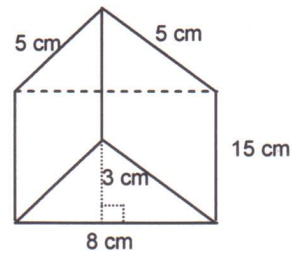


### 1.2.3: Applications of Volume

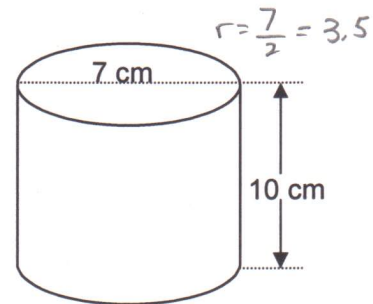
1. Calculate the volume of the perfume bottle.

$$\begin{aligned}
 V_{\text{PRISM}} &= A_{\text{BASE}} \times \text{Height} \\
 &= \left(\frac{bh}{2}\right) \times H \\
 &= \left(\frac{(8)(3)}{2}\right) \cdot 15 \\
 &= \left(\frac{24}{2}\right) \cdot 15 \\
 &= 12 \cdot 15 \\
 &= 180 \text{ cm}^3
 \end{aligned}$$



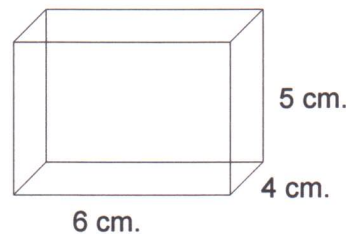
2. How much soup can this container hold?

$$\begin{aligned}
 V_{\text{CYLINDER}} &= A_{\text{BASE}} \times \text{Height} \\
 &= \pi r^2 H \\
 &= \pi (3.5)^2 (10) \\
 &= \pi (3.5)(3.5)(10) \\
 &= \pi (12.25)(10) \\
 &= 38.48(10) \\
 &= 384.8 \text{ cm}^3
 \end{aligned}$$



3. Calculate the volume of the rectangular prism.

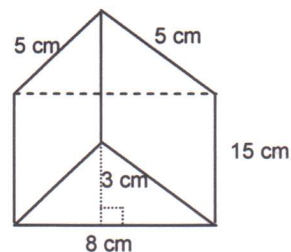
$$\begin{aligned}
 V_{\text{PRISM}} &= A_{\text{BASE}} \times \text{Height} \\
 &= l \cdot w \cdot H \\
 &= (6)(4)(5) \\
 &= (24)(5) \\
 &= 120 \text{ cm}^3
 \end{aligned}$$



### 1.2.3: Applications of Volume

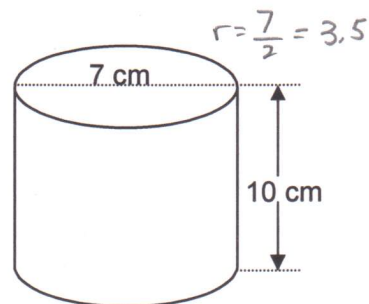
1. Calculate the volume of the perfume bottle.

$$\begin{aligned}
 V_{\text{PRISM}} &= A_{\text{BASE}} \times \text{Height} \\
 &= \left(\frac{bh}{2}\right) \times H \\
 &= \left(\frac{(8)(3)}{2}\right) \cdot 15 \\
 &= \left(\frac{24}{2}\right) \cdot 15 \\
 &= 12 \cdot 15 \\
 &= 180 \text{ cm}^3
 \end{aligned}$$



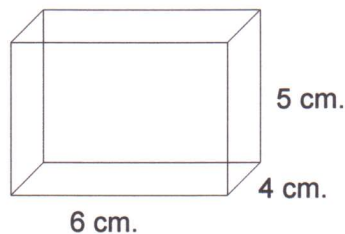
2. How much soup can this container hold?

$$\begin{aligned}
 V_{\text{CYLINDER}} &= A_{\text{BASE}} \times \text{Height} \\
 &= \pi r^2 H \\
 &= \pi (3.5)^2 (10) \\
 &= \pi (3.5)(3.5)(10) \\
 &= \pi (12.25)(10) \\
 &= 38.48(10) \\
 &= 384.8 \text{ cm}^3
 \end{aligned}$$



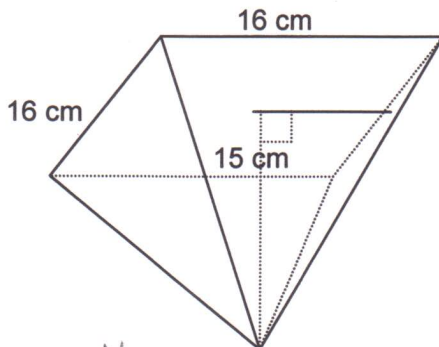
3. Calculate the volume of the rectangular prism.

$$\begin{aligned}
 V_{\text{PRISM}} &= A_{\text{BASE}} \times \text{Height} \\
 &= l \cdot w \cdot H \\
 &= (6)(4)(5) \\
 &= (24)(5) \\
 &= 120 \text{ cm}^3
 \end{aligned}$$

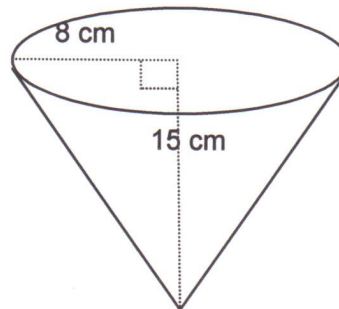


### 1.2.3: Applications of Volume (continued)

4. Which popcorn container will hold more?



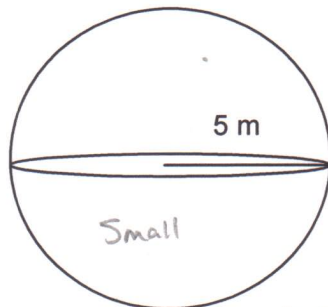
$$\begin{aligned}
 V_{\text{PYRAMID}} &= V_{\text{PRISM}} \div 3 \\
 &= s^2 H \div 3 \\
 &= (16)(16)(15) \div 3 \\
 &= (256)(15) \div 3 \\
 &= 3840 \div 3 \\
 &= 1280 \text{ cm}^3
 \end{aligned}$$



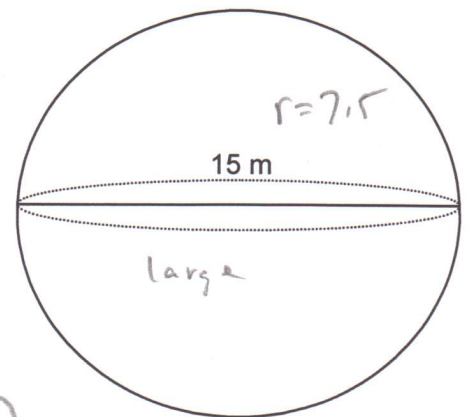
$$\begin{aligned}
 V_{\text{CONE}} &= V_{\text{CYLINDER}} \div 3 \\
 &= (\pi r^2 h) \div 3 \\
 &= (\pi (8^2)(15)) \div 3 \\
 &= (\pi (64)(15)) \div 3 \\
 &= (201.06)(15) \div 3 \\
 &= 3015.93 \div 3 \\
 &= 1005.31 \text{ cm}^3
 \end{aligned}$$

The square base pyramid holds more popcorn

5. How many times bigger is the second sphere?



$$\begin{aligned}
 V_{\text{SMALL}} &= 4(\pi r^3 \div 3) \\
 &= 4(\pi (5)^3 \div 3) \\
 &= 4(\pi (5)(5)(5) \div 3) \\
 &= 4(\pi (125) \div 3) \\
 &= 4(392.7 \div 3) \\
 &= 4(130.9) \\
 &= 523.6 \text{ m}^3
 \end{aligned}$$

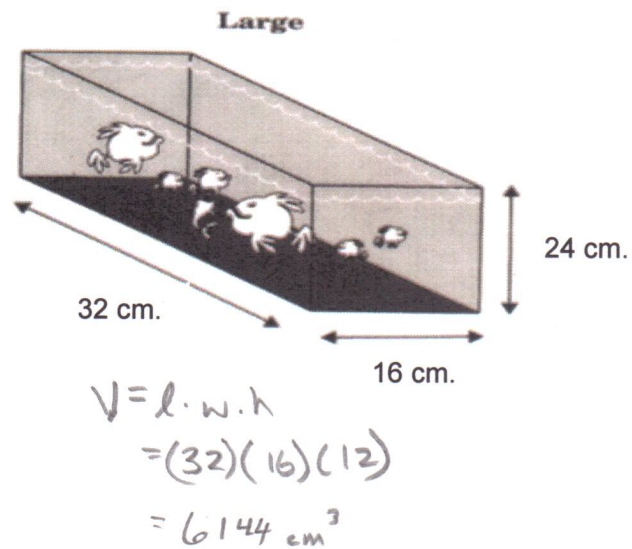
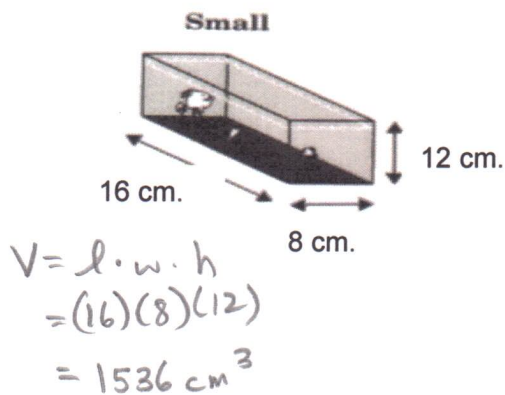


$$\begin{aligned}
 V_{\text{LARGE}} &= 4(\pi r^3 \div 3) \\
 &= 4(\pi (15)^3 \div 3) \\
 &= 4(\pi (15)(15)(15) \div 3) \\
 &= 4(\pi (421.875) \div 3) \\
 &= 4(11325.4 \div 3) \\
 &= 1767.15 \text{ m}^3
 \end{aligned}$$

$$\text{Times bigger} = \frac{V_{\text{LARGE}}}{V_{\text{SMALL}}} = \frac{1767.15}{523.6} = \underline{\underline{3.4 \text{ times bigger!}}}$$

### 1.2.3: Applications of Volume (continued)

6. How much more expensive should the large aquarium be than the small aquarium if the cost is based on the volume?



$$\text{Times more} = \frac{V_{\text{LARGE}}}{V_{\text{SMALL}}}$$

$$= \frac{6144}{1536}$$

$$= 4$$

The cost should be 4 times more than the small if based on volume

7. Determine the volume of the cabin. Show your work.

$$V_{\text{TOTAL}} = V_{\text{PYRAMID}} + V_{\text{PRISM}}$$

$$= \left( s^2 H \div 3 \right) + s^2 H$$

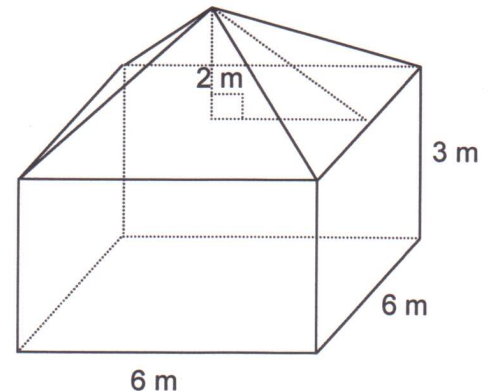
$$= \left( (6)^2 (3) \div 3 \right) + (6)^2 (3)$$

$$= \left( (36)(3) \div 3 \right) + (36)(3)$$

$$= 108 \div 3 + 108$$

$$= 36 + 108$$

$$= 144 \text{ m}^3$$

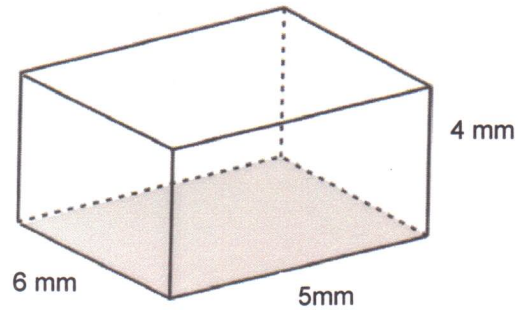


The volume of the cabin is  $144 \text{ m}^3$

## 1.2.P: Practice

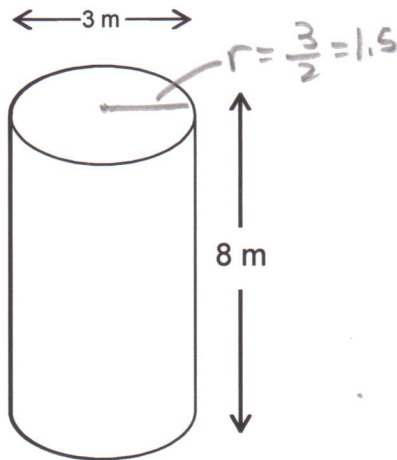
1. Using the relationships you have discovered, calculate the volume of each of the following 3-D figures.

(a)



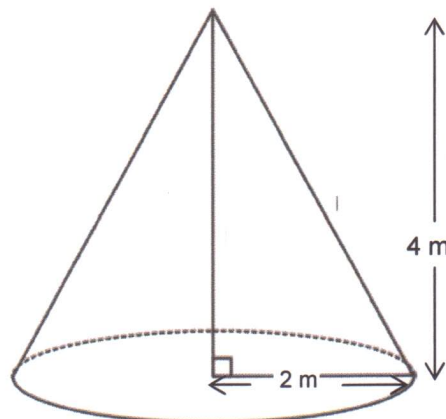
$$\begin{aligned} V_{\text{PRISM}} &= \text{Area of Base} \times \text{Height} \\ &= l \cdot w \cdot h \\ &= (6)(5)(4) \\ &= 120 \text{ mm}^3 \end{aligned}$$

(b)



$$\begin{aligned} V_{\text{CYLINDER}} &= \pi r^2 h \\ &= \pi (1.5)^2 (8) \\ &= \pi (1.5)(1.5)(8) \\ &= 56.55 \text{ m}^3 \end{aligned}$$

(c)



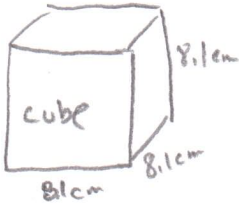
$$\begin{aligned} V_{\text{CONE}} &= V_{\text{CYLINDER}} \div 3 \\ &= (\pi r^2 h) \div 3 \\ &= (\pi (2)^2 (4)) \div 3 \\ &= (\pi (2)(2)(4)) \div 3 \\ &= (\pi (4)(4)) \div 3 \\ &= (12.57)(4) \div 3 \\ &= 16.76 \text{ m}^3 \end{aligned}$$

## 1.2.P: Practice (continued)

2. A movie theatre wants to compare the volumes of popcorn in two containers, a cube with edge length 8.1 cm and a cylinder with radius 4.5 cm and height 8.0 cm.

Which container holds more popcorn?

Draw diagrams to support your solution.



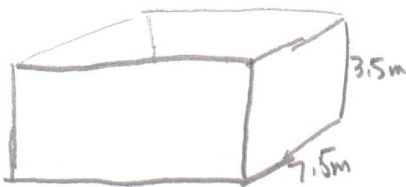
$$\begin{aligned}V_{\text{CUBE}} &= (8.1)(8.1)(8.1) \\ &= 531.4 \text{ cm}^3\end{aligned}$$



$$\begin{aligned}V_{\text{CYLINDER}} &= (\pi r^2 h) \div 3 \\ &= (\pi (4.5)^2 (8)) \div 3 \\ &= (\pi (20.25)(8)) \div 3 \\ &= 169.6 \text{ cm}^3\end{aligned}$$

The cube holds more popcorn.

3. An entertainment room is 10.5 m long by 7.5 m wide by 3.5 m high. If  $5 \text{ m}^3$  of air is needed for each person, how many people can use the room at one time?



① Find volume of room

$$\begin{aligned}V &= l \cdot w \cdot h \\ &= (10.5)(7.5)(3.5) \\ &= 275.6 \text{ m}^3\end{aligned}$$

- ② If each person needs  $5 \text{ m}^3$  of air

$$5 \times \frac{?}{\text{\# of people}} = 275.6$$

$$\begin{aligned}\text{\# of people} &= \frac{275.6}{5} \\ &= 55.1\end{aligned}$$

∴ The room can hold 55 people!