

# Key Concepts

Lesson  
7-7

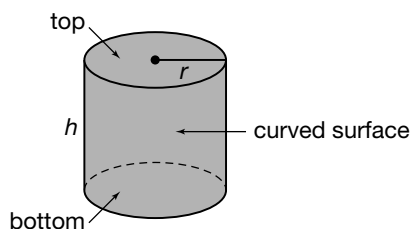
## Surface Area of Cylinders

**Objective** Teach students how to compute the surface area of a cylinder.

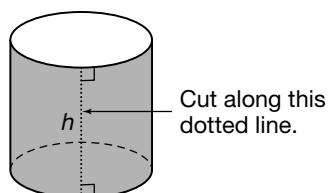
**Note to the Teacher** *Begin the lesson by comparing the surfaces of a cylinder to those of a rectangular prism. Point out that both a cylinder and a rectangular prism have a pair of congruent bases, but that a cylinder has a curved surface that connects its circular bases rather than the four “side” faces that connect the rectangular bases of a rectangular prism. Stress that while students know how to find the area of the circular bases of a cylinder, finding the area of the curved surface requires some visual manipulation of the cylinder.*

### Two Circles and a Curved Surface

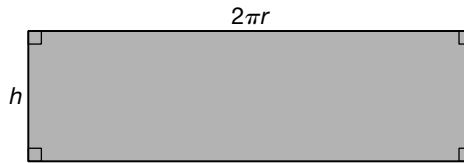
Have a discussion to see if your students can come up with a formula for the surface area of a cylinder. Guide the discussion so that they remember that the surface area is the total area of the top and bottom of the cylinder, which are congruent circles each having area  $\pi r^2$ , and the area of the curved surface (the “sides”) of the cylinder.



Focus students' attention on the curved surface of a cylinder. Have them imagine a hollow cylinder from which they have just removed the top and bottom. Ask your students to imagine cutting the remaining curved surface of the cylinder along its height dimension and flattening it out.



When flattened out, the surface is a rectangle of height  $h$  (the height of the cylinder) whose other side length is equal to the circumference of the circle, which is  $2\pi r$ .



The area formula for a rectangle therefore shows that the area of the curved surface of a cylinder is the product of  $h$  and  $2\pi r$  or  $2\pi rh$ .

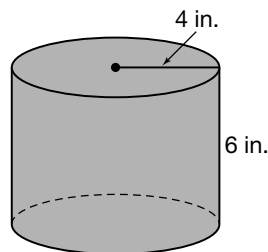
**Note to the Teacher** *It may be helpful to actually have your students use a rectangular piece of paper to model the curved surface of a cylinder by holding one pair of opposite ends of the paper together.*

So, the total surface area of a cylinder with radius  $r$  and height  $h$  is the sum of the areas of the top and bottom circular bases ( $2 \cdot \pi r^2$ ) and the area of the curved surface ( $2\pi rh$ ).

$$\text{surface area} = 2\pi r^2 + 2\pi rh$$

Do an example in class, and then assign more examples for your students to do either individually or in small groups. Here is a good example to do on the chalkboard.

**Example** Find the surface area of a cylinder of radius 4 inches and height 6 inches.



**Solution** The formula that we just derived for the surface area of a circular cylinder is

$$\text{surface area} = 2\pi r^2 + 2\pi rh.$$

In this case, we have  $r = 4$  and  $h = 6$ . So,

$$\begin{aligned}\text{surface area} &= 2\pi(4^2) + 2\pi(4)(6) && \text{Replace } r \text{ with } 4 \text{ and} \\ & && \text{ } h \text{ with } 6. \\ &= 2\pi(16) + 2\pi(24) \\ &= 32\pi + 48\pi \\ &= 80\pi\end{aligned}$$

So the surface area of the cylinder is  $80\pi$  square inches. If we approximate  $\pi$  as 3.14 and use a calculator, then we find that the surface area of this cylinder is about 251.2 square inches.

