LESSON 10.5

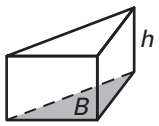
Volumes of Prisms and Cylinders

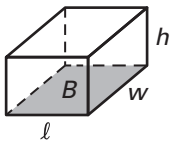
CA Standards
MG 2.1
AF 3.2

Goal: Find the volumes of prisms and cylinders.

Volume of a Prism

Words The volume of a prism is the product of the area B of the base and the height h.





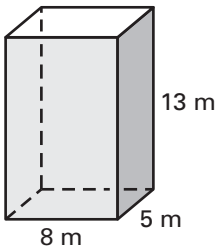
Algebra $V =$ Bh

WATCH OUT!
When you find the volume of a triangular prism, be careful not to confuse the height of the prism with the height of the triangular base.

EXAMPLE 1 Finding Volumes of Prisms

Find the volume of the prism.

a.



$V = Bh$

$= lwh$

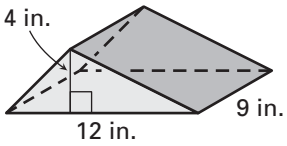
$=$ $8(5)(13)$

$=$ 520

Answer The volume is 520 cubic meters.

Notice that you can also use the formula $V = lwh$ when finding the volume of a rectangular prism.

b.



$V = Bh$

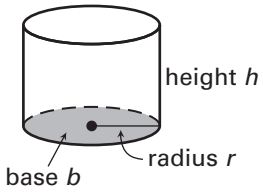
$=$ $\frac{1}{2}(12)(4)(9)$

$=$ 216

Answer The volume is 216 cubic inches.

Volume of a Cylinder

Words The volume of a cylinder is the product of the area B of the base and the height h.



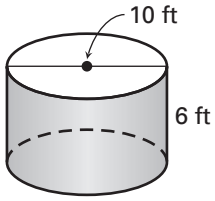
Algebra $V =$ Bh

$= \pi r^2 h$

Because the base of a cylinder is a circle, the area B of the base is πr^2.

EXAMPLE 2 Finding the Volume of a Cylinder

Find the volume of the cylinder.



Solution

The radius is one half the diameter,

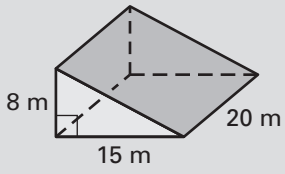
so $r =$ 5 ft .

$V = Bh$	Write formula for volume of a cylinder.
$= \pi r^2 h$	The area of a circular base is πr^2.
$= \pi($ 5 $)^2($ 6 $)$	Substitute 5 for r and 6 for h.
$=$ 150 π	Simplify.
$\approx$ 471.24	Evaluate using a calculator.

Answer The volume is about 471 cubic feet .

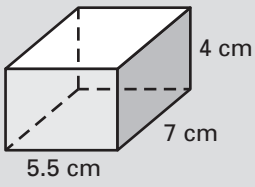
Guided Practice **Find the volume of the solid. Round to the nearest unit.**

1.



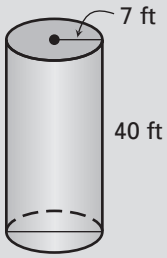
1200 m^3

2.



154 cm^3

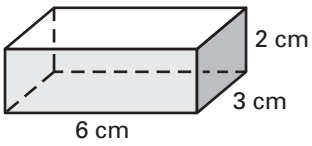
3.

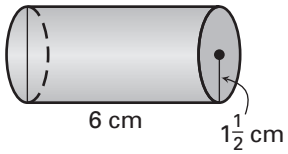


6158 ft^3

EXAMPLE 3 Comparing Volumes

Cheese At a grocery store, one type of cheddar cheese is sold in the shape of a rectangular prism, and another type is sold in the shape of a cylinder. Which shape of cheddar cheese has the greater volume?





To decide which shape of cheddar cheese has the greater volume, find the volume of each shape.

When the abbreviation for a unit of measure has an exponent of 3, you read the 3 as "cubic."
ft^3 = cubic feet
$in.^3$ = cubic inches

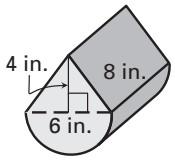
$V = Bh$
$= lwh$
$= 6(3)(2)$
$= 36$ cm^3

$V = Bh$
$= \pi r^2 h$
$= \pi\left(1\frac{1}{2}\right)^2(6)$
≈ 42.41 cm^3

Answer The cylindrical shape of cheddar cheese has the greater volume.

EXAMPLE 4 Finding the Volume of a Composite Solid

The composite solid shown is composed of a triangular prism and half of a cylinder. Find the volume of the solid in cubic centimeters.



Step 1 Find the volume of the triangular prism.

$V = Bh$ Write formula for volume of a prism.

$= \frac{1}{2}(6)(4)(8) = 96$ Substitute values. Then simplify.

Step 2 Find the volume of half of a cylinder.

$V = Bh$ Write formula for volume of a cylinder.

$= \frac{1}{2}\pi r^2 h$ Write formula for half the volume of a cylinder.

$= \frac{1}{2}\pi(3)^2(8) \approx 113.1$ Substitute values. Then simplify.

Because 1 in. = 2.54 cm, you know that $(1\text{ in.})^3 = (2.54\text{ cm})^3$. Therefore, $1\text{ in.}^3 \approx 16.39\text{ cm}^3$. Use this fact in Step 3.

Step 3 Calculate the volume of the composite solid in cubic centimeters. Find the sum of the volumes from Steps 1 and 2.

$V \approx 96 + 113.1 = 209.1\text{ in.}^3$

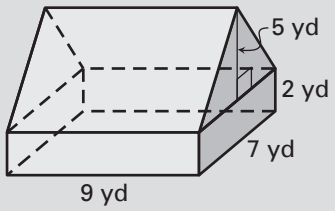
Then convert cubic inches to cubic centimeters.

$209.1\text{ in.}^3 \times \frac{16.39\text{ cm}^3}{1\text{ in.}^3} \approx 3427.1\text{ in.}^3$

Answer The volume of the solid is about 3427.1 in.^3.

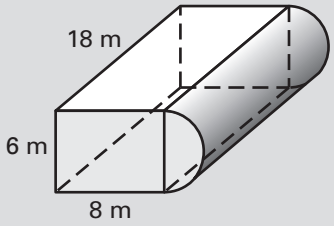
Guided Practice **Find the volume of the solid. Round to the nearest tenth.**

4.



283.5 yd^3

5.



1118.5 m^3

EXAMPLE 5 Graphing a Volume Function

A cylinder has a fixed radius of 4 inches. Graph the volume of the cylinder as a function of x, where x represents the height of the cylinder.

Solution

Step 1 Write a formula for the volume of the cylinder.

$V = \pi r^2 h$ Write formula for volume of a prism.

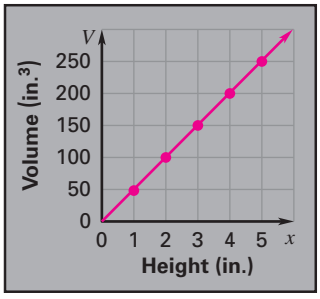
$= \pi \cdot (\boxed{4})^2 \cdot \boxed{x}$ Substitute.

$= \boxed{16\pi x}$ Simplify.

Step 2 Make a table.

x	V
1	50
2	101
3	151
4	201
5	251

Step 3 Graph the ordered pairs. Draw a line through the points.



Homework