

12.2

Surface Area of Prisms and Cylinders

Goal • Find the surface areas of prisms and cylinders.

Your Notes

VOCABULARY

Prism A prism is a polyhedron with two congruent faces, called bases, that lie in parallel planes.

Lateral faces The lateral faces of a prism are parallelograms formed by connecting the corresponding vertices of the bases.

Lateral edges The lateral edges of a prism are the segments connecting the corresponding vertices of the bases.

Surface area The surface area of a polyhedron is the sum of the areas of its faces.

Lateral area The lateral area of a polyhedron is the sum of the areas of its lateral faces.

Net A net of a polyhedron is a two-dimensional representation of the faces of a polyhedron.

Right prism In a right prism, each lateral edge is perpendicular to both bases.

Oblique prism An oblique prism is a prism with lateral edges that are not perpendicular to the bases.

Cylinder A cylinder is a solid with congruent circular bases that lie in parallel planes.

Right cylinder In a right cylinder, the segment joining the centers of the bases is perpendicular to the bases.

Your Notes

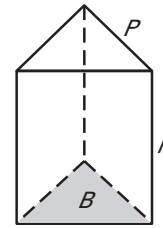
Remember, the *apothem* of a polygon is the distance from the center to any side of the polygon.

THEOREM 12.2: SURFACE AREA OF A RIGHT PRISM

The surface area S of a right prism is

$$S = 2B + Ph = aP + Ph,$$

where a is the apothem of the base, B is the area of a base, P is the perimeter of a base, and h is the height.



Example 1 Find the surface area of a right prism

Find the surface area of the right prism.

Solution

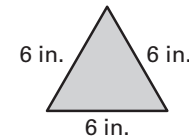
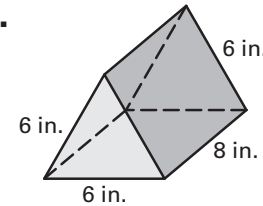
Each base is an equilateral triangle with a side length s of 6 inches. Using the formula for the area of an equilateral triangle, the area of each base is

$$\begin{aligned} B &= \frac{1}{4}\sqrt{3}(s^2) \\ &= \frac{1}{4}\sqrt{3}(\underline{6}^2) = \underline{9}\sqrt{3} \text{ in.}^2 \end{aligned}$$

The perimeter of each base is $P = \underline{18}$ in. and the height is $h = \underline{8}$ in.

$$\begin{aligned} S &= 2B + Ph && \text{Surface area of a right prism} \\ &= 2(\underline{9}\sqrt{3}) + \underline{18}(\underline{8}) && \text{Substitute.} \\ &\approx \underline{175.18} && \text{Simplify.} \end{aligned}$$

The surface area is about 175.18 square inches.



✓ Checkpoint Complete the following exercise.

1. Find the surface area of a right rectangular prism with height 5 feet, length 11 feet, and width 4 feet.
238 ft²

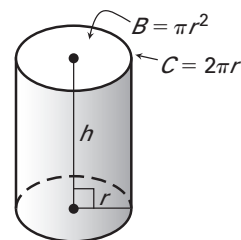
Your Notes

THEOREM 12.3: SURFACE AREA OF A RIGHT CYLINDER

The surface area S of a right cylinder is

$$S = 2B + Ch = \underline{2\pi r^2 + 2\pi rh},$$

where B is the area of a base, C is the circumference of a base, r is the radius of a base, and h is the height.

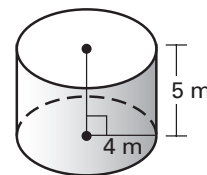


Example 2 Find the surface area of a cylinder

Find the surface area of the right cylinder.

Solution

Each base has a radius of 4 meters, and the cylinder has a height of 5 meters.



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

$$= 2\pi(\underline{4}^2) + 2\pi(\underline{4})(\underline{5})$$

$$= \underline{32} \pi + \underline{40} \pi$$

$$= \underline{72} \pi$$

$$\approx \underline{226.19}$$

Surface area of a cylinder

Substitute.

Simplify.

Add.

Use a calculator.

The surface area is about 226.19 square meters.

✓ Checkpoint Complete the following exercise.

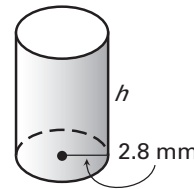
- Find the surface area of a right cylinder with height 9 centimeters and radius 6 centimeters. Round your answer to two decimal places.

$$565.49 \text{ cm}^2$$

Your Notes

Example 3 Find the height of a cylinder

Find the height of the right cylinder shown, which has a surface area of 198.8 square millimeters.



Solution

Substitute known values in the formula for the surface area of a right cylinder and solve for the height h .

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

Surface area
of a cylinder

$$198.8 = 2\pi(2.8)^2 + 2\pi(2.8)h$$

Substitute.

$$198.8 = 15.68\pi + 5.6\pi h$$

Simplify.

$$198.8 - 15.68\pi = 5.6\pi h$$

Subtract

15.68π
from each
side.

$$149.54 \approx 5.6\pi h$$

Simplify. Use
a calculator.

$$8.5 \approx h$$

Divide
each side
by 5.6π .

The height of the cylinder is about 8.5 millimeters.

✓ **Checkpoint** Complete the following exercise.

3. Find the radius of a right cylinder with height 5 inches and surface area 168π square inches.
7 in.

Homework