

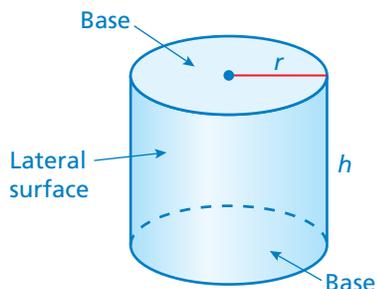
6.3 Surface Areas of Cylinders

Essential Question How can you find the surface area of a cylinder?

1 ACTIVITY: Finding Area

Work with a partner. Use a cardboard cylinder.

- Talk about how you can find the area of the outside of the roll.
- Use a ruler to estimate the area of the outside of the roll.
- Cut the roll and press it out flat. Then find the area of the flattened cardboard. How close is your estimate to the actual area?



The surface area of a cylinder is the sum of the areas of the bases and the lateral surface.

2 ACTIVITY: Finding Surface Area

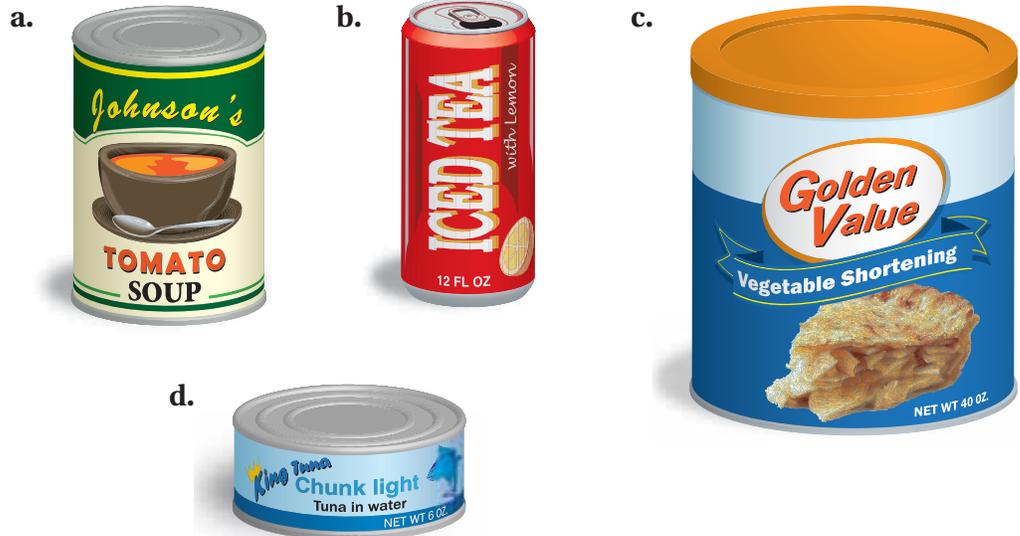
Work with a partner.



- Trace the top and bottom of a can on paper. Cut out the two shapes.
- Cut out a long paper rectangle. Make the width the same as the height of the can. Wrap the rectangle around the can. Cut off the excess paper so the edges just meet.
- Make a net for the can. Name the shapes in the net.
- How are the dimensions of the rectangle related to the dimensions of the can?
- Explain how to use the net to find the surface area of the can.

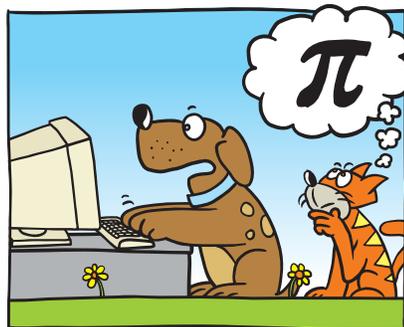
3 ACTIVITY: Estimation

Work with a partner. From memory, estimate the dimensions of the real-life item in inches. Then use the dimensions to estimate the surface area of the item in square inches.



What Is Your Answer?

4. **IN YOUR OWN WORDS** How can you find the surface area of a cylinder? Give an example with your description. Include a drawing of the cylinder.
5. To eight decimal places, $\pi \approx 3.14159265$. Which of the following is closest to π ?
 - a. 3.14
 - b. $\frac{22}{7}$
 - c. $\frac{355}{113}$



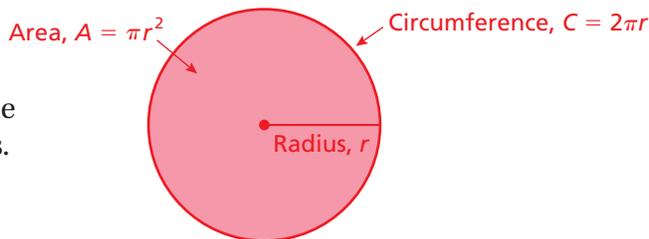
"To approximate the irrational number $\pi \approx 3.141593$, I simply remember 1, 1, 3, 3, 5, 5."



"Then I compute the rational number $\frac{355}{113} \approx 3.141593$."

Practice

Use what you learned about the surface area of a cylinder to complete Exercises 5–7 on page 266.



The diagram reviews some important facts for circles.

Key Idea

Surface Area of a Cylinder

Words The surface area S of a cylinder is the sum of the areas of the bases and the lateral surface.

Remember

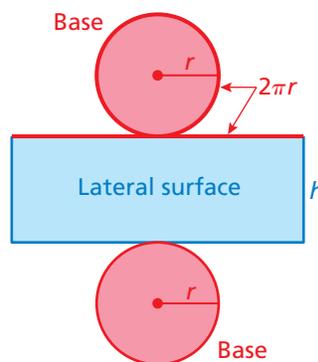
$$\pi = \frac{\text{circumference}}{\text{diameter}}$$

Pi can be approximated as 3.14 or $\frac{22}{7}$.

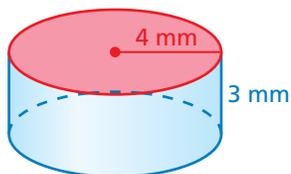
Algebra $S = 2\pi r^2 + 2\pi rh$

Area of bases

Area of lateral surface



EXAMPLE 1 Finding the Surface Area of a Cylinder

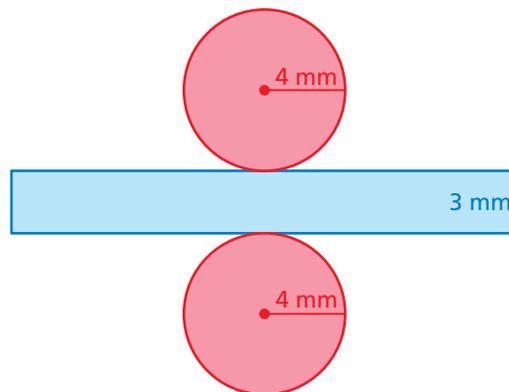


Find the surface area of the cylinder. Round your answer to the nearest tenth.

Draw a net.

$$\begin{aligned} S &= 2\pi r^2 + 2\pi rh \\ &= 2\pi(4)^2 + 2\pi(4)(3) \\ &= 32\pi + 24\pi \\ &= 56\pi \approx 175.8 \end{aligned}$$

∴ The surface area is about 175.8 square millimeters.



On Your Own

1. A cylinder has a radius of 2 meters and a height of 5 meters. Find the surface area of the cylinder. Round your answer to the nearest tenth.

Now You're Ready
Exercises 8–10

EXAMPLE 2 Finding Surface Area

How much paper is used for the label on the can of peas?

Find the *lateral* surface area of the cylinder.



$$S = 2\pi rh$$

Do not include the area of the bases in the formula.

$$= 2\pi(1)(2)$$

Substitute.

$$= 4\pi \approx 12.56$$

Multiply.

⚡ About 12.56 square inches of paper is used for the label.

EXAMPLE 3 Real-Life Application

You earn \$0.01 for recycling the can in Example 2. How much can you expect to earn for recycling the tomato can? Assume that the recycle value is proportional to the surface area.

Find the surface area of each can.



Tomatoes

$$S = 2\pi r^2 + 2\pi rh$$

$$= 2\pi(2)^2 + 2\pi(2)(5.5)$$

$$= 8\pi + 22\pi$$

$$= 30\pi$$

Peas

$$S = 2\pi r^2 + 2\pi rh$$

$$= 2\pi(1)^2 + 2\pi(1)(2)$$

$$= 2\pi + 4\pi$$

$$= 6\pi$$

Use a proportion to find the recycle value x of the tomato can.

$$\frac{30\pi \text{ in.}^2}{x} = \frac{6\pi \text{ in.}^2}{\$0.01}$$

surface area

recycle value

$$30\pi \cdot 0.01 = x \cdot 6\pi$$

Use Cross Products Property.

$$5 \cdot 0.01 = x$$

Divide each side by 6π .

$$0.05 = x$$

Simplify.

⚡ You can expect to earn \$0.05 for recycling the tomato can.

On Your Own

Now You're Ready
Exercises 11–13

2. **WHAT IF?** In Example 3, the height of the can of peas is doubled.

a. Does the amount of paper used in the label double?

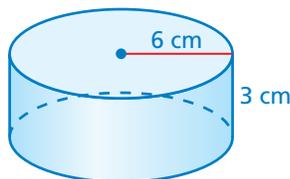
b. Does the recycle value double? Explain.

Vocabulary and Concept Check

- CRITICAL THINKING** Which part of the formula $S = 2\pi r^2 + 2\pi rh$ represents the lateral surface area of a cylinder?
- CRITICAL THINKING** Given the height and the circumference of the base of a cylinder, describe how to find the surface area of the entire cylinder.

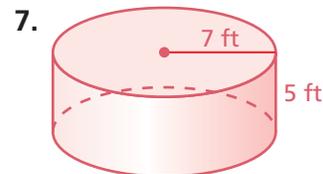
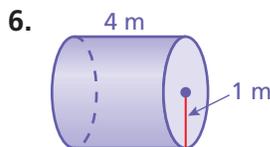
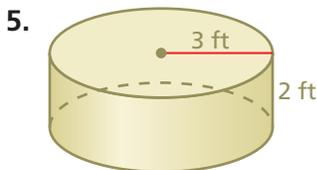
Find the indicated area of the cylinder.

- Area of a base
- Surface area

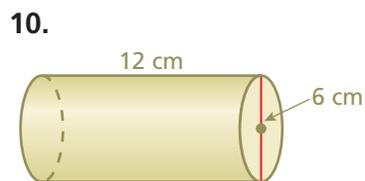
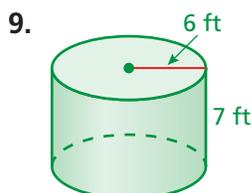
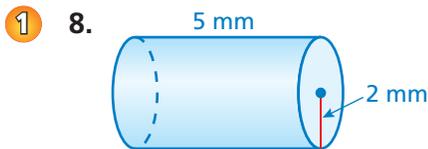


Practice and Problem Solving

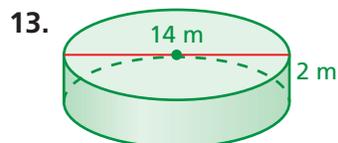
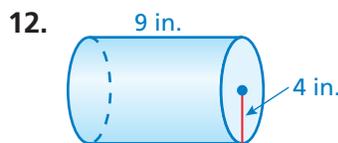
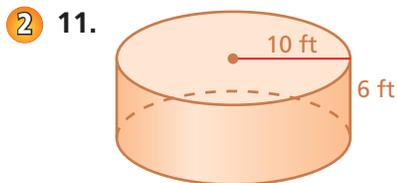
Make a net for the cylinder. Then find the surface area of the cylinder. Round your answer to the nearest tenth.



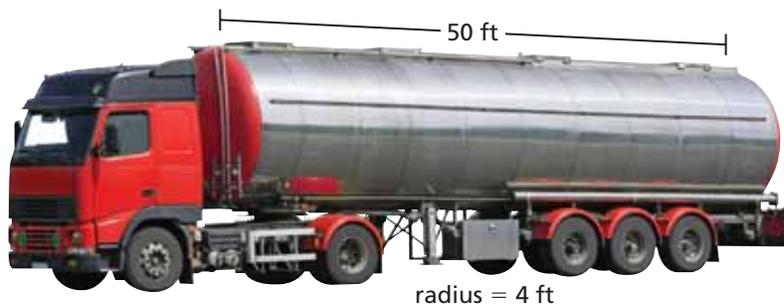
Find the surface area of the cylinder. Round your answer to the nearest tenth.



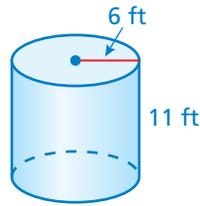
Find the lateral surface area of the cylinder. Round your answer to the nearest tenth.



14. **TANKER** The truck's tank is a stainless steel cylinder. Find the surface area of the tank.



15. **ERROR ANALYSIS** Describe and correct the error in finding the surface area of the cylinder.

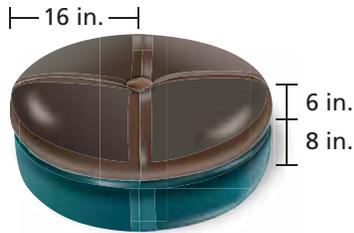


X

$$S = 2\pi rh$$

$$\approx 2\pi(6)(11)$$

$$= 132\pi \text{ ft}^2$$



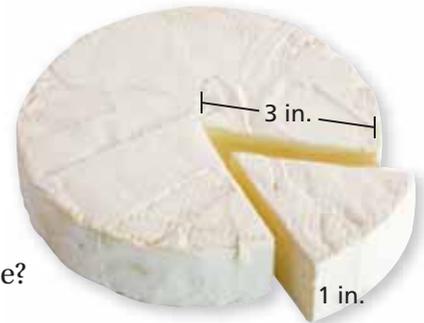
16. **OTTOMAN** What percent of the surface area of the ottoman is green (not including the bottom)?
17. **REASONING** You make two cylinders using 8.5-inch by 11-inch pieces of paper. One has a height of 8.5 inches and the other has a height of 11 inches. Without calculating, compare the surface areas of the cylinders.



18. **INSTRUMENT** A ganza is a percussion instrument used in samba music.
- Find the surface area of each of the two labeled ganzas.
 - The weight of the smaller ganza is 1.1 pounds. Assume that the surface area is proportional to the weight. What is the weight of the larger ganza?

19. **BRIE CHEESE** The cut wedge represents one-eighth of the cheese.

- Find the surface area of the cheese before it is cut.
- Find the surface area of the remaining cheese after the wedge is removed. Did the surface area increase, decrease, or remain the same?



20. **Critical Thinking** The lateral surface area of a cylinder is 184 square centimeters. The radius is 9 centimeters. What is the surface area of the cylinder? Explain how you found your answer.



Fair Game Review what you learned in previous grades & lessons

Evaluate the expression.

21. $\frac{1}{2}(26)(9)$

22. $\frac{1}{2}(8.24)(3) + 8.24$

23. $\frac{1}{2}(18.84)(3) + 28.26$

24. **MULTIPLE CHOICE** A store pays \$15 for a basketball. The percent of markup is 30%. What is the selling price?

(A) \$10.50

(B) \$19.50

(C) \$30

(D) \$34.50