

2.6

Making Concrete Stronger

Volume and Surface Area of a Cylinder

Objectives

In this lesson, you will:

- Find volumes of cylinders.
- Find surface areas of cylinders.

Key Terms

- cylinder
- height



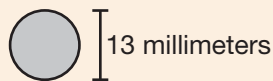
SCENARIO If you have ever seen highway construction workers preparing a roadway for a concrete surface, you might have seen the workers laying out steel reinforcing bars, or rebar for short. The rebar makes the concrete surface stronger.

Problem 1 Reinforcing Concrete

A simple model of a piece of rebar is shown below. Rebar has small raised grooves on it so that it is better integrated with the concrete. The model below doesn't include the grooves.



- A.** A view of one end of the rebar is shown below. What is the area of the end? Use 3.14 for π and round your answer to the nearest square millimeter if necessary. Use a complete sentence in your answer.



- B.** Describe the shape of the piece of rebar. Use a complete sentence in your answer.
- C.** How is this solid different from the solids that you have been investigating so far in this chapter? Use complete sentences in your answer.



2

Investigate Problem 1

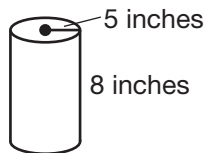


Take Note

A **right cylinder** is a cylinder in which the segment that connects the centers of the bases is perpendicular to the bases. We will only consider right cylinders in this chapter.

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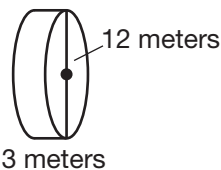
1. **Just the Math: Cylinder** A piece of rebar is in the shape of a *cylinder*. A **cylinder** is a solid that has two congruent parallel bases that are circles. The **height** of a cylinder is the perpendicular distance between bases. Identify the radius, diameter, and height of each cylinder.



Radius: _____

Diameter: _____

Height: _____



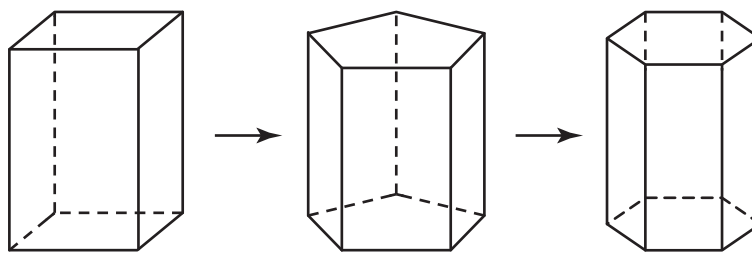
Radius: _____

Diameter: _____

Height: _____



2. Consider the square prism shown below at the left. Then imagine that the bases change to regular pentagons as shown in the center. Now imagine that the bases change to regular hexagons as shown on the right.



Suppose that you continue this process and keep increasing the number of sides in the polygons that form the bases. What shape do you think the bases will eventually form? Use complete sentences to explain your reasoning.

How does this help you figure out how to find the volume of a cylinder? Use a complete sentence in your answer.

Investigate Problem 1



- 3. Just the Math: Volume of a Cylinder** The volume V of a cylinder with radius r and height h is given by

$$V = \pi r^2 h.$$

Use complete sentences to explain in your own words how to find the volume of a cylinder in terms of the area of a base.



- 4.** A piece of rebar is 75 centimeters long and has a diameter of 13 millimeters. What is the diameter of the piece of rebar in centimeters? Show all your work and use a complete sentence in your answer.

Take Note

Whenever you are making a calculation that involves one or more measurements, the measurements should all use the same units. For instance, if a calculation involves several measurements of time, all of the times should be in hours, or all of the times should be in seconds, and so on.

What is the total volume of this piece of rebar? Show all your work and use a complete sentence in your answer. Use 3.14 for π and round your answer to the nearest tenth if necessary.

- 5.** Suppose that a construction worker cuts a section of the rebar that is described in Question 4. This section of rebar is one centimeter long and weighs approximately 0.01 kilogram. Find the weight of the piece of rebar from Question 4. Show all your work and use a complete sentence in your answer.

Investigate Problem 1



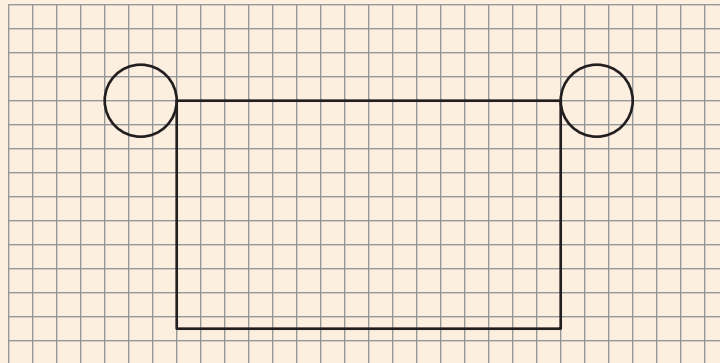
6. Rebar is also used in concrete sidewalks. A sidewalk is being made. A worker needs to use 3 pieces of rebar that are each 300 centimeters long and 10 pieces of rebar that are each 90 centimeters long. The diameter and weight of each piece of rebar are the same as in Questions 4 and 5. How much steel in cubic centimeters will be in the sidewalk? How much will it weigh? Use 3.14 for π . Show all your work and use a complete sentence in your answer.

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Problem 2 Surface of a Cylinder



- A. Draw the figure below on a sheet of graph paper exactly as shown. Then cut out the figure and tape the longer sides together to form a cylinder.



- B. What shapes were used to form your model of a cylinder? Use a complete sentence in your answer.

Problem 2 Surface of a Cylinder

- C. Use your model to help you explain how you would find the surface area of a cylinder. Use complete sentences in your answer.

Investigate Problem 2



1. Consider the rectangle on the grid in part (A). What is the length of this rectangle? Use a complete sentence in your answer.

How does the width of the rectangle relate to the circle?
Use a complete sentence in your answer.

Find the width of the rectangle. Show all your work and use a complete sentence in your answer. Use 3.14 for π .

Find the area of the rectangle. Use a complete sentence in your answer.

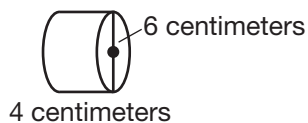
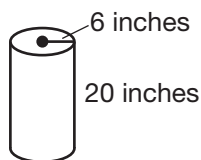
2. Find the area of the bases of the cylinder in Problem 2. Show all your work and use a complete sentence in your answer. Use 3.14 for π .
3. Find the surface area of the cylinder in Problem 2. Show all your work and use a complete sentence in your answer.

Investigate Problem 2

4. Write a formula for the surface area of a cylinder. Use S for the surface area, r for the radius, and h for the height.



5. Find the surface area of each cylinder. Show all your work and use a complete sentence in your answer. Use 3.14 for π .



6. Find the surface area of a piece of rebar that has a diameter of 1.3 centimeters and a height of 75 centimeters. Show all your work and use a complete sentence in your answer. Use 3.14 for π and round your answer to the nearest tenth.

