (in.)	Circumference (in.)	Area (in. <sup>2</sup> )
Small	■	■	■	■
Medium	■	■	■	■
Large	■	■	■	■

- b. Jamar claims the area of a pizza is about  $0.75 \times (\text{diameter})^2$ . Is he correct? Explain.

**For Exercises 12–16, some common circular objects are described by giving their radius or diameter. Explain what useful information (if any) you would get from calculating the area or circumference of the object.**

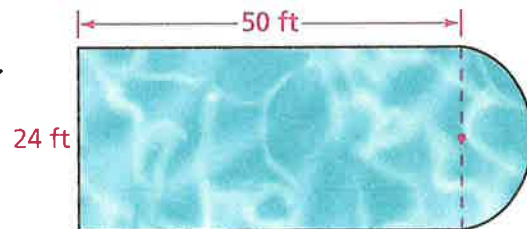
12.  $4\frac{5}{8}$ -inch-diameter compact disc
13. 21-inch-diameter bicycle wheel
14. 12-inch-diameter water pipe
15. lawn sprinkler that sprays a 15-meter-radius section of lawn
16. a 9-inch-diameter round cake pan
17. Pick one of the objects from Exercises 12–16 and write a problem about it. Be sure to give the answer to your problem.

For Exercises 18–22, you may want to make scale drawings on grid paper to help find the missing measurements.

18. Derek's dinner plate has a diameter of about 9 inches. Find its circumference and area.
19. A bicycle wheel is about 26 inches in diameter. Find its radius, circumference, and area.
20. The spray from a lawn sprinkler makes a circle 40 feet in radius. What are the approximate diameter, circumference, and area of the circle of lawn watered?
21. An old-fashioned Long Play (LP) record (that people used for listening to music in the past) has a 12-inch diameter; a compact disc has a  $4\frac{5}{8}$ -inch diameter.

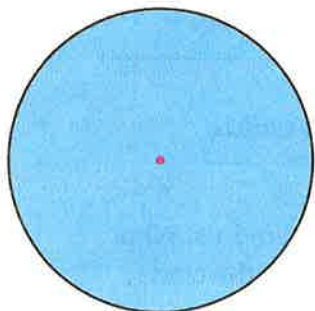


- a. Find the radius, circumference, and area of each object. For the area, disregard the hole in the center of each object.
  - b. How many trips around the compact disc would equal one trip around the LP record?
  - c. How many compact discs (cut into pieces) would it take to cover the LP record? Disregard the hole in the center of each object.
22. A rectangular lawn has a perimeter of 36 meters and a circular exercise run has a circumference of 36 meters. Which shape will give Rico's dog more area to run? Explain.
  23. The swimming pool at the right is a rectangle with a semicircle at one end. What are the area and perimeter of the pool?



For Exercises 24–29, estimate the area in square centimeters and the perimeter or circumference in centimeters.

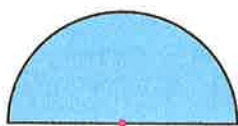
24.



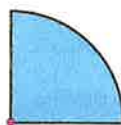
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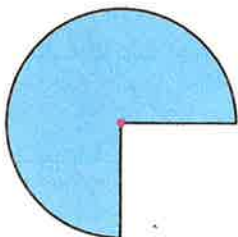
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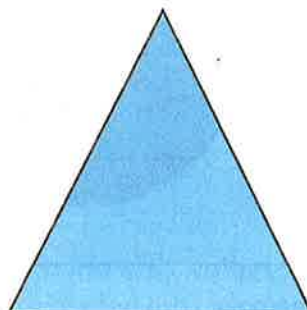
27.



28.

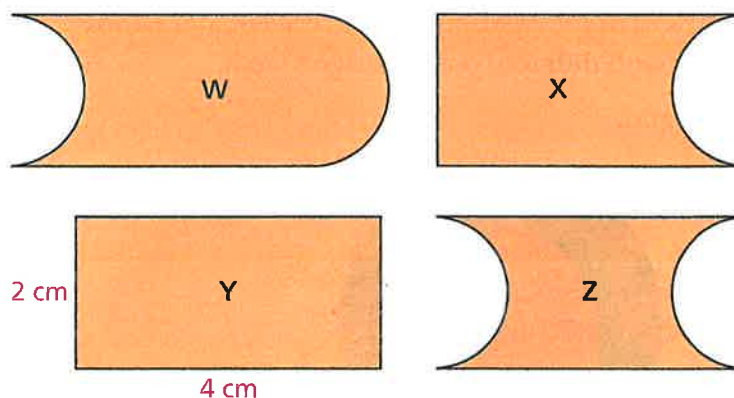


29.

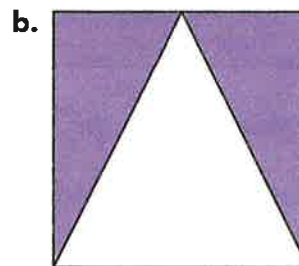
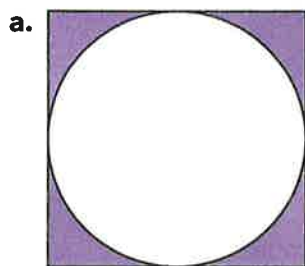




For Exercises 30 and 31, use these figures. The figures are drawn to scale.

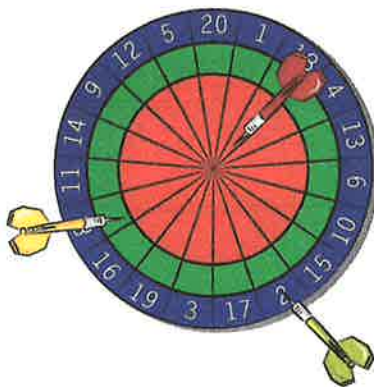


- 30. Multiple Choice** Which answer has the figures in order from least to greatest area?
- F. W, X, Y, Z  
 G. Z, X, W or Y  
 H. Y, X, Z or W  
 J. Z, Y, X, W
- 31. Multiple Choice** Which answer has the figures in order from least to greatest perimeter?
- A. W, X, Y, Z  
 B. Z, X, W or Y  
 C. Y, X, Z or W  
 D. Z, Y, X, W
- 32.** A group of students submitted these designs for a school flag. The side length of each flag is 6 feet. Each flag has two colors. How much of each color of material will be needed?

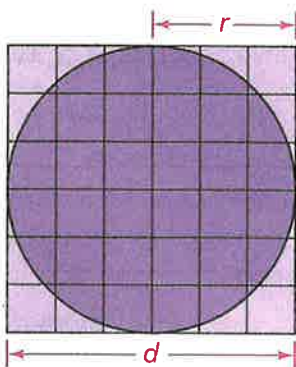


- 33.** This circular dartboard has three circles with the same center. (These are called *concentric circles*.) The diameter of the largest circle is 20 inches. The diameters of the inner circles decrease by 4 inches as you move from the largest to the smallest. Each of the circular bands will be a different color with different points assigned to it.

Find the area of each band.



- 34.** A circle is inscribed in a square with side length  $d$  units. Kaylee and Cassie were trying to find a formula for the area of a circle. They came up with two formulas for the area:



Kaylee: Area  $\approx \frac{3}{4}d^2$

Cassie: Area  $\approx 3r^2$

- Who is correct? Explain why.
- The class developed this formula for the area of a circle:  

$$\text{Area} = \pi r^2$$
 How do Kaylee and Cassie's formulas compare with the class formula?
- If the diameter of a circle is 15 centimeters, what is its area?
- If the area of a circle is 98 square inches, what is its radius?

## Connections



35. Explain which measurements associated with circles would be useful in describing the size of each article of clothing.
- belts
  - jeans
  - hats
  - shirts
36. The table shows some diameters and circumferences of circular pizzas.

**Pizza Measurements**

Diameter (in.)	Circumference (in.)
9	28.27
12	37.70
15	47.12
18	■
21	■

- Find the missing circumferences.
- Make a coordinate graph with diameter on the horizontal axis and circumference on the vertical axis.
- Describe the graph.
- Estimate the circumference of a pizza with a diameter of 20 inches.
- Estimate the diameter of a pizza with a circumference of 80 inches.



For Exercises 37–42, do each calculation. Then, explain how the expression could represent an area or perimeter calculation.

37.  $2 \times 10.5$

38.  $(4.25)^2 \times 3.14$

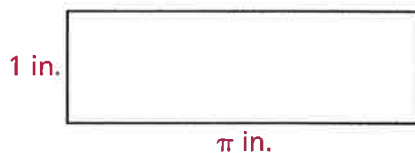
39.  $\frac{1}{2} \times 15.25 \times 7.3$

40.  $1\frac{3}{5} \times 2\frac{1}{4}$

41.  $(2 \times 8) + (2 \times 10)$

42.  $7\frac{1}{2} \times 3.14$

43. Kateri and Jorge are talking about the number  $\pi$ . Kateri says that any problem involving  $\pi$  has to be about circles. Jorge disagrees and shows him the example below. What do you think? Explain your reasoning.



For Exercises 44–46, describe the figure formed by each type of slice of the square prism.



Square Prism

44. vertical slice  
45. horizontal slice  
46. slanting slice

## Did You Know?

**You can estimate pi** using probability. Take a square that is 2 units on each side. Inscribe a circle inside that has a radius of 1 unit.

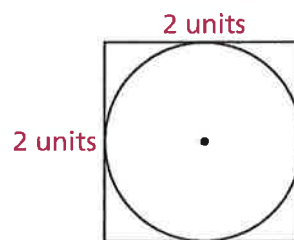
The area of the square is 4 square units. The area of the circle is  $\pi r^2$  or  $\pi(1)^2 = \pi$  square units.

The ratio of the area of the circle to the area of the square is  $\frac{\pi}{4}$ .

You can do computer simulations in which the computer randomly places a dot inside the square. A computer can place 10,000 dots inside the square in less than 30 seconds.

This ratio  $\frac{\text{number of dots inside the circle}}{\text{total number of dots inside the square}}$  should approximate  $\frac{\pi}{4}$ .

So,  $\pi$  should equal four times the ratio  $\frac{\text{number of dots inside the circle}}{\text{total number of dots inside the square}}$ .



47. Charlie runs three computer simulations such as the one described in the *Did You Know?* box above. He records data for the three trials.

- a. Copy and complete the table below of Charlie's data.

**Pi Estimations**

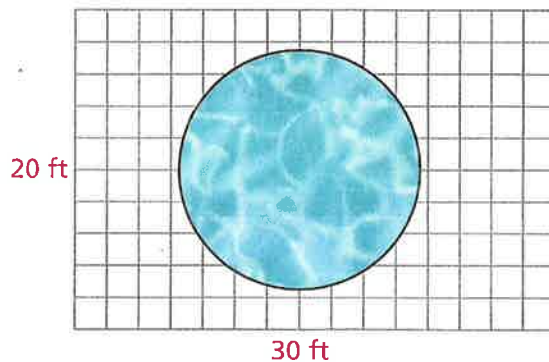
Trial	Dots Inside the Circle	Dots Inside the Square	Ratio: $\frac{\text{Dots in Circle}}{\text{Dots in Square}}$
1	388	500	■
2	352	450	■
3	373	475	■

- b. Decide which trial is closest to an approximation for  $\frac{\pi}{4}$ . Explain your reasoning.



## Extensions

48. The diameter of Earth is approximately 42,000,000 feet. If a 6-foot-tall man walked around Earth along the equator, how much farther would his head move than his feet?
49. Suppose a piece of rope wraps around Earth. Then rope is added to make the entire rope 3 feet longer.
- Suppose the new rope circles Earth exactly the same distance away from the surface at all points. How far is the new rope from Earth's surface?
  - A piece of rope is wrapped around a person's waist. Then rope is added to make it 3 inches longer. How far from the waist is the rope if the distance is the same all around?
  - Compare the results in parts (a) and (b).
50. The Nevins want to install a circular pool with a 15-foot diameter in their rectangular patio. The patio will be surrounded by new fencing, and the patio area surrounding the pool will be covered with new tiles.



- How many feet of fencing are needed to enclose the patio?
- How much plastic is needed to cover the pool if there is a 1-foot overhang?
- How many feet of plastic tubing are needed to fit around the edge of the pool?
- How many square feet of ground will be covered with tiles?