# Lesson 62

Finding Surface Areas and Volumes of Cylinders

Cylinder – A three-dimensional figure with two parallel circular bases and a curved lateral surface that connects the bases.

Base of a Cylinder – One of the two circular surfaces of the cylinder.

Altitude of a cylinder – The segment that is perpendicular to, and has its endpoints on the planes of the bases. The length of the altitude is the height of the cylinder.

Radius of a cylinder – The distance from the center of the cylinder's base to any point on the edge of the base.
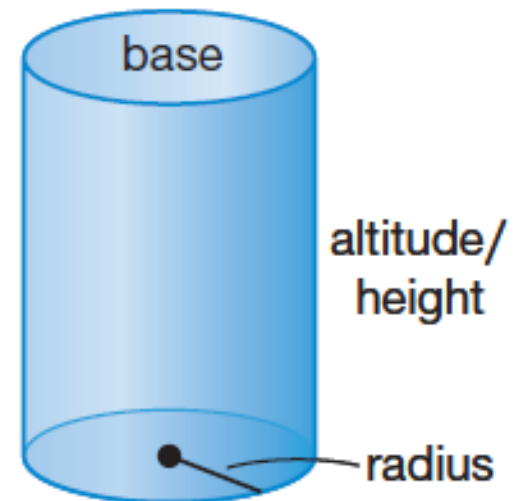
Exploration Analyzing the Net of a Cylinder

In this exploration, you will create and analyze the net of a cylinder.

1. What plane figures comprise the net of a cylinder?

2. Draw circle *P* with a radius of 2.5 cm. This will be one base of the cylinder. How can you draw the other base of the cylinder?

3. What is the total area of both bases to the nearest hundredth square centimeter?

4. What would be the length and width of the rectangular piece of the net?

5. Calculate the appropriate length for the rectangular piece to the nearest millimeter. The height of the finished cylinder should be 8 cm. Use a ruler and a protractor to draw the lateral surface of the cylinder. What is the area of the lateral surface?

6. Cut out the bases and the lateral surface for your cylinder.

Use a small piece of tape to attach the bases to the lateral surface as shown in the figure below. What is the total area of the net?

7. Use small pieces of tape to construct the cylinder from your net. How is the surface area of the cylinder related to the total area of the net?

The lateral area of a cylinder is the area of the curved surface of a cylinder. The diagram shows the net of a cylinder.

When the cylinder is unfolded, the lateral area is actually a rectangle that has a length equal to the circumference of the cylinder's base.
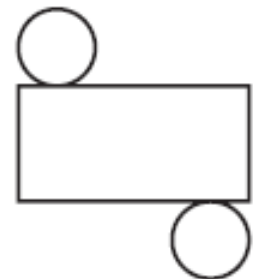
Lateral Area of a Cylinder – Use the following formula for the lateral area of a cylinder where r is the radius and h is the height of the cylinder.

$$L = 2\pi rh$$

Example 1 Finding the Lateral Area of a Cylinder

Find the lateral area of the cylinder in terms of π.

SOLUTION

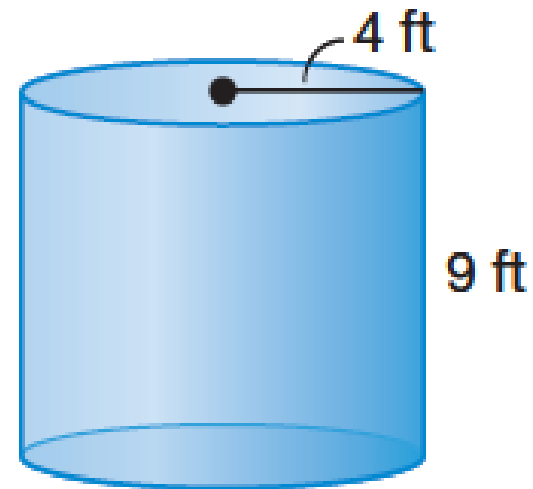Use the formula for lateral area.

$L = 2\pi rh$ Lateral Area

$L = 2\pi(4)(9)$ Substitute

$L = 72\pi$ ft 2   Simplify

4 ft

9 ft

To find the total surface area of a cylinder, find the lateral area and add it to the area of the two circular bases.

Surface Area of a Cylinder – Use the following formula to find the total surface area of a cylinder where B is the area of a base and L is the lateral area.

$$S = 2B + L$$

If the formula for the area of each circular base and the formula for lateral area are substituted into the formula for surface area, it becomes:

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

Example 2 Finding the Surface Area of a Cylinder

Find the total surface area of the cylinder in terms of π.

SOLUTION

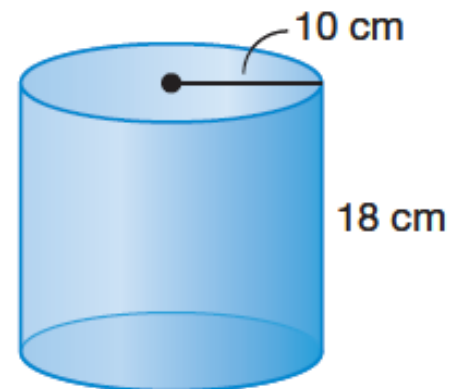Use the formula for surface area.

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

$S = 2\pi(10)^2 + 2\pi(10)(18)rh$ Substitute

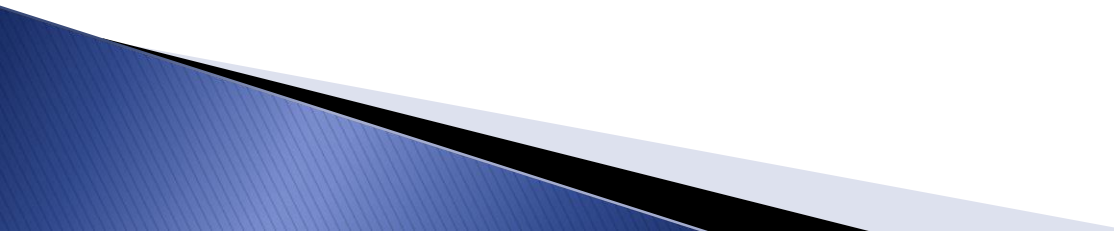$S = 560\pi cm^2$ Simplify

10 cm

18 cm

Taking the volume of a cylinder can be described as taking the base and dropping it through the height.

Volume of a Cylinder – The volume of a cylinder can be found by multiplying the area of the base by the height. Since the base is a circle, use the formula:
$$V = \pi r^2 h$$

The cylinders in the examples above are right cylinders. A right cylinder's bases are aligned directly above one another. If the bases of a cylinder are not aligned directly on top of each other, it is an oblique cylinder. The height of an oblique cylinder can be found by dropping an altitude from one base to the plane that contains the second base.

Example 3 Finding the Volume of a Cylinder

Find the volume of the right cylinder in terms of π.

SOLUTION

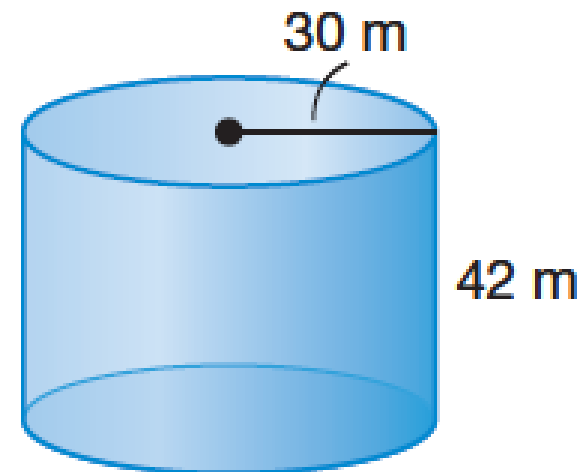Use the formula for volume of a cylinder:

$V = \pi r^2 h$ Volume of a cylinder

$V = \pi(30)^2(42)$ Substitute

$V = 37{,}800\pi m^3$ Simplify

30 m

42 m

Example 4 Application: Water Towers

The city of Lewiston has a cylindrical water tower that is 45 feet tall. The radius of the tower's base is 55 feet. How many cubic feet of water can the tower hold? Use 3.14 to approximate π.

SOLUTION

Find the volume of the cylindrical water tank.
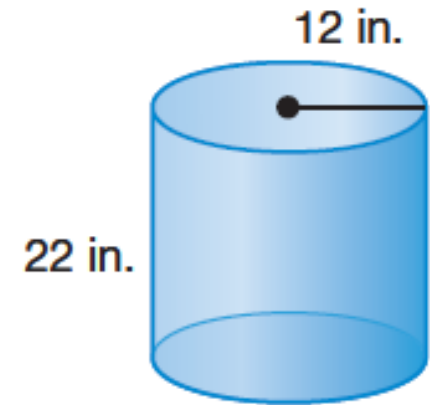
$$V = \pi r^2 h$$
$$V = \pi (55)^2 (45)$$
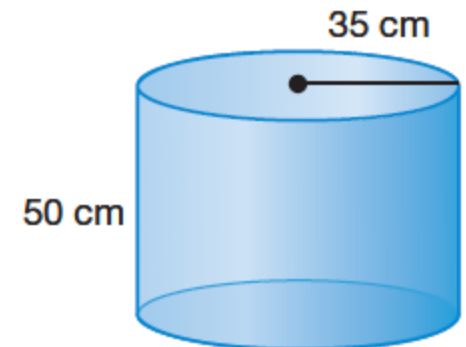$$V = 136{,}125\pi$$
$$V \approx 427{,}432.5 ft^3$$

The volume of the storage tank is approximately 427,432.5 cubic feet.

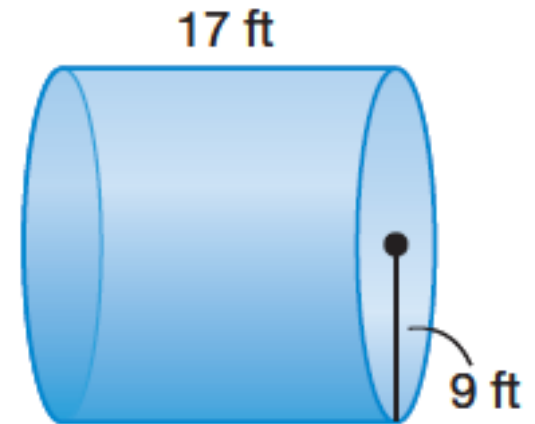# You Try!!!!!

a. Find the lateral area of the cylinder in terms

12 in.

22 in.

b.Find the total surface area of the cylinder to the nearest centimeter.

35 cm

50 cm

You Try!!!!!

c.Find the volume of the right cylinder to the nearest foot.

17 ft

9 ft

d.A farmer uses a cylindrical silo to store grain. The silo has a radius of 75 feet and is 150 feet tall. What is the storage capacity of the silo to the nearest foot?

Assignment

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　　Lesson Practice (Ask Mr. Heintz)

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　　Practice 1-30 (Do the starred ones first)