

# Answer Key

## Geometric Shapes

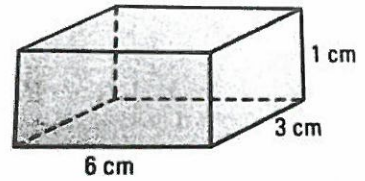
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### Volume of Prisms 01

1. What is the total volume of the prism at right?

$$6 \times 3 \times 1 = \boxed{18 \text{ cm}^3}$$

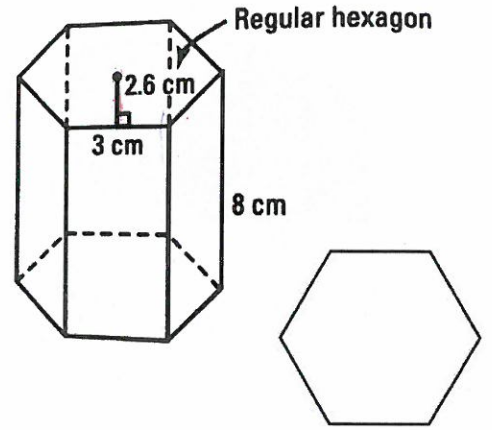


2. What is the total volume of the prism at right?

$$\left( \frac{\text{Apothem} \times \text{perimeter}}{2} \right) \text{height.}$$

$$= \left( \frac{2.6 \times 18}{2} \right) 8$$

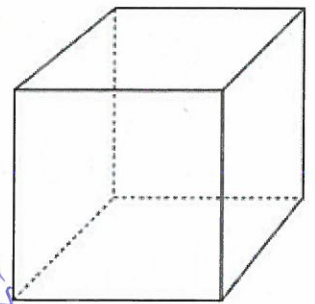
$$= \boxed{187.2 \text{ cm}^3}$$



3. What is the side length of a cube with a volume of

a.  $\sqrt[3]{125 \text{ cm}^3} = 5 \text{ cm}$   
 b.  $\sqrt[3]{512 \text{ cm}^3} = 8 \text{ cm}$   
 c.  $\sqrt[3]{60 \text{ cm}^3} = 3.91 \text{ cm}$

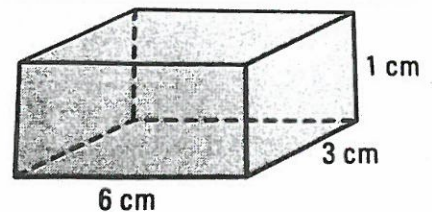
\* Here you cube root the volume to get the cube's side length.



4. Determine the edge of a cube that has the same volume as the prism on the right.

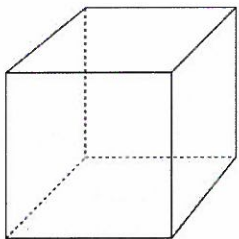
$$\text{Volume of prism} = 6 \times 3 \times 1 = 18 \text{ cm}^3$$

Now you  $\sqrt[3]{18} = \boxed{2.62 \text{ cm}}$   
 (Cube root)



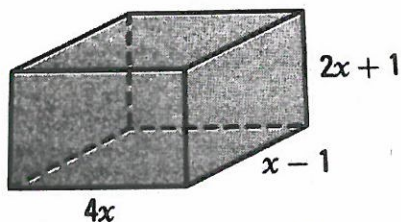
$$\square 32 \div 4 = \underline{\underline{8\text{cm}}}$$

5. Determine the total volume of a cube if one of its faces has a perimeter of 32 cm



$$\text{Volume} = 8 \times 8 \times 8 = \boxed{512 \text{ cm}^3}$$

6. Find an algebraic expression for the volume of the prism below.



units<sup>3</sup>

$$\begin{aligned} &(x-1)(2x+1) \\ &2x^2 + x - 2x - 1 \\ &4(2x^2 - x - 1) \end{aligned}$$

$$\boxed{8x^3 - 4x^2 - 4x}$$

$$\begin{aligned} &4x(x-1) \\ &(4x^2 - 4x)(2x+1) \\ &8x^3 + 4x^2 - 8x^2 - 4x \\ &8x^3 - 4x^2 - 4x \end{aligned}$$

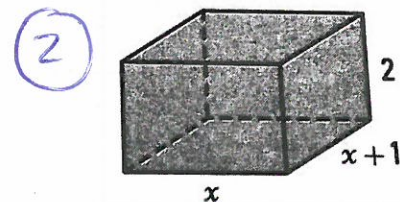
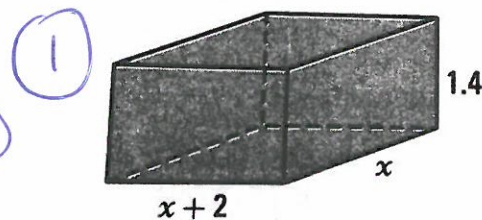
7. For what value of x do the prisms on the right have the same volume?

$$\begin{aligned} \textcircled{1} &(x+2)(x)(1.4) \\ &(x^2 + 2x)(1.4) \end{aligned}$$

$$\boxed{1.4x^2 + 2.8x}$$

$$\begin{aligned} \textcircled{2} &x(x+1)(2) \\ &(x^2 + x)2 \end{aligned}$$

$$\boxed{2x^2 + 2x}$$



$$1.4x^2 + 2.8x = 2x^2 + 2x$$

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**Volume of Prisms 02**

**Unit Conversion**

1. Convert the following volumes into the requested units.

a.  $3 \text{ m}^3$  into  $\text{dm}^3$ .  
 $\times 1000$        $3000 \text{ dm}^3$

b.  $48\,000 \text{ cm}^3$  into  $\text{m}^3$   
 $\div 1000 \div 1000 = 0.048 \text{ m}^3$

2. How much will a  $435\,000 \text{ cm}^3$  block of granite cost, given that granite costs \$ 320 /  $\text{m}^3$ ?

$0.435 \text{ m}^3 \times \frac{320 \$}{\text{m}^3} = 139.2 \$$

**Capacity (the volume of liquid in a container):**

$1 \text{ liter} = 1 \text{ dm}^3$
------------------------------------

3. Convert the following units to liters.

a.  $0.02 \text{ m}^3 = 20 \text{ dm}^3 = 20 \text{ L}$

b.  $350\,000 \text{ mm}^3 = 0.35 \text{ dm}^3 = 0.35 \text{ L}$

4. Oscar buys a huge container of perfume with a capacity of 3.18 l for \$150. If he wished to transfer the contents of the container into 200  $\text{cm}^3$  bottles, then sell each smaller bottle for \$30 how much money would he make or lose?

$0.2 \text{ dm}^3 = 0.2 \text{ L}$

$3.18 \text{ L for } 150 \$$

$3.18 \text{ L} \div 0.2 \text{ L} = 15.9 \text{ bottles} = 15 \text{ bottles}$        $\rightarrow$  Not a full bottle

$15 \text{ bottles} \times 30 = 450. \$$

Profit =  $450 - 150 = 300 \$$  Gain

5. Express, in liters, the volume of a cube with 11 cm edges.

$$1.1 \times 1.1 \times 1.1 = 1.331 \text{ dm}^3 = \boxed{1.331 \text{ L}}$$

6. The mass of 1 liter of air is 1.3 g. What is the mass, in kg, of the air in our classroom with a length of 12 m, a width of 8 m, and a height of 5 m?

$$120 \text{ dm} \quad 80 \text{ dm} \quad 50 \text{ dm}$$

$$120 \times 80 \times 50 = 480000 \text{ dm}^3 = 480000 \text{ L}$$

$$480000 \times 1.3 \text{ g} = 624000 \text{ g} \div 1000 = \boxed{624 \text{ Kg}}$$

7. Jacob has found a summer job working for a driveway building crew. The driveway he is trying to sell is rectangular. Its dimensions are 8.6 m by 4.8 m. A uniform 5 cm thick layer of asphalt is spread over the driveway. What will the cost of the asphalt be if it costs \$325/m<sup>3</sup>? [How much profit will Jacob make if he charges the customer an extra 15% of the cost of the asphalt?]

$$8.6 \text{ m} \times 4.8 \text{ m} \times 0.05 \text{ m} = 2.064 \text{ m}^3$$

$$2.064 \text{ m}^3 \times \frac{325 \text{ \$}}{\text{m}^3} = \boxed{670.8 \text{ \$}}$$

$$0.15 \times 670.80 = \boxed{100.62 \text{ \$}}$$

8. Mr. Auger's patio is rectangular with dimensions 12 m by 8 m.

Yesterday, 5 cm of snow fell on the patio.

a. What is the volume of snow on the patio?

b. If 1 m<sup>3</sup> of snow gives 60 l of water, what volume of water will there be once the snow melts?

$$a. 12 \text{ m} \times 8 \text{ m} \times 0.05 \text{ m} = \boxed{4.8 \text{ m}^3}$$

$$b. 4.8 \text{ m}^3 \times \frac{60 \text{ L}}{1 \text{ m}^3} = \boxed{288 \text{ L}}$$

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Volume of Prisms 03 and Cylinders

1 liter = 1 dm<sup>3</sup>

Capacity (the volume of liquid in a container):

1. Jenna and Melody are making fake gold coins that they will use in a robbery. The plan requires the girls to make 1500 "gold" coins using lead and gold paint. What is the volume lead needed if each coin is an 11 sided regular polygon at its base with 0.7 cm sides, an apothem of 1.2 cm, and a height of 2 mm?

1500 coins

$\frac{(\text{apothem} \times \text{perimeter}) \times \text{height}}{2}$

$$\frac{(1.2 \times (.7 \times 11)) \times 0.2}{2} = 0.924 \text{ cm}^3$$

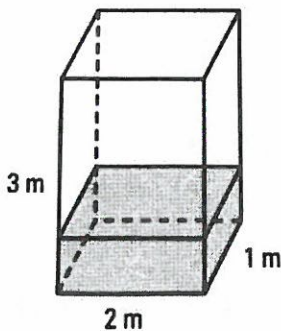
$$0.924 \times 1500 = 1386 \text{ cm}^3 \text{ of lead.}$$

2. Tasneem wants to open a petting zoo and fill a room with Canadian geese. The dimensions of the room are 9 m by 6 m by 3.25 m. How many geese can she legally fit in the room if each goose must be given at least 4500 liters of air?

$$9 \text{ m} \times 6 \text{ m} \times 3.25 \text{ m} = 175.5 \text{ m}^3 = 175500 \text{ dm}^3 \text{ (L)}$$

$$175500 \text{ L} \div 4500 \text{ L} = 39 \text{ geese}$$

3. Mahek is filling her shark aquarium. The aquarium is already filled with 1500 l of seawater. How much time will it take Mahek to fill the rest of the tank at a rate of 20 liters per minute?

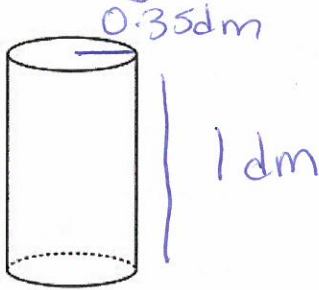


$$30 \text{ dm} \times 20 \text{ dm} \times 10 \text{ dm} = 6000 \text{ dm}^3$$

$$6000 \text{ L} - 1500 \text{ L} = 4500 \text{ L}$$

$$4500 \text{ L} \times \frac{1 \text{ min}}{20 \text{ L}} = 225 \text{ minutes}$$

4. Sarah buys a small cylindrical shaped bottle of perfume for \$48 (taxes included). If the radius of the bottle is 3.5 cm and its height is 10 cm, how much does the perfume cost per liter?



$$\begin{aligned} \pi r^2 h &= \pi (0.35)^2 (1) \\ &= 0.385 \text{ dm}^3 \\ &\quad (\text{L}) \end{aligned}$$

$$\frac{0.385 \text{ L}}{48 \$} = \frac{1 \text{ L}}{x}$$

$$x = \boxed{124.68 \$}$$

5. Kayla is moving into an apartment and has bought a table. The glass top of the circular table has a diameter of 1.4 m and a thickness of 1 cm. Knowing that a liter (1 dm<sup>3</sup>) of glass has a weight of 4.4 pounds, how much does the glass part of the table weigh?



$$\begin{aligned} \pi r^2 h &= \pi (7.5)^2 (0.1) \\ &= 17.67 \text{ dm}^3 \end{aligned}$$

$$17.67 \text{ dm}^3 \times 4.4 \text{ pounds} = \boxed{77.75 \text{ pounds}}$$

6. A cylindrical tunnel with a 21 m diameter is dug over a distance of 5 km. How many trips must a truck carrying 45 m<sup>3</sup> of dirt make to carry away all the dirt that was dug up?



$$\begin{aligned} \pi r^2 h &= \pi (10.5)^2 (5000) \\ &= 1731802.95 \text{ m}^3 \end{aligned}$$

$$1731802.95 \div 45 = 38484.5 = 38485 \text{ trips}$$

round up.                      trips

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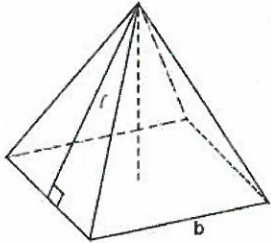
### Volume of Pyramids and Cones 01

Remember: Always start with a **formula**.

Show **all** your work **clearly**.

Include **units** in your final answer

1. The height of a pyramid is 15.6 cm. The base is a rectangle that is 24 cm long and 12 cm wide. What is the volume of this pyramid?



$$\frac{Abxh}{3} = \frac{(24 \times 12) 15.6}{3} = 1497.6 \text{ cm}^3$$

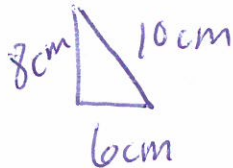
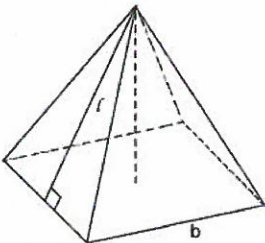
2. The base of a pyramid is a right triangle with sides measuring 2.4 cm, 3.2 cm, and 4 cm. The height of the pyramid is 8 cm. What is the volume of this pyramid?

(Triangle)

$$\frac{Abxh}{3} = \frac{(b \times h)}{2} \cdot h = \frac{(2.4 \cdot 3.2)}{2} \cdot 8 = 10.24 \text{ cm}^3$$

A 3D diagram of a pyramid with a right-angled triangular base. The base legs are labeled 2.4 cm and 3.2 cm, and the hypotenuse is labeled 4 cm. A right-angle symbol is shown at the vertex between the 2.4 cm and 3.2 cm sides.

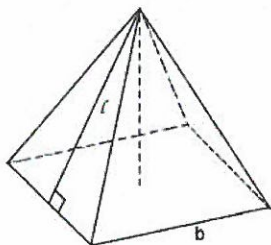
3. A square base pyramid with 12 cm sides has a slant height of 10 cm. What is the volume of this pyramid?



$$\sqrt{10^2 - 6^2} = 8$$

$$\frac{Abxh}{3} = \frac{144 \cdot 8}{3} = 384 \text{ cm}^3$$

4. The base of a pyramid is a square with 12 cm sides. The lateral edge measures 10 cm. What is the volume of this pyramid?



5. What is the approximate weight of the Cheops pyramid in Egypt, knowing that it has a square base with sides approximately 230 m long and a slant height of 180 m, and that 1 cubic meter of sandstone weighs approximately 2500 kg?

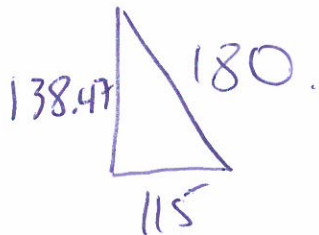


*express in scientific notation*

$$\frac{Abxh}{3} = \frac{(230 \cdot 230) 138.47}{3}$$

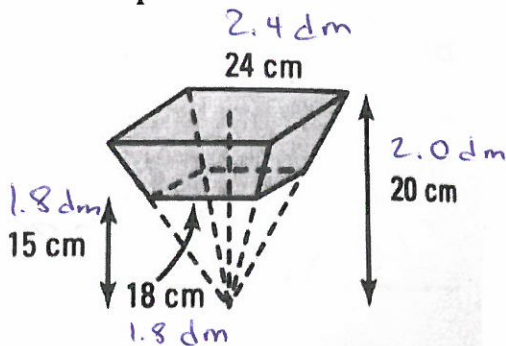
$$= 2441687.67 \text{ m}^3$$

Mass:  $2441687.67 \times 2500 =$   
 $6104219167 \text{ Kg}$   
 $6.1 \times 10^9 \text{ Kg}$



$$\sqrt{180^2 - 115^2} = 138.47$$

6. A flowerpot has the shaded shape represented below. What is the capacity (in liters) of dirt that this pot contains when it is filled to the top of the flowerpot?



Pot = shaded part.

①

Small pyramid

$$\frac{(1.8 \cdot 1.8) \cdot 1.5}{3} = 1.62 \text{ dm}^3$$

② 3

large pyramid

$$\frac{(2.4)(2.4)(2)}{3} = 3.84 \text{ dm}^3$$

③

large - small = Size of pot

$$3.84 - 1.62 = 2.22 \text{ dm}^3$$

$$= \boxed{2.22 \text{ L}}$$

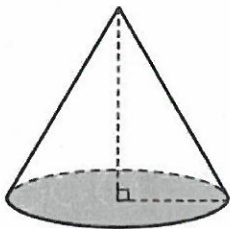


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**Volume of Pyramids, Cones and Spheres 02**

Always start with a **formula**.  
Show **all** your work **clearly**.  
Include **units** in your final answer

1. A cone has a height equal to its radius. What is the volume of this cone knowing that its diameter is equal to 4.36m?



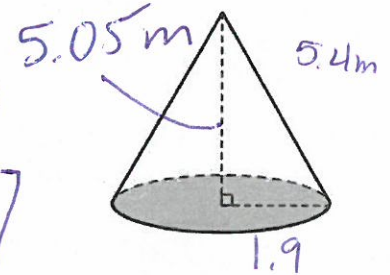
$2.18\text{m} = r$

$$\frac{\pi r^2 h}{3} = \frac{\pi (2.18)^2 (2.18)}{3} = 10.85 \text{ m}^3$$

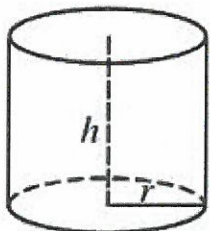
2. What is the volume of cone with a slant height of 5.4 m and a diameter of 3.8m? Round your answer to the nearest tenth.

$$\frac{\pi r^2 h}{3} = \frac{\pi (1.9)^2 (5.05)}{3} = 19.09 \text{ m}^3$$

$$= \boxed{19.1 \text{ m}^3}$$



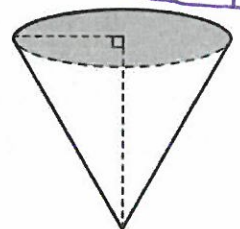
3. A water cooler has a cylindrical shape with a radius of 15 cm and a height of 42 cm. How many cups in the shape of a cone with a 3 cm radius and 7 cm height can be filled if the water cooler is full? Round.



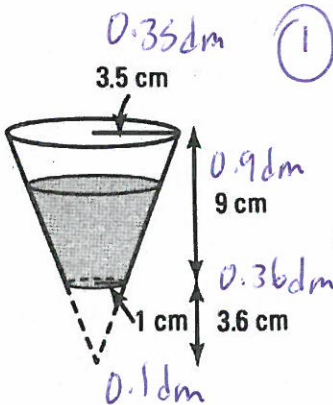
Volume cylinder  
:  $\pi (15)^2 42 = 29688.05 \text{ cm}^3$

Volume cone  
:  $\frac{\pi r^2 h}{3} = \frac{\pi (3)^2 (7)}{3} = 65.97 \text{ cm}^3$

$$29688.05 \div 65.97 = 449.99 = \boxed{450 \text{ cups}}$$



4. A glass cup has the shape below. If it is filled to 3/4 of its full capacity with champagne from a 2 L bottle, how many cups will be served?



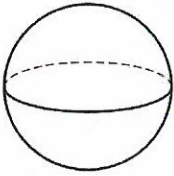
① Volume large cone  
:  $\frac{\pi r^2 h}{3} = \frac{\pi (0.35)^2 (1.26)}{3} = 0.16 \text{ dm}^3$

② Volume small cone:  
:  $\frac{\pi r^2 h}{3} = \frac{\pi (0.1)^2 (0.36)}{3} = 0.0038 \text{ dm}^3$

③  $0.16 - 0.0038 = 0.156 \text{ dm}^3$   
 $\times 0.75 = 0.117 \text{ dm}^3$

④  $2\text{L} \div 0.117 \text{ dm}^3 = 17.06$   
 $= \boxed{17 \text{ glasses}}$

5. Calculate the approximate volume of planet Earth if its radius is estimated at 6400 km?



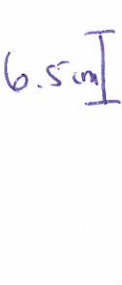
$$\frac{4\pi r^3}{3} = \frac{4\pi(6400)^3}{3} = 1.1 \times 10^{12} \text{ km}^3$$

6. How many liters of air are needed to fill a spherical balloon with a 30 cm diameter? What happens to the volume of the balloon if the diameter is doubled?

①  $\frac{4\pi r^3}{3} = \frac{4\pi(1.50)^3}{3} = 14.14 \text{ dm}^3 = 14.14 \text{ L of air}$

② It is increased by 8.  $\left\{ \begin{array}{l} \text{proof} \\ \frac{4\pi(3.0)^3}{3} = 113.097 \div 14.14 = 8 \end{array} \right.$

7. A cylindrical can contains 3 tennis balls with a radius of 3.25 cm. What is the smallest possible volume of wasted space in this cylinder? *unoccupied space.*



①  $\frac{4\pi(3.25)^3}{3} \cdot 3 = 431.37 \text{ cm}^3$

② cylinder =  $\pi r^2 h = \pi(3.25)^2(19.5) = 647.06 \text{ cm}^3$

$$647.06 - 431.37 = 215.7 \text{ cm}^3$$

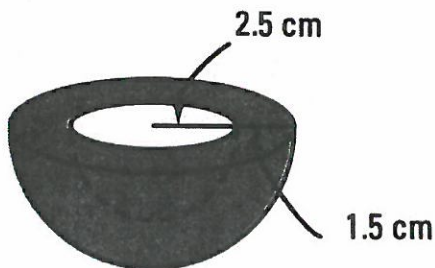
8. How many oranges with a 6 cm diameter must be squeezed to completely fill a cylindrical juice container with a 6 cm radius and a height of 20 cm? (Each orange gives 20% of its volume in juice.)

①  $\pi(6)^2 20 = 2261.95 \text{ cm}^3$

②  $\frac{4\pi(3)^3}{3} = 113.1 \text{ cm}^3 \times 0.20 = 22.62 \text{ cm}^3$

$$2261.95 \div 22.62 = 100 \text{ oranges}$$

9. What is the volume of the shaded area?



large sphere =  $\frac{4\pi r^3}{3} = \frac{4\pi(4)^3}{3} = 268.1 \text{ cm}^3$

small sphere =  $\frac{4\pi r^3}{3} = \frac{4\pi(2.5)^3}{3} = 65.45 \text{ cm}^3$

$$268.1 - 65.45 = 202.65 \text{ cm}^3$$

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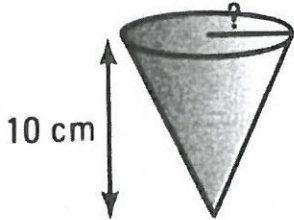
Working backwards

### Volume of Pyramids, Cones and Spheres 04

1000 mL = 1 L  
1 L = 1 dm<sup>3</sup>

Always start with a **formula**.  
Show **all** your work **clearly**.  
Include **units** in your final answer

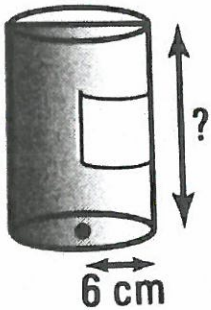
1. Given that the following solid has a volume of 94.25 cm<sup>3</sup>, what is its radius?



$$\frac{\pi r^2 h}{3} = 94.25 \text{ cm}^3$$
$$\frac{\pi (r^2)(10)}{3} = 94.25$$

$r = 3 \text{ cm}$

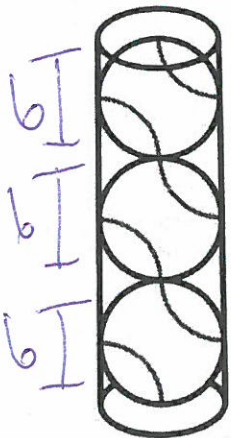
2. The can below can hold 188.5 ml of condensed soup. How tall is the can?



$$\pi r^2 h = 188.5 \text{ mL}$$
$$\pi (6 \text{ cm})^2 h = 188.5$$

$h = 1.67 \text{ cm}$

3. If each ball has a volume of 113.10 cm<sup>3</sup>, what is the volume of the cylindrical can?



①  $113.10 \text{ cm}^3 = \frac{4\pi r^3}{3}$       ②  $\pi r^2 h$

$$113.1(3) = 4\pi r^3$$
$$\frac{339.3}{4\pi} = \frac{4\pi r^3}{4\pi}$$
$$\sqrt[3]{27} = \sqrt[3]{r^3}$$

$3 = r$

$$= \pi (3)^2 (18)$$

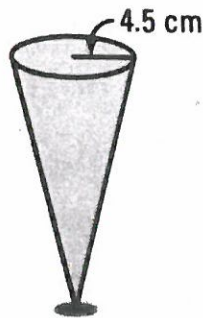
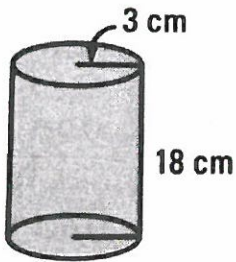
$= 508.94 \text{ cm}^3$

4. A cube and a sphere have the same volume. If the sphere's radius is 3 cm, what is the cube's total area?

$$\frac{4\pi r^3}{3} =$$

Area

5. The two containers below have the same volume. What is the height of the cone?



$$\begin{aligned} (1) \quad \pi r^2 h &= \pi (3)^2 (18) \\ &= 508.94 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} (2) \quad 508.94 &= \pi (4.5)^2 h \\ \frac{508.94}{\pi (4.5)^2} &= h \\ 8 &= h \end{aligned}$$

$$\boxed{8 \text{ cm}}$$

6. A cone and a cylinder have the same volume. The cone has a radius of 4 cm and a slant height of 6 cm. If the cylinder's radius is 5 cm, what is the height of the cylinder?

$$6 \sqrt{6^2 - 4^2} = 4.47 \text{ cm}$$

$$(1) \quad \frac{\pi r^2 h}{3} = \frac{\pi (4)^2 (4.47)}{3} = 74.5 \text{ cm}^3$$

$$\begin{aligned} (2) \quad 74.5 &= \pi r^2 h \\ \frac{74.5}{\pi 25} &= \frac{\pi (5)^2 h}{\pi (25)} \end{aligned}$$

$$\boxed{0.95 \text{ cm} = h}$$

7. A cylindrical cup with a 5 cm radius contains 5 scoops of ice cream, each with a 3 cm radius. If the ice cream melts, how high will the melted ice cream fill the cup.

Volume of scoops

$$\frac{4\pi r^3}{3} \cdot 5$$

$$\frac{4\pi (3)^3}{3} \cdot 5$$

$$= 565.5 \text{ cm}^3$$

height once melted

$$\pi r^2 h = 565.5$$

$$\frac{\pi (5)^2 h}{\pi 25} = \frac{565.5}{\pi 25}$$

$$\boxed{h = 7.2 \text{ cm}}$$