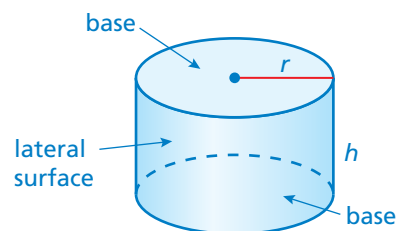## Essential Question How can you find the surface area of a cylinder?

A *cylinder* is a solid that has two parallel, identical circular bases.

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.**

- **Estimate the area using the methods you discussed.**

- **Use the roll and the scissors to find the actual area of the cardboard.**

- **Compare the actual area to your estimates.**

2 ACTIVITY: Finding Surface Area

Work with a partner.

Geometry
In this lesson, you will
- find surface areas of cylinders.

- **Make a net for the can. Name the shapes in the net.**

- **Find the surface area of the can.**

- **How are the dimensions of the rectangle related to the dimensions of the can?**

Math Practice

View as Components

How can you use the results of Activity 2 to help you identify the components of the surface area?

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.

a.

Johnson's

TOMATO SOUP

b.

ICED TEA *with Lemon*

12 FL OZ

c.

Golden Value

Vegetable Shortening

NET WT 40 OZ.

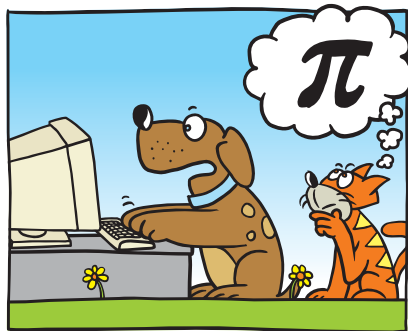d.

King Tuna **Chunk light**
Tuna in water
NET WT 6 OZ.

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. $\dfrac{22}{7}$ 　　　　　　　c. $\dfrac{355}{113}$

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

Help is on the way.

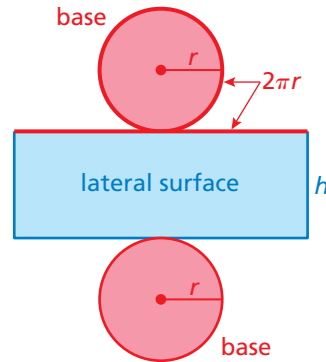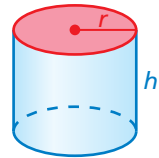"Then I compute $\dfrac{355}{113} \approx 3.141593$."

Practice

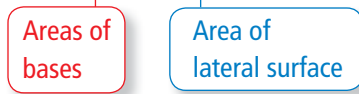Use what you learned about the surface area of a cylinder to complete Exercises 3–5 on page 372.

🔑 Key Idea

Surface Area of a Cylinder

Remember

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

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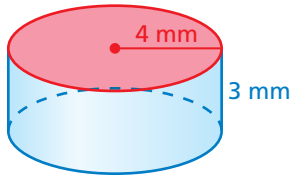
base

r

h

$2\pi r$

lateral surface h

r

base

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

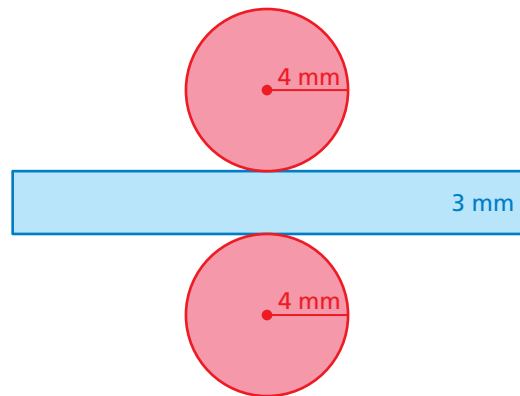Areas of bases

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.

4 mm

3 mm

Draw a net.

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

$$= 2\pi(4)^2 + 2\pi(4)(3)$$

$$= 32\pi + 24\pi$$

$$= 56\pi$$

$$\approx 175.8$$

4 mm

3 mm

4 mm

∴ The surface area is about 175.8 square millimeters.

🔴 On Your Own

Now You're Ready
Exercises 6–8

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

1.
6 yd

9 yd

2.
3 cm

18 cm
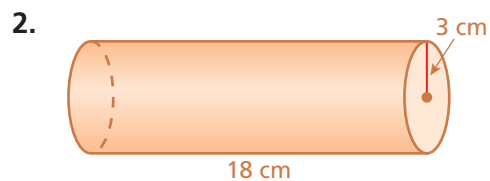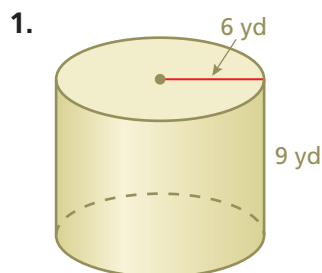
EXAMPLE **2** **Finding Surface Area**

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

Find the lateral surface area of the cylinder.

1 in.

2 in.

> Do not include the areas of the bases in the formula.

$$S = 2\pi rh$$

$$= 2\pi(1)(2) \qquad \text{Substitute.}$$

$$= 4\pi \approx 12.56 \qquad \text{Multiply.}$$

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.

2 in.

5.5 in.

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.

$$\frac{30\pi \text{ in.}^2}{x} = \frac{6\pi \text{ in.}^2}{\$0.01} \quad \begin{matrix} \text{surface area} \\ \text{recycle value} \end{matrix}$$

$$30\pi \cdot 0.01 = x \cdot 6\pi \qquad \text{Cross Products Property}$$

$$5 \cdot 0.01 = x \qquad \text{Divide each side by } 6\pi.$$

$$0.05 = x \qquad \text{Simplify.}$$

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

🔴 **On Your Own**

Now You're Ready
Exercises 9–11

**3.** **WHAT IF?** In Examples 2 and 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

1. **CRITICAL THINKING** Which part of the formula $S = 2\pi r^2 + 2\pi rh$ represents the lateral surface area of a cylinder?

2. **CRITICAL THINKING** You are given the height and the circumference of the base of a cylinder. Describe how to find the surface area of the entire cylinder.

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.**
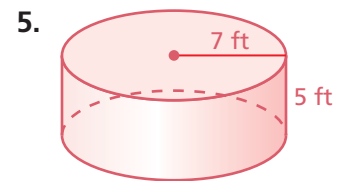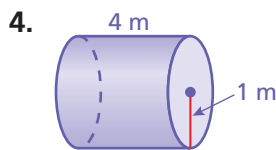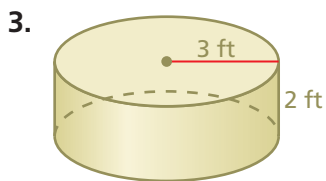
3.
3 ft
2 ft

4.
4 m
1 m

5.
7 ft
5 ft

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

① 6.
5 mm
2 mm

7.
6 ft
7 ft

8.
12 cm
6 cm

Find the lateral surface area of the cylinder. Round your answer to the nearest tenth.
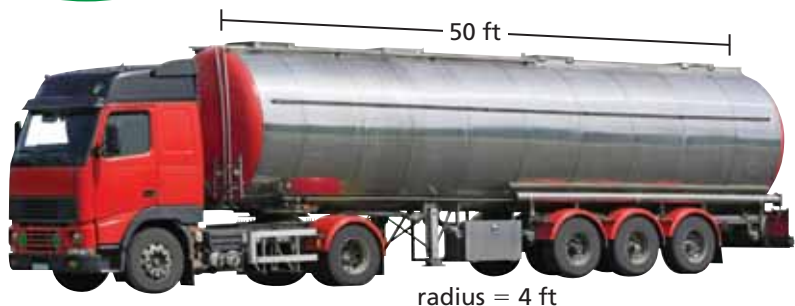
② 9.
10 ft
6 ft

10.
9 in.
4 in.

11.
14 m
2 m
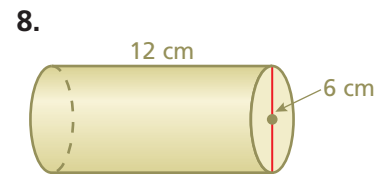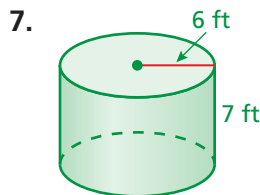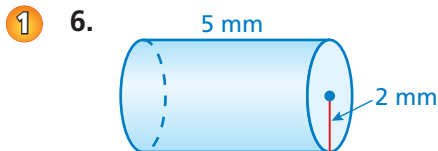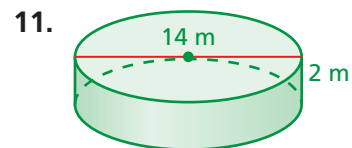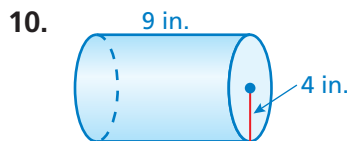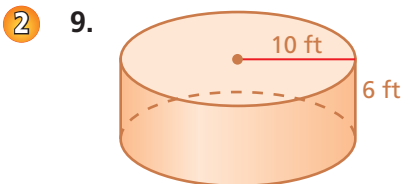
12. **ERROR ANALYSIS** Describe and correct the error in finding the surface area of the cylinder.
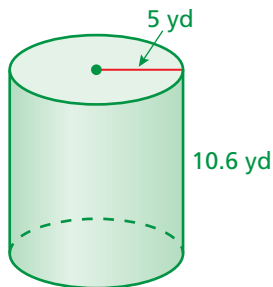
5 yd
10.6 yd

✗
$S = \pi r^2 + 2\pi rh$
$= \pi(5)^2 + 2\pi(5)(10.6)$
$= 25\pi + 106\pi$
$= 131\pi \approx 411.3 \text{ yd}^2$

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

50 ft

radius = 4 ft

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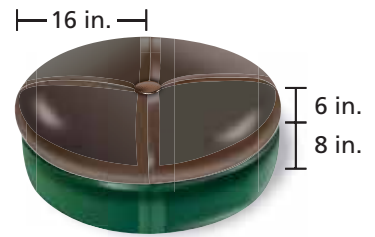
15. REASONING You make two cylinders using 8.5-by-11-inch pieces of paper. One has a height of 8.5 inches, and the other has a height of 11 inches. Without calculating, compare the surface areas of the cylinders.

16 in.

6 in.
8 in.

16. INSTRUMENT A *ganza* is a percussion instrument used in samba music.

   a. Find the surface area of each of the two labeled ganzas.

   b. 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?

10 cm

24.5 cm

3.5 cm

5.5 cm

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

   a. Find the surface area of the cheese before it is cut.

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

3 in.

1 in.

18. Repeated Reasoning A cylinder has radius r and height h.

   a. How many times greater is the surface area of a cylinder when both dimensions are multiplied by a factor of 2? 3? 5? 10?

   b. Describe the pattern in part (a). How many times greater is the surface area of a cylinder when both dimensions are multiplied by a factor of 20?

r

h
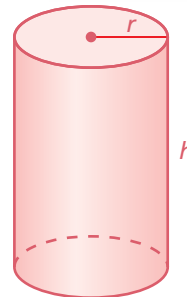
Fair Game Review *What you learned in previous grades & lessons*

Find the area. *(Skills Review Handbook)*

19.

2 ft

5 ft

20.

4 cm

8 cm

21.

7 in.

5 in.

12 in.
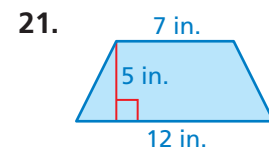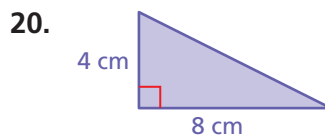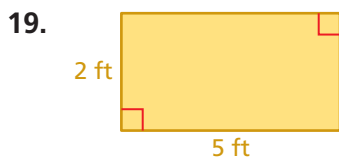
22. MULTIPLE CHOICE 40% of what number is 80? *(Section 6.4)*

   Ⓐ 32   Ⓑ 48   Ⓒ 200   Ⓓ 320