

12.4 Volume of Prisms and Cylinders

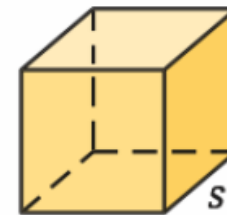
The **volume** of a solid is the number of cubic units contained in its interior. Volume is measured in cubic units, such as cubic centimeters (cm^3).

POSTULATES

For Your Notebook

POSTULATE 27 Volume of a Cube Postulate

The volume of a cube is the cube of the length of its side.



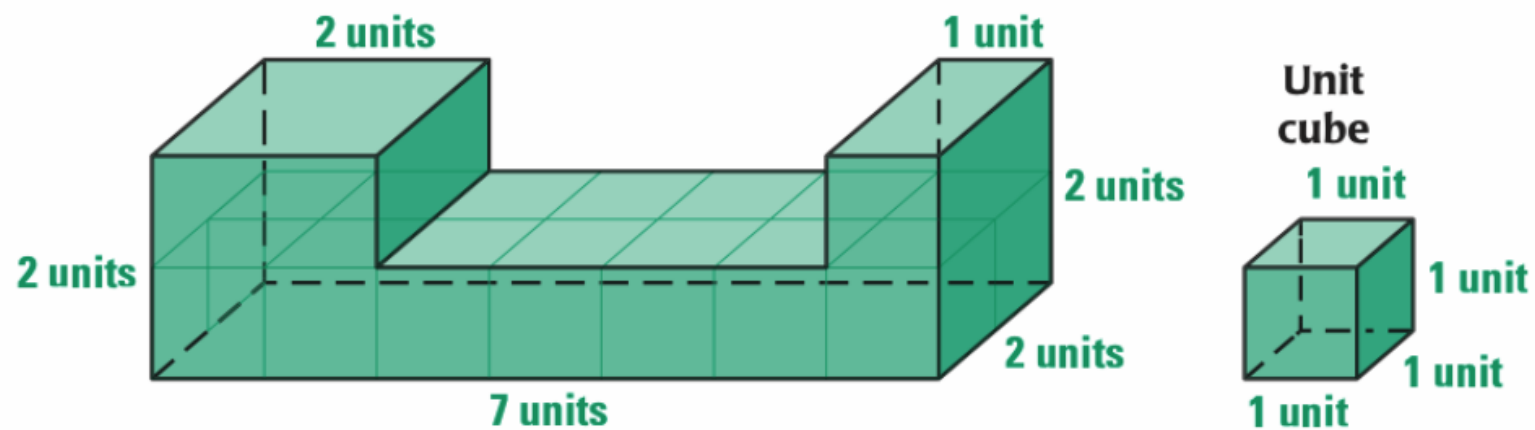
$$V = s^3$$

POSTULATE 28 Volume Congruence Postulate

If two polyhedra are congruent, then they have the same volume.

POSTULATE 29 Volume Addition Postulate

The volume of a solid is the sum of the volumes of all its nonoverlapping parts.

EXAMPLE 1 Find the number of unit cubes**3-D PUZZLE** Find the volume of the puzzle piece in cubic units.

VOLUME FORMULAS The volume of any right prism or right cylinder can be found by multiplying the area of its base by its height.

THEOREMS

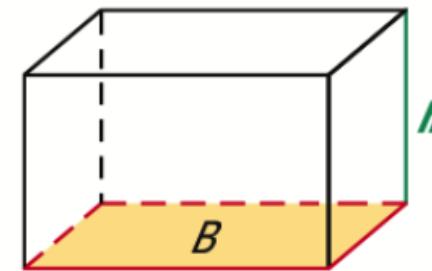
THEOREM 12.6 Volume of a Prism

The volume V of a prism is

$$V = Bh,$$

where B is the area of a base and h is the height.

For Your Notebook



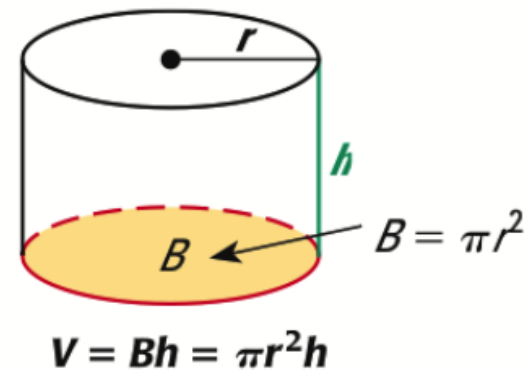
$$V = Bh$$

THEOREM 12.7 Volume of a Cylinder

The volume V of a cylinder is

$$V = Bh = \pi r^2 h,$$

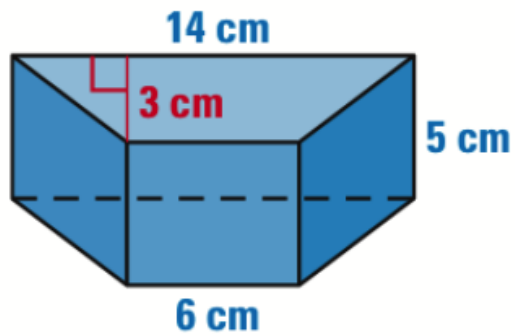
where B is the area of a base, h is the height, and r is the radius of a base.



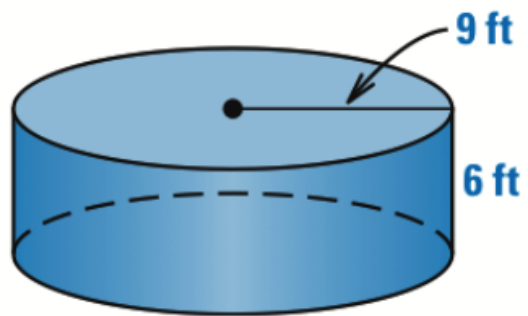
EXAMPLE 2**Find volumes of prisms and cylinders**

Find the volume of the solid.

a. Right trapezoidal prism



b. Right cylinder

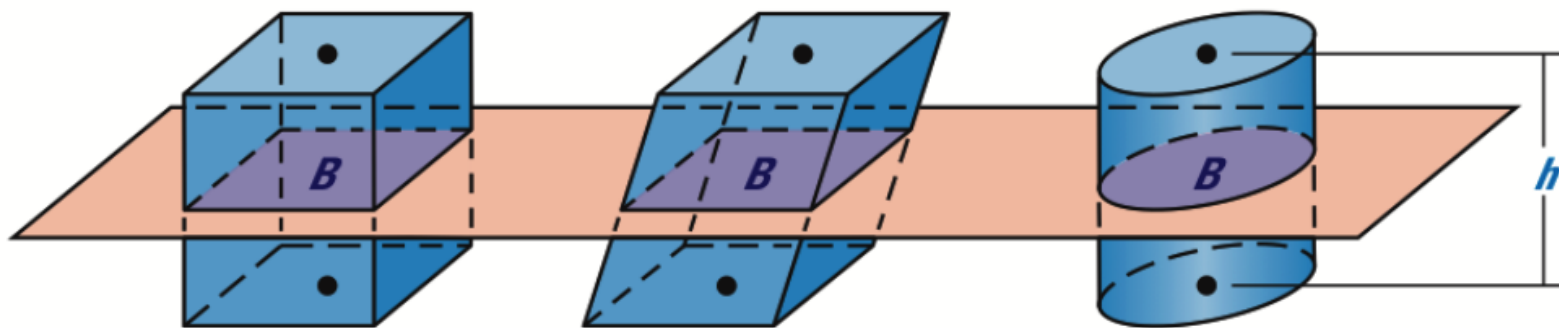


EXAMPLE 3 Use volume of a prism

xy ALGEBRA The volume of the cube is 90 cubic inches. Find the value of x .



USING CAVALIERI'S PRINCIPLE Consider the solids below. All three have equal heights h and equal cross-sectional areas B . Mathematician Bonaventura Cavalieri (1598–1647) claimed that all three of the solids have the same volume. This principle is stated below.



THEOREM

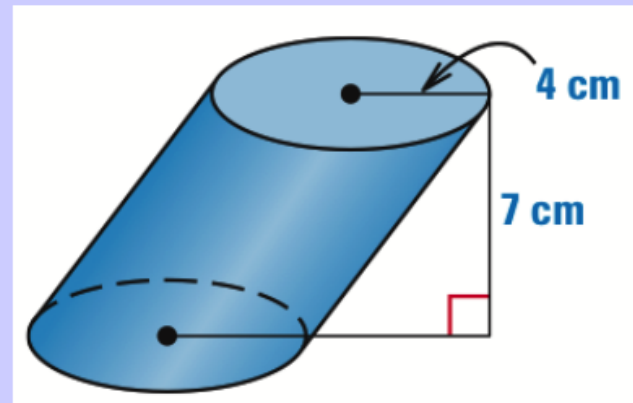
For Your Notebook

THEOREM 12.8 Cavalieri's Principle

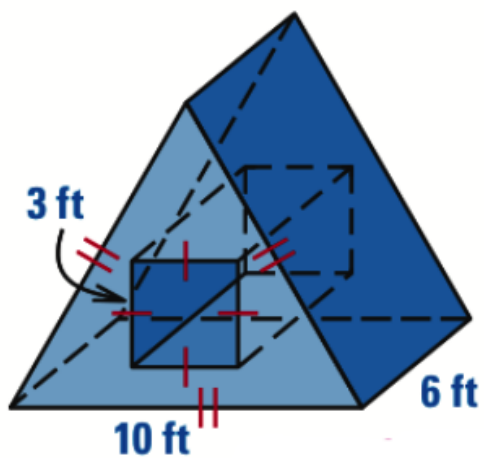
If two solids have the same height and the same cross-sectional area at every level, then they have the same volume.

EXAMPLE 4 Find the volume of an oblique cylinder

Find the volume of the oblique cylinder.



Find the volume of the solid shown below.

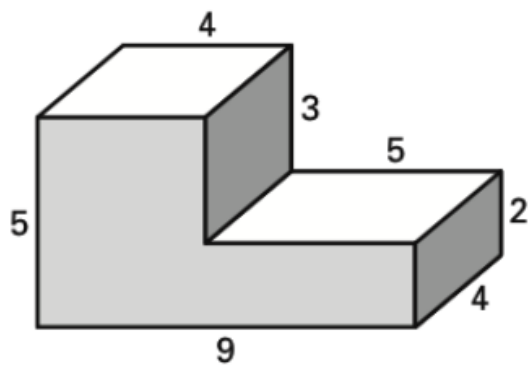
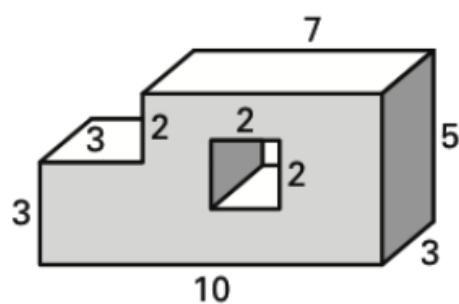
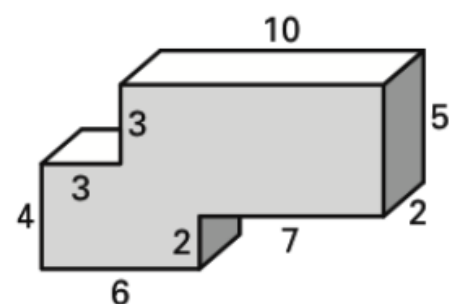


Assignment:

12.4 WS

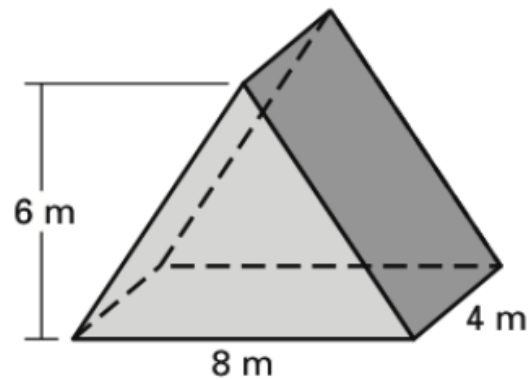
LESSON
12.4
Practice
For use with pages 819–825

Find the volume of the solid by determining how many unit cubes are contained in the solid.

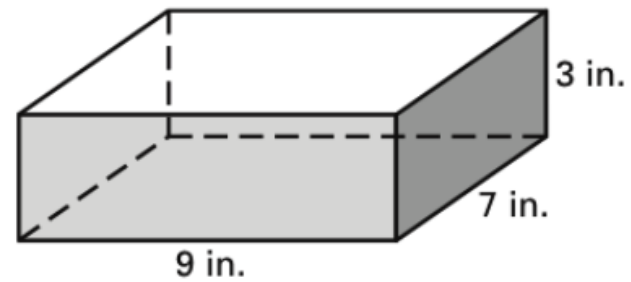
1.

2.

3.


Find the volume of the right prism or right cylinder. Round your answer to two decimal places.

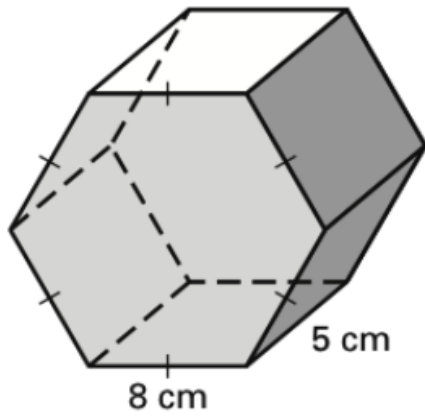
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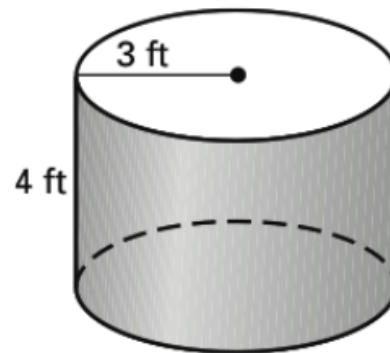
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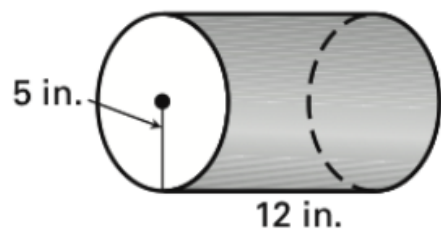
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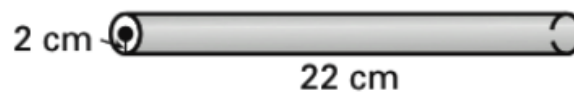
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8.

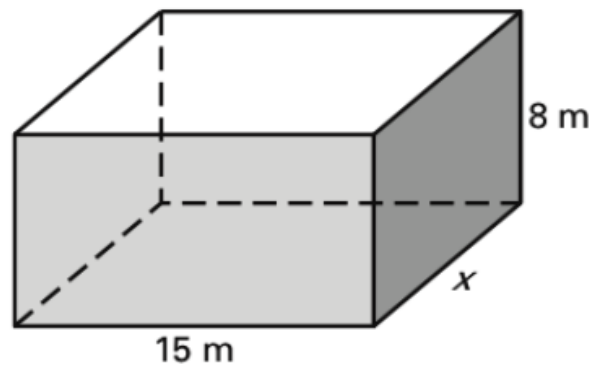


9.

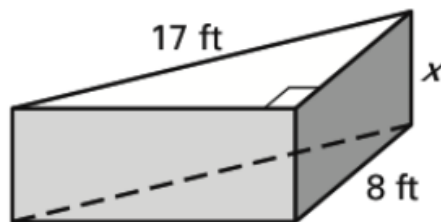


Find the length x using the given volume V .

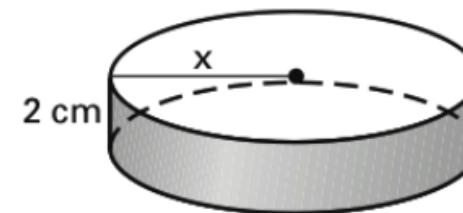
10. $V = 1440 \text{ m}^3$



11. $V = 360 \text{ ft}^3$



12. $V = 72\pi \text{ cm}^3$



13. Multiple Choice How many 2 inch cubes can fit completely in a box that is 10 inches long, 8 inches wide, and 4 inches tall?

A. 24

B. 32

C. 40

D. 320

Sketch the described solid and find its volume. Round your answer to two decimal places.

14. A rectangular prism with a height of 3 feet, width of 6 feet, and length of 9 feet.

15. A right cylinder with a radius of 4 meters and a height of 8 meters.