

## 12.4 Volumes of Cylinders and Prisms

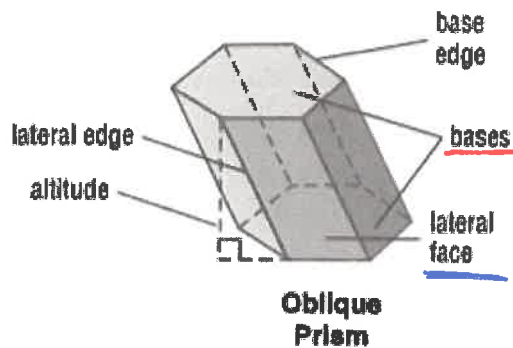
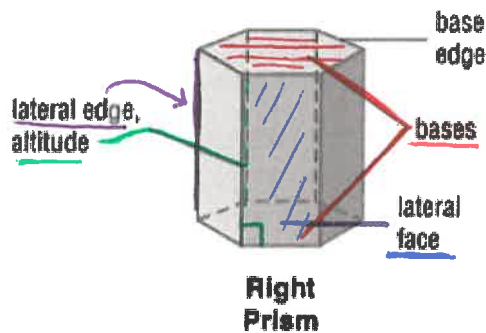
### Geometry CP

**Volume:** the number of cubic units contained in a solids interior

**Prism:** a polyhedron w/ 2 congruent faces that lie in parallel planes  
bases

**Lateral Faces:** other faces of the prism that are parallelograms formed by connecting the corresponding vertices of the bases

**Altitude/Height:** perpendicular distance between its bases  
 segments connecting these vertices: lateral edges



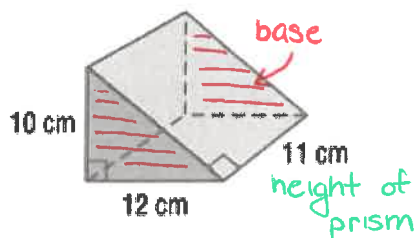
**Volume of a Prism** is  $V = Bh$ , where  $B$  is area of the base and

$h$  is the height of the prism.



1. Find the volume of the following:

a.



$$V = Bh$$

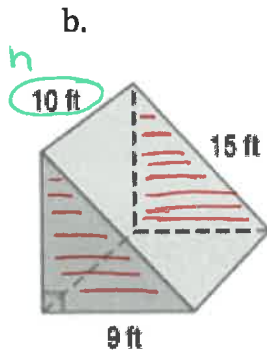
$$V = \left(\frac{1}{2}bh_{\Delta}\right)h$$

$$= \left(\frac{1}{2}(12)(10)\right)(11)$$

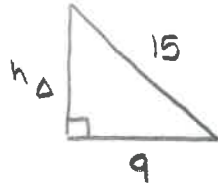
$$= 660 \text{ cm}^3$$

Base  $\rightarrow$  right triangle

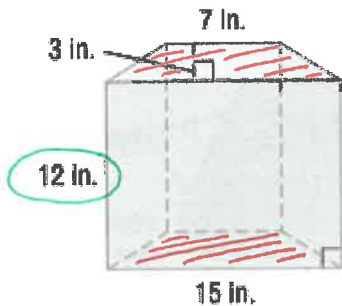
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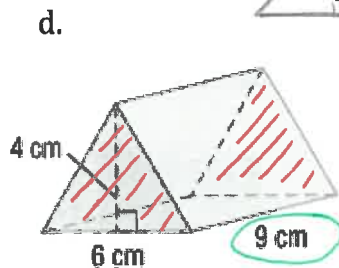
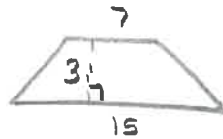
$$\begin{aligned} V &= Bh \\ &= \left(\frac{1}{2} b h_{\Delta}\right) h \\ &= \frac{1}{2} (9)(12)(10) = \boxed{540 \text{ ft}^3} \end{aligned}$$



$$\begin{aligned} (h_{\Delta})^2 + 9^2 &= 15^2 \\ h_{\Delta} &= 12 \end{aligned}$$



$$\begin{aligned} V &= Bh \\ &= \left(\frac{1}{2} h (b_1 + b_2)\right) h \\ &= \frac{1}{2} (3)(7 + 15)(12) \\ &= \boxed{396 \text{ in}^3} \end{aligned}$$



$$\begin{aligned} V &= Bh \\ &= \left(\frac{1}{2} b h_{\Delta}\right) h \\ &= \frac{1}{2} (6)(4)(9) \\ &= \boxed{108 \text{ cm}^3} \end{aligned}$$

**Cylinder:**

a solid w/ congruent circular bases that lie in parallel planes.

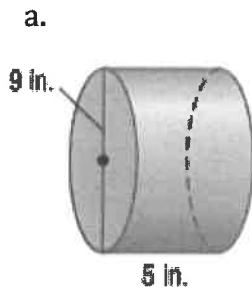
**Volume of a Cylinder** is  $V = Bh$  or  $V = \pi r^2 h$  where  $B$  is the area of the base

and  $h$  is the height and  $r$  is the radius of the cylinder.

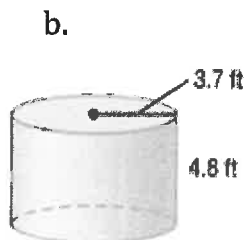


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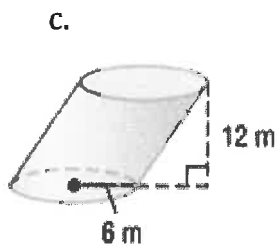
2. Find the volume of the following:



$$\begin{aligned} V &= \pi r^2 h \\ &= \pi (4.5)^2 (5) \\ &= 101.25\pi \text{ in}^3 \end{aligned}$$



$$\begin{aligned} V &= \pi r^2 h \\ &= \pi (3.7)^2 (4.8) \\ &= 65.7\pi \text{ ft}^3 \end{aligned}$$

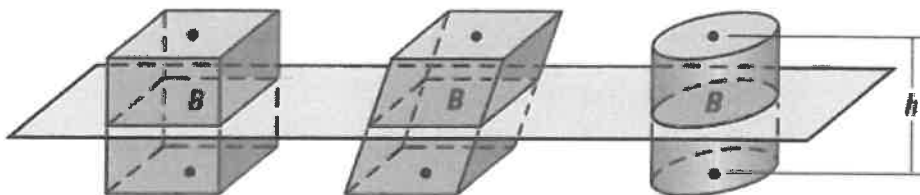


$$\begin{aligned} V &= \pi r^2 h \\ &= \pi (6)^2 (12) \\ &= 432\pi \text{ m}^3 \end{aligned}$$

Cavalieri's Principle  
(Theorem 12.6)

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

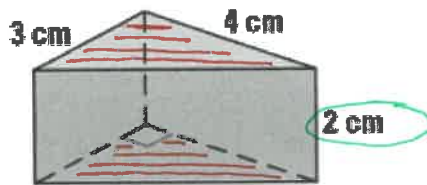
All three solids below have cross sections with equal areas,  $B$ , and all three have equal heights,  $h$ .



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3. Find the volume of the solids below:

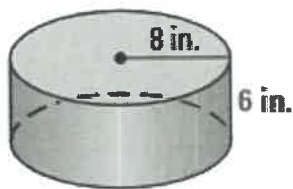
a.



$$\begin{aligned} V &= Bh \\ &= \frac{1}{2} b h_{\Delta} l \\ &= \frac{1}{2} (3)(4)(2) \end{aligned}$$

$$= 12 \text{ cm}^3$$

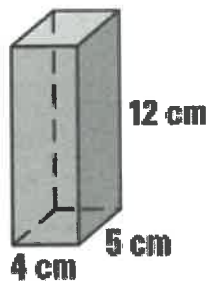
b.



$$\begin{aligned} V &= Bh \\ &= \pi r^2 h \\ &= \pi (8)^2 (6) \end{aligned}$$

$$= 384 \pi \text{ in}^3$$

c.



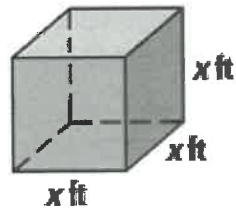
$$\begin{aligned} V &= Bh \\ &= lwh \\ &= 4(5)(12) \end{aligned}$$

$$= 240 \text{ cm}^3$$

4. Find the missing variable:

a.

Cube,  $V = 100 \text{ ft}^3$

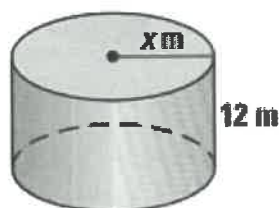


$$\begin{aligned} V &= Bh \\ V &= x \cdot x \cdot x \\ 100 &= x^3 \end{aligned}$$

$$4.64 \text{ ft} = x$$

b.

Right cylinder,  $V = 4561 \text{ m}^3$



$$\begin{aligned} V &= \pi r^2 h \\ 4561 &= \pi x^2 (12) \end{aligned}$$

$$120.98 = x^2$$

$$11 \text{ m} \approx x$$