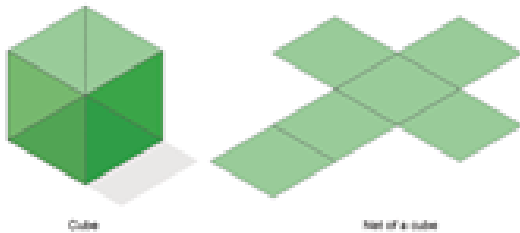


# Chapter 3: Volume and Capacity

Remember: Volume is how much space something takes up!

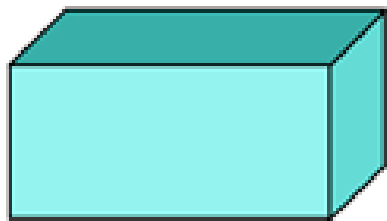
When we worked with area, we always worked in 2 dimensions....we took 3 dimensional shapes and flattened them into their nets.

Surface area is always: 2D 3D Units<sup>2</sup>  
Volume is always: 2D 3D Units<sup>3</sup>



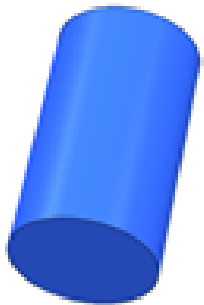
Remember that to find the volume of something, we will find the area of its "base" and then multiply by the height, or depth of the object.

Identify the base shape of each of the objects.



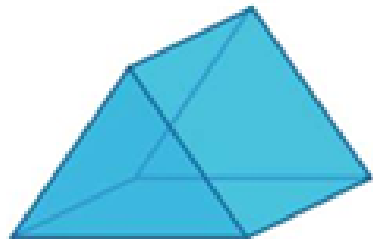
Rectangle

$$\text{Area} = l \times w$$



Circle

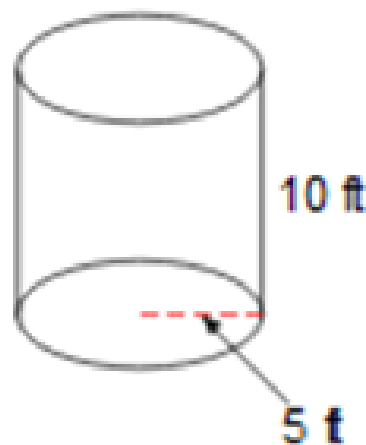
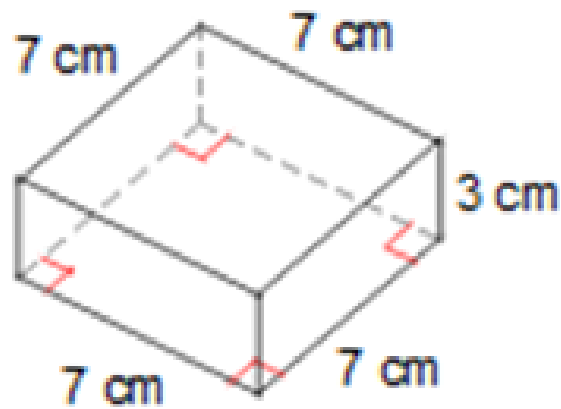
$$\text{Area} = \pi r^2$$



Triangle

$$\text{Area} = \frac{b \cdot h}{2}$$

Example: Find the volume of each shape



$$A_{\text{base}} = l \times w$$

$$A = 7\text{ cm} \times 7\text{ cm}$$

$$A_{\text{base}} = 49\text{ cm}^2$$

$$\begin{aligned} V &= A_{\text{base}} \times h \\ &= 49\text{ cm}^2 \times 3\text{ cm} \\ &= 147\text{ cm}^3 \end{aligned}$$

$$A_{\text{base}} = \pi r^2$$

$$A_{\text{base}} = \pi (5)^2$$

$$= \pi (25)$$

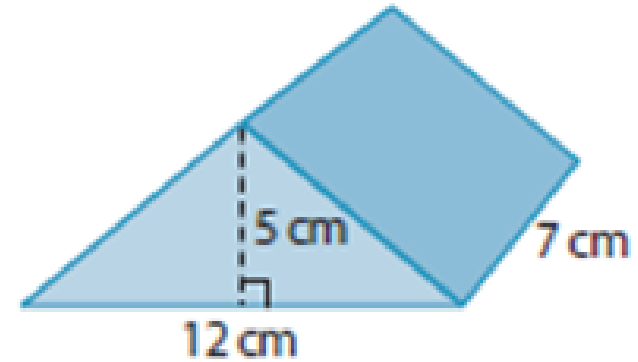
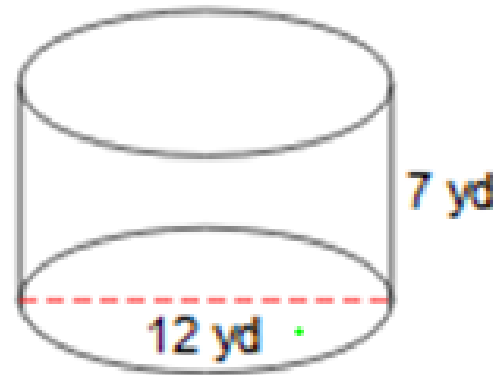
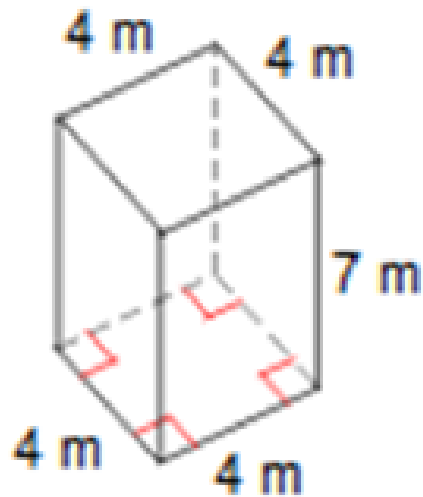
$$= 78.5398\text{ ft}^2$$

$$V = A_{\text{base}} \times h$$

$$= 78.5398\text{ ft}^2 \times 10\text{ ft}$$

$$= 785.398\text{ ft}^3$$

Your Turn: Find the volume of each shape



Rectangle =  $l \times w$

$$\begin{aligned} \text{A}_{\text{base}} &= l \times w \\ &= 4 \times 4 = 16 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} V &= \text{A}_{\text{base}} \times h \\ &= 16 \text{ m}^2 \times 7 \text{ m} \\ &= 112 \text{ m}^3 \end{aligned}$$

$$\text{Circle} = \pi r^2$$

$$\begin{aligned} \text{A}_{\text{base}} &= \pi (6)^2 = 12.57 \\ &= \pi (36) = 113.0973 \text{ yd}^2 \end{aligned}$$

$$\begin{aligned} V &= \text{A}_{\text{base}} \times h \\ &= 113.0973 \text{ yd}^2 \times 7 \text{ yd} \\ &= 791.68 \text{ yd}^3 \end{aligned}$$

$$\begin{aligned} \text{Triangle} &= \frac{b \cdot h}{2} \\ &= \frac{12 \cdot 5}{2} = \frac{60}{2} \end{aligned}$$

$$\text{A}_{\text{base}} = 30 \text{ cm}^2$$

$$\begin{aligned} V &= \text{A}_{\text{base}} \times h \\ &= 30 \text{ cm}^2 \times 7 \text{ cm} \\ &= 210 \text{ cm}^3 \end{aligned}$$

9. A box has a volume of  $60 \text{ ft}^3$ . The area of the base of the box is  $15 \text{ ft}^2$ . What is the height of the box?

$$V = A_{\text{base}} \times h$$

$$V = 60 \text{ ft}^3$$

$$A_{\text{base}} = 15 \text{ ft}^2$$

$$\frac{60 \text{ ft}^3}{15 \text{ ft}^2} = \frac{15 \cancel{\text{ft}^2} \times h}{15 \cancel{\text{ft}^2}}$$

$$\frac{\cancel{\text{ft}} \times \cancel{\text{ft}} \times \text{ft}}{\cancel{\text{ft}} \times \cancel{\text{ft}}}$$

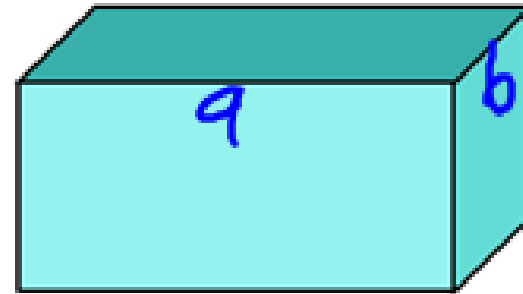
$$4 \text{ ft} = h$$

10. A storage space in the shape of a rectangular prism has a length of 9 metres and a width of 6 metres. The volume is  $162 \text{ m}^3$ . What is the height of the space?

$$V = A_{\text{base}} \times h$$

$$\frac{162 \text{ m}^3}{54 \text{ m}^2} = \frac{\cancel{54 \text{ m}^2} \times h}{\cancel{54 \text{ m}^2}}$$

$$3 \text{ m} = h$$



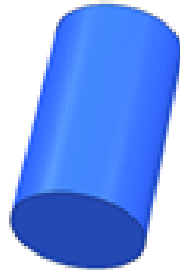
$$\begin{aligned} A_{\text{base}} &= 9 \times 6 \\ &= 54 \text{ m}^2 \end{aligned}$$

It sure would be nice if we had some formulas...



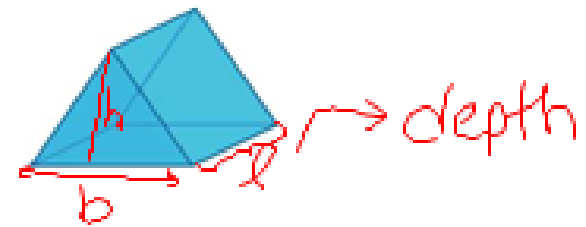
Area of the base =  $l \times w$

Volume =  $lwh$



Area of the base =  $\pi r^2$

Volume =  $\pi r^2 h$

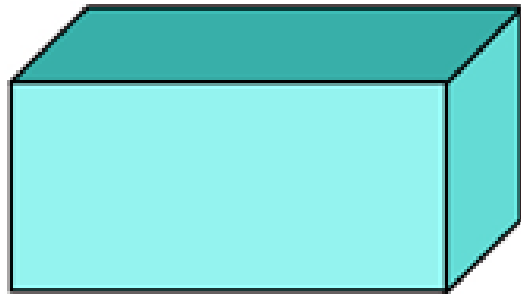


Area of the base =  $\frac{b \cdot h}{2}$

Volume =  $\frac{b \cdot h \cdot l}{2}$  (where  $l$  is depth)

11. Heating and air-conditioning installers need to calculate volume.

- a) A banquet room has dimensions of 50 feet by 50 feet by 12 feet.  
What is the volume of air in the banquet room?
- b) Express your answer to the nearest cubic yard.



$$\begin{aligned} \text{a) } V &= lwh \\ &= (50\text{ft})(50\text{ft})(12\text{ft}) \end{aligned}$$

$$\text{b) } 50\cancel{\text{ft}} \times \frac{1\text{yd}}{3\cancel{\text{ft}}} = 30000\text{ft}^3$$

$$3\text{ft} = 1\text{yd}$$

$$= \frac{50}{3}\text{yd} = 16.6667\text{yd}$$

$$\begin{aligned} V &= lwh \\ &= 16.67 \times 16.67 \times 4 \\ &= 1111.11\text{yd}^3 \end{aligned}$$

$$12\text{ft} \times \frac{1\text{yd}}{3\text{ft}} = \frac{12}{3} = 4\text{yd}$$



13. Fence posts are usually set in concrete. A bag of concrete mix, when mixed with water, makes about  $\frac{1}{2}$  ft<sup>3</sup> of concrete. A cylindrical hole has a diameter of 8 in. and a depth of 3 ft. How many bags of concrete mix will fill the hole?



Work in ft.

$$8 \text{ in} \times \frac{1 \text{ ft}}{12 \text{ in}} = 0.6666 \text{ ft}$$

$$r = \frac{0.6666}{2}$$

$$r = 0.3333 \text{ ft}$$

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

$$= \pi (0.3333)^2 \times 3$$

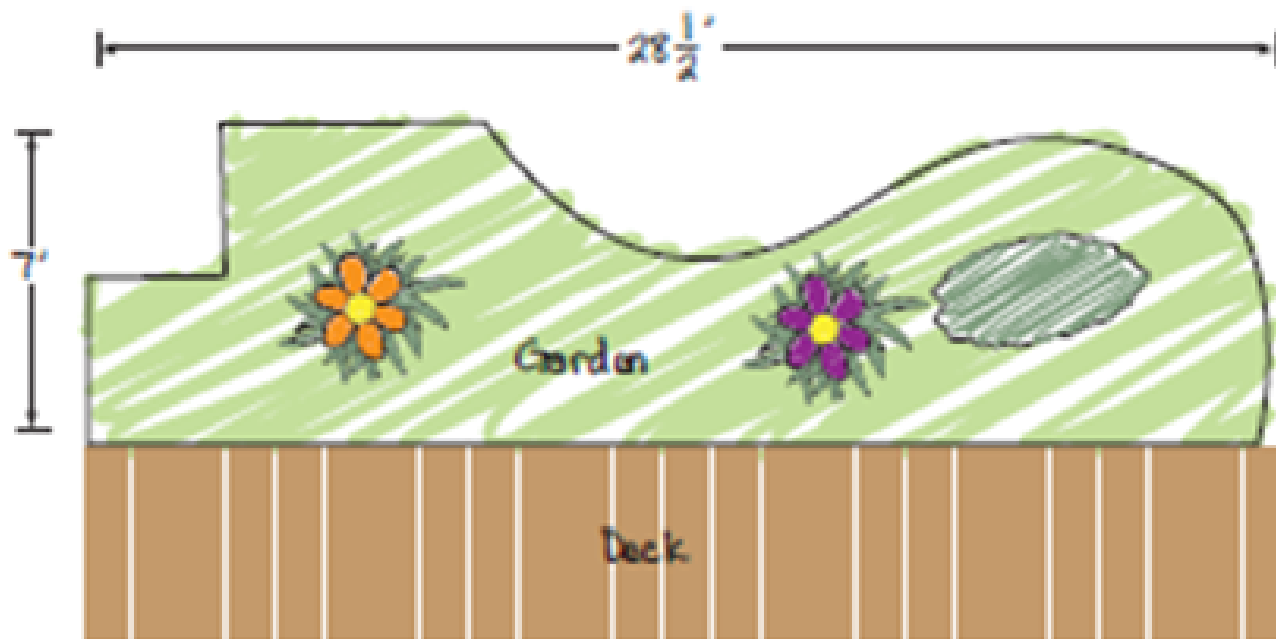
$$= \pi (0.1111) \times 3$$

$$V = 1.0471 \text{ ft}^3$$

→ Just over 2 bags.

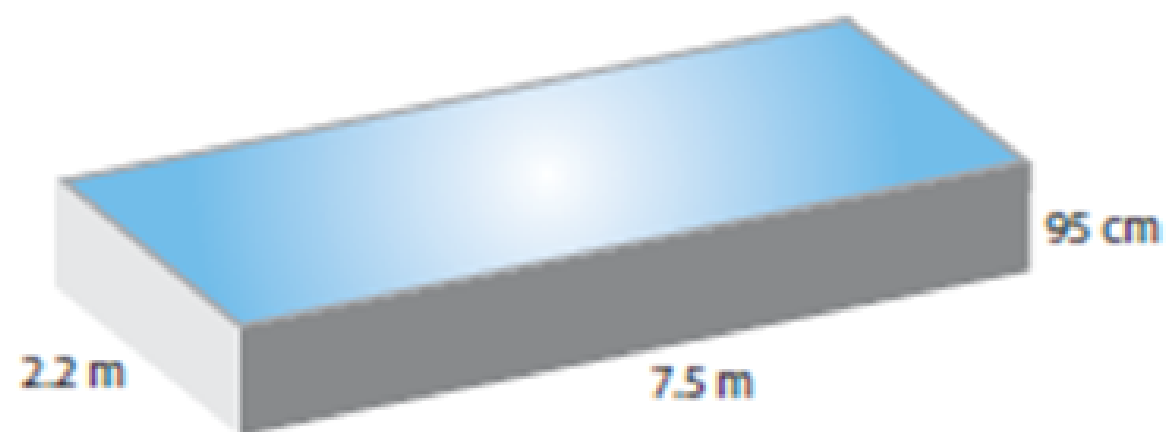
## Estimating Volume

Kelly wants to spread mulch on an irregularly shaped garden beside her deck. She wants to spread the mulch about 4in. deep throughout the garden. Mulch is sold in cubic yards. Determine the amount of mulch Kelly should order.



### Your Turn

Approximately how much water does this pool hold? Estimate the volume to the nearest cubic metre.



Page 114 #1, 2

Page 115 #4, 6