12.2 Surface Area of Prisms and Cylinders

Goal • Find the surface area of a prism and of a cylinder.

VOCABULARY

Prism A prism is a polyhedron with two congruent faces, called bases, that lie in parallel planes. The other faces, called lateral faces, are parallelograms formed by connecting the corresponding vertices of the bases. The segments connecting these vertices are lateral edges.

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

Oblique prisms Oblique prisms are prisms that have lateral edges that are not perpendicular to the bases. The length of the oblique lateral edges is the slant height of the prism.

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

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

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

Cylinder A cylinder is a solid with congruent circular bases that lie in parallel planes. The altitude, or height, of a cylinder is the perpendicular distance between its bases. The radius of the base is also called the radius of the cylinder.

Right cylinder A cylinder such that the segment joining the centers of the bases is perpendicular to the bases

Lateral area of a cylinder The lateral area of a cylinder is the area of its curved surface. The lateral area is equal to the product of the circumference and the height, which is $2\pi rh$.

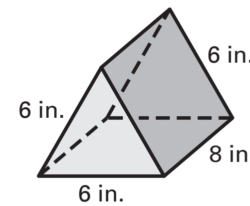
Surface area of a cylinder The sum of the lateral area and the areas of the two bases

THEOREM 12.2: SURFACE AREA OF A RIGHT PRISM

The surface area S of a right prism can be found using the formula $S = 2B +$ __*Ph*__, where B is the area of a base, P is the perimeter of a base, and h is the height.

Example 1 ***Using Theorem 12.2***

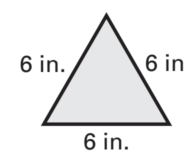
Find the surface area of the right prism.



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

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



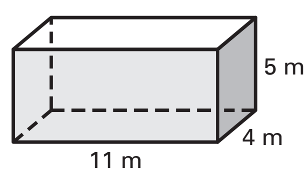
The perimeter of each base is $P =$ __18__ in. and the height is $h =$ __8__ in.

Answer So, the surface area is

$$S = 2B + Ph = 2(\underline{9}\sqrt{3}) + \underline{18}(\underline{8}) \approx \underline{175} \text{ in.}^2$$

Checkpoint Find the surface area of the right prism.

1.



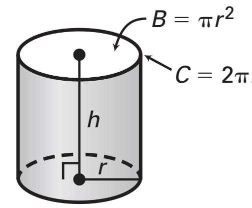
238 m^2

THEOREM 12.3: SURFACE AREA OF A RIGHT CYLINDER

The surface area S of a right cylinder is

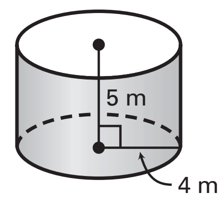
$S = 2B + Ch = \underline{2\pi r^2 + 2\pi rh}$,

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 ***Finding the Surface Area of a Cylinder***

Find the surface area of the right cylinder.



Solution

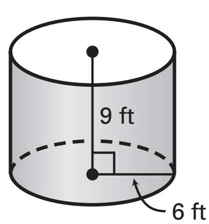
Each base has a radius of $\underline{4}$ meters, and the cylinder has a height of $\underline{5}$ meters.

$S = 2\pi r^2 + 2\pi rh$	**Formula for surface area of a cylinder**
$= 2\pi(\underline{4})^2 + 2\pi(\underline{4})(\underline{5})$	**Substitute.**
$= \underline{32}\pi + \underline{40}\pi$	**Simplify.**
$= \underline{72}\pi$	**Add.**
$\approx \underline{226.19}$	**Use a calculator.**

Answer The surface area is about $\underline{226}$ square meters.

✔ ***Checkpoint*** **Find the surface area of the right cylinder. Round your result to two decimal places.**

2.



565.49 ft^2