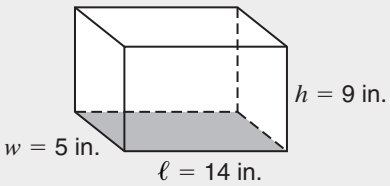
11-7 Volume of Prisms

Name _____ Date _____

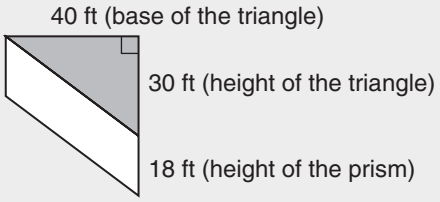
- *Volume of a Rectangular Prism,* $V = Bh \longrightarrow V = (\ell w)h$, where ℓ and w are the length and width of the base.

  $V = (\ell w)h$
  $= (14)(5)(9)$ ← Substitute.
  $V = 630$
  The volume is 630 in.^{3} ← Use cubic units.



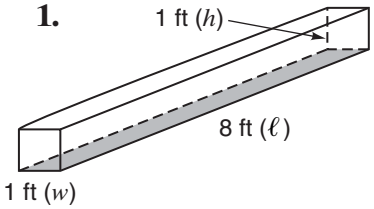
- *Volume of a Triangular Prism,* $V = Bh \longrightarrow V = \left(\frac{1}{2}bh\right)\boldsymbol{h}$, where b and h are the base and height of the triangular base, and the $\boldsymbol{h}$ is the height of the prism.

  $V = \left(B = \frac{1}{2}bh\right)h$
  $= \left(\frac{1}{2} \bullet 40 \bullet 30\right)18$ ← Substitute.
  $V = 10\,800$
  The volume is 10 800 ft^3. ← Use cubic units.



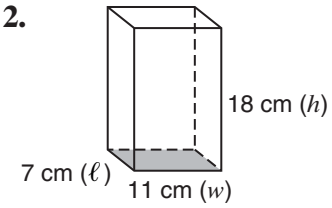
Find the volume of each rectangular prism (ℓ = length, w = width, and h = height).

1.



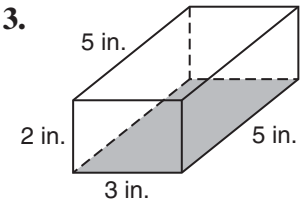
$V = \ell wh = 8$ ft$(1$ ft$)(1$ ft$)$
$V = 8$ ft^3

2.



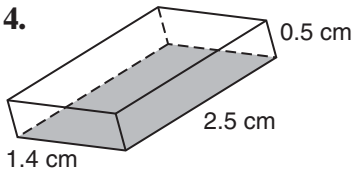
$V = 7$ cm$(11$ cm$)(18$ cm$)$
$V = 1386$ cm^3

3.



$V = 2$ in.$(5$ in.$)(3$ in.$)$
$V = 30$ in.^{3}

4.



$V = 2.5$ cm$(1.4$ cm$)(0.5$ cm$)$
$V = 1.75$ cm^3

5. $\ell = 2$ mm
$w = 4$ mm
$h = 6$ mm
$V = (2$ mm$)(4$ mm$)(6$ mm$)$
$V = 48$ mm^3

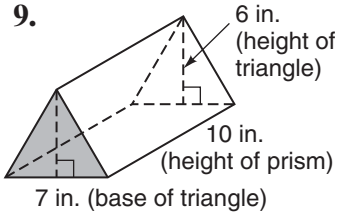
6. $\ell = 72$ cm
$w = 44$ cm
$h = 9$ cm
$V = (72$ cm$)(44$ cm$)(9$ cm$)$
$V = 28\,512$ cm^3

7. $\ell = 3.5$ yd
$w = 2.2$ yd
$h = 1.7$ yd
$V = (3.5$ yd$)(2.2$ yd$)(1.7$ yd$)$
$V = 13.09$ yd^3

8. $\ell = 1.6$ in.
$w = 0.05$ in.
$h = 8$ in.
$V = (1.6$ in.$)(0.05$ in.$)(8$ in.$)$
$V = 0.64$ in.^{3}

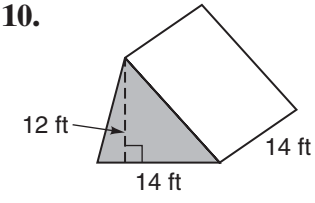
Find the volume of each triangular prism.

9.



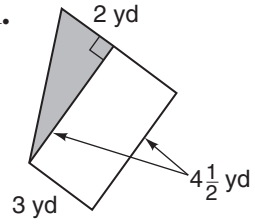
$B = \frac{1}{2}(7$ in.$)(6$ in.$) = 21$ in.^{2}
$V = (21$ in.$^2)(10$ in.$)$
$= 210$ in.^{3}

10.



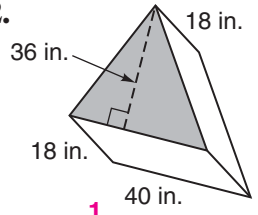
$B = \frac{1}{2}(14$ ft$)(12$ ft$)$
$B = 84$ ft^2; $V = 84$ ft$^2(14$ ft$)$
$V = 1176$ ft^3

11.



$B = \frac{1}{2}(2$ yd$)(4.5$ yd$)$
$B = 4.5$ yd^2
$V = 4.5$ yd$^2(3$ yd$)$
$V = 13.5$ yd^3

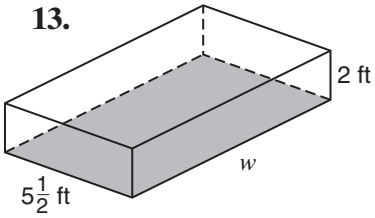
12.



$B = \frac{1}{2}(40$ in.$)(36$ in.$)$
$B = 720$ in.^{2}
$V = 720$ in.$^2(18$ in.$)$
$V = 12{,}960$ in.^{3}

Find the missing dimension for each figure.

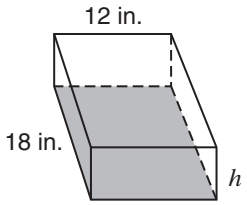
13.



$V = 33$ ft^3

$V = \ell wh$; $33 = \left(5\frac{1}{2}\right)(w)(2)$
$33 = 11w$
$w =$ 3 ft

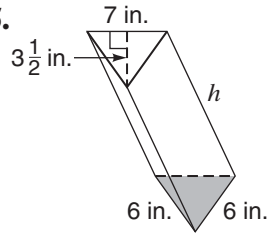
14.



$V = 1080$ in.^{3}

1080 in.^{3} = 18 in.(12 in.)(h)
= 216 in.^{2}(h)
h of prism = 5 in.

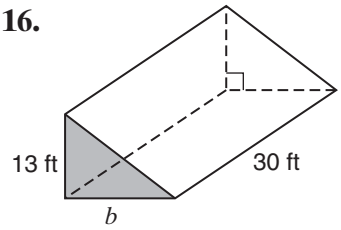
15.



$V = 171.5$ in.^{3}

$B = \frac{1}{2}(7 \text{ in.})\left(3\frac{1}{2} \text{ in.}\right)$
= 12.25 in.^{2}; 171.5 in.^{3}
h of prism = _____
= 12.25 in.^{2}(h); h = 14 in.

16.



$V = 3315$ ft^3

3315 =
$\frac{1}{2}b(13)(30) = 195b$
$b =$ 17 ft

Rename the volume of each figure. Find an equivalent volume expressed in different units.

17. $V = 450$ cm^3

V(mm^3) $V = (450 \text{ cm}^3)\left(\frac{1000 \text{ mm}^3}{1 \text{ cm}^3}\right) = 450\,000$

18. $V = 30\,000$ cm^3

V (m^3) $V = (30\,000 \text{ cm}^3)\left(\frac{1 \text{ m}^3}{1\,000\,000 \text{ cm}^3}\right) = 0.03 \text{ m}^3$

19. rectangular prism; $\ell = 3$ yd, $w = 2$ yd, $h = 4$ yd

$V = (3 \text{ yd})(2 \text{ yd})(4 \text{ yd}) = 24 \text{ yd}^3$
1 yd^3 = (3 ft)(3 ft)(3 ft) = 27 ft^3; 24 yd$^3\left(\frac{27 \text{ ft}^3}{1 \text{ yd}^3}\right)$
= 648 ft^3

V (ft^3)

20. rectangular prism; $\ell = 1$ ft, $w = 2$ ft, $h = 3$ ft

$V = (1 \text{ ft})(2 \text{ ft})(3 \text{ ft}) = 6 \text{ ft}^3$
1 ft^3 = (12 in.)(12 in.)(12 in.) = 1728 in.^{3}; 6 ft$^3\left(\frac{1728 \text{ in.}^3}{1 \text{ ft}^3}\right)$
= 10,368 in.^{3}

V (in.^{3})

Problem Solving

21. A rectangular prism is built entirely of 1-cm cubes and has a volume of 24 cubic centimeters. Give all the possible whole number dimensions of the rectangular prism.

There are 6 possible sets of dimensions:
1 • 1 • 24; 1 • 2 • 12; 1 • 3 • 8; 1 • 4 • 6;
2 • 2 • 6; 2 • 3 • 4

22. All of Sean's paperback books are 10.5 cm wide, 2 cm thick, and 17 cm high. What is the greatest number of books he can pack in one shipping carton with inside dimensions of 64 cm × 34 cm × 10.5 cm?

V(box) = 64 • 34 • 10.5 = 22,848 cm^3; V(book) = 10.5 • 2 • 17 = 357 cm^3; V(box) ÷ V(book) = 64; There is exactly enough space to pack 64 books in the carton.

CHALLENGE

23. The diagram shows three views of the same figure. Use the drawings to find the volume of the figure.

$V =$ $V = \ell wh$; V =(5 cm)(2 cm) (1 cm); V = 10 cm^3