

Applications

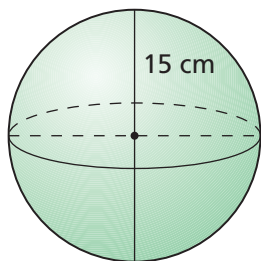
1. A playground ball has a diameter of 18 cm.
 - a. Sketch a cylinder that fits the playground ball, and label its height and base.
 - b. What is the volume of the cylinder?
 - c. What is the volume of the ball?

2. Find the volume of an exercise ball with a diameter of 62 centimeters.

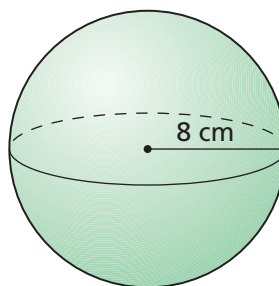


For Exercises 3–6, find the volume of the following spheres. In some spheres, the diameter is given. In others, the radius is given.

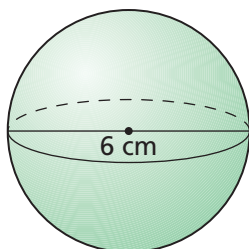
3.



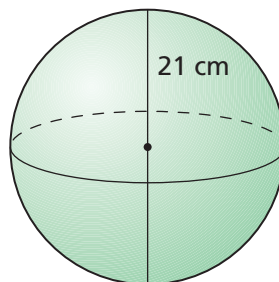
4.



5.



6.



For Exercises 7–9, each of the number sentences models the formula for the volume of a figure you have worked with in this unit. Name the figure, sketch and label the figure, and find the volume.

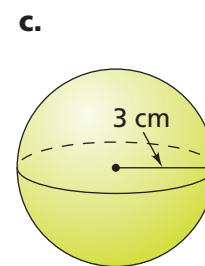
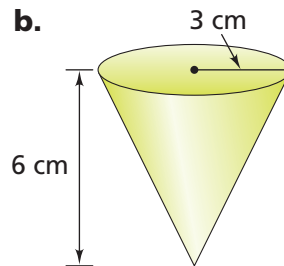
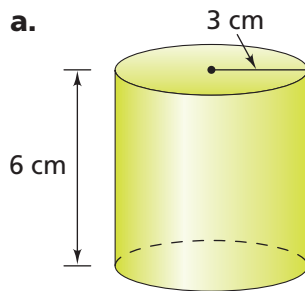
7. $2\frac{2}{3} \times 4\frac{4}{5} \times 3\frac{7}{8}$

8. $\pi \times (2.2)^2 \times 6.5$

9. $\frac{1}{3}\pi \times (4.25)^2 \times 10$

- 10.** Watertown has three water storage tanks in different shapes: a cylinder, a cone, and a sphere. Each tank has a radius of 20 feet and a height of 40 feet.
- Sketch each tank, and label its dimensions.
 - Estimate which tank will hold the most water. Explain.
 - What is the volume of the cylindrical tank?
 - What is the volume of the conical tank?
 - What is the volume of the spherical tank?

- 11.** Find the volume of each shape.

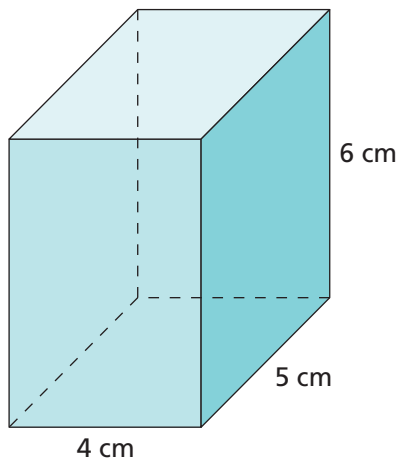


- d.** How do the volumes of the three shapes compare?

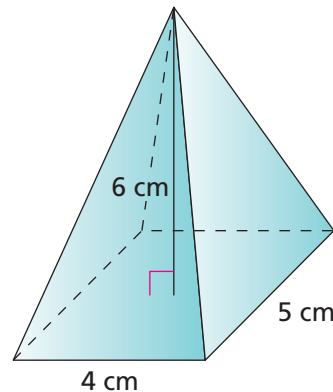
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For Exercises 12 and 13, find the volume of each shape.

12.

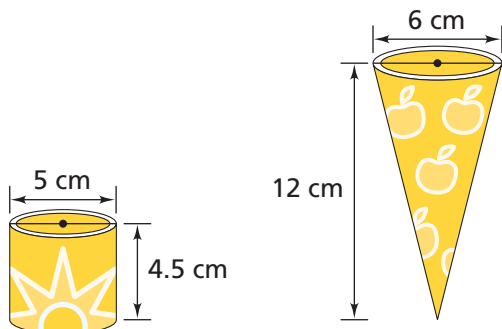


13.

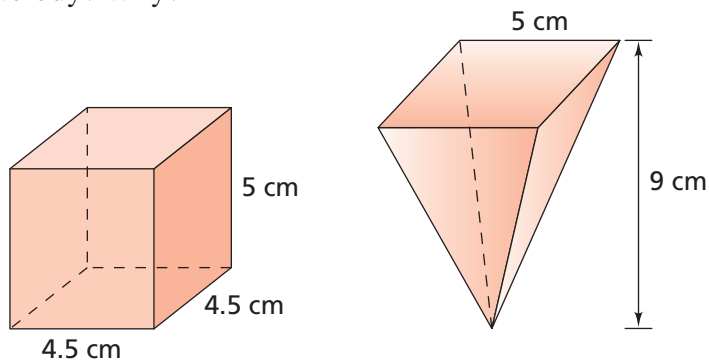


- 14. a.** Sketch and label the dimensions of a pyramid with base dimensions 5 centimeters by 7 centimeters and height 8 centimeters.
- b.** Find the volume of the pyramid in part (a).

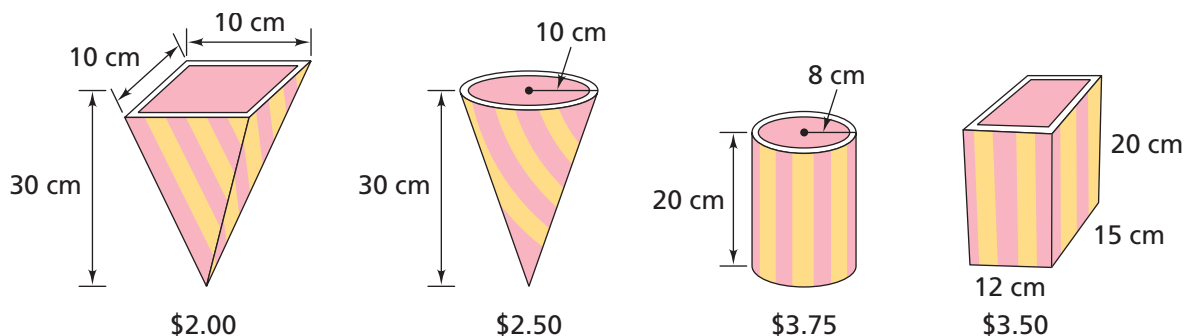
- 15.** The track-and-field club is planning a frozen yogurt sale to raise money. They need to buy containers to hold the yogurt. They must choose between the cup and the cone below. Each container costs the same. The club plans to charge customers \$1.25 for a serving of yogurt. Which container should the club buy? Why?



- 16.** The Mathletes are planning their own frozen yogurt sale. They need to buy containers to hold the yogurt. They must choose between the prism and pyramid below. The other conditions that apply to the club in Exercise 15 also apply to the Mathletes. Which container should the club buy? Why?



- 17.** The prices and dimensions of several movie theater popcorn containers are shown below. Which container has the most popcorn per dollar? Explain. (Note: The diagrams below are not drawn to scale.)



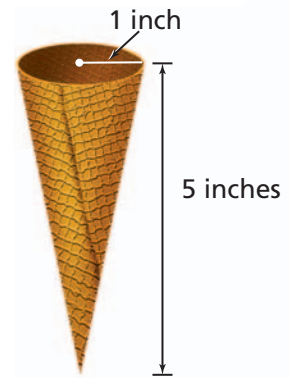
For Exercises 18–20, the volume of each shape is approximately 250 cubic inches.

18. Find the height of a cylinder with a radius of 3 inches.
19. Find the radius of a sphere.
20. Find the height of a cone with a radius of 3 inches.

For Exercises 21–22, suppose each shape has a square base, the side of the base is 3 inches, and the volume is 225 cubic inches. Find the height.

21. rectangular prism
22. pyramid

23. If a scoop of ice cream is a sphere with a radius of 1 inch, how many scoops can be packed into the cone at the right?



24. Chilly's Ice Cream Parlor purchases ice cream in $2\frac{1}{2}$ -gallon cylindrical containers. Each container is $10\frac{5}{32}$ inches high and 9 inches in diameter. A jumbo scoop of ice cream comes in the shape of a sphere that is approximately 4 inches in diameter. How many jumbo scoops can Chilly's serve from one $2\frac{1}{2}$ -gallon container of ice cream?




25. Chilly's Ice Cream Parlor is known for its root beer floats.
 - The float is made by pouring root beer over 3 scoops of ice cream until the glass is filled $\frac{1}{2}$ inch from the top.
 - A glass is in the shape of a cylinder with a radius of $1\frac{1}{4}$ inches and height of $8\frac{1}{2}$ inches.
 - Each scoop of ice cream is a sphere with a radius of $1\frac{1}{4}$ inches.

Will there be more ice cream or more root beer in the float? Explain your reasoning.

Connections

- 26.** A drink can is a cylinder with a radius of 3 centimeters and a height of 12 centimeters.
- Sketch the can, and label its dimensions.
 - What is the circumference of the can?
 - What is the volume?
 - What is the surface area?
 - How many cans will it take to fill a liter bottle? (A liter bottle contains 1,000 cubic centimeters.)
- 27.** Three students measured the height of the same cylinder and their measurements are listed below. What is the average of the heights?
- $2\frac{1}{2}$ feet $2\frac{2}{3}$ feet $2\frac{7}{12}$ feet
- 28.** Five students measured the height of the same prism and their measurements are listed below. What is the average of the heights?
- 5.1 centimeters 4.9 centimeters
5.25 centimeters 5.15 centimeters
4.85 centimeters

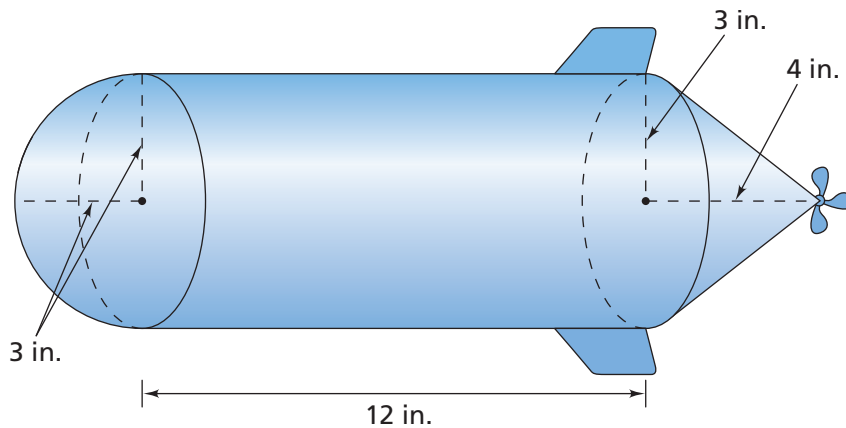
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Each number sentence in Exercises 29–31 is a model for the surface area of a three-dimensional figure. Identify which three-dimensional figure the number sentence describes. Find the surface area.

- 29.** $2 \times (4) + 2 \times (8.5) + 2 \times (7.25)$
- 30.** $2 \times (4 + 8.5 + 7.25)$
- 31.** $2\pi \times (4)^2 + 2\pi \times (4)(8.5)$
- 32.** Kaiya measures the circumference of a sphere and finds that it is 54 centimeters. What is the volume of the sphere?

Extensions

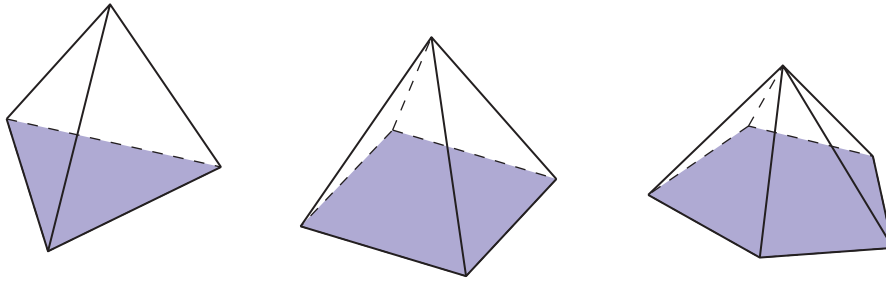
- 33.** Ted made a scale model of a submarine for his science class.
- What is the volume of Ted's model?
 - If 1 inch in the model represents 20 feet in the actual submarine, what is the volume of the actual submarine?



- 34.** Some of the Inuit people build igloos shaped like hemispheres (halves of a sphere). Some of the Hopi people in Arizona build adobes shaped like rectangular boxes. Suppose an igloo has an inner diameter of 20 feet.
- Describe the shape of a Hopi dwelling that would provide the same amount of living space as the igloo described above.
 - What dimensions of the floor would give the Hopi dwelling the same amount of floor space as the igloo?



- 35.** A pyramid is named for the shape of its base. The left shape below is a triangular pyramid, the center shape is a square pyramid, and the right shape is a pentagonal pyramid.



- a.** Suppose the bases of a pyramid are all regular polygons. What happens to the shape of the pyramid as the number of sides in the base increases?
- b.** Describe a method for finding the surface area of a pyramid.
- 36.** For each shape below, find the dimensions that will most closely fit inside a cubic box with 5-centimeter edges.
- a.** sphere **b.** cylinder **c.** cone **d.** pyramid
- e.** Does a sphere, a cylinder, or a cone fit best inside the cubic box? That is, for which shape is there the least space between the shape and the box?
- 37.** The edges of a cube measure 10 centimeters. Describe the dimensions of a cylinder and a cone with the same volume as the cube. Explain.

