

MTH1W Grade 9 Mathematics

6.6 Measurement Calculations in Three Dimensions

- Goal(s)**
- *To determine the surface area and volume of 3-dimensional shapes*
 - *Solve problems involving composite figures*

Remember...

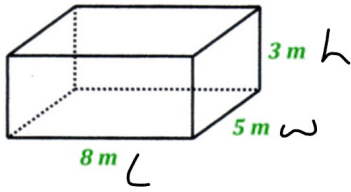
Surface Area

The total area of the faces of a 3D shape. Surface area is measured in square units.

Volume

The amount of space inside a solid figure. Volume is measured in cubic units.

Determine the **volume** of the shape.

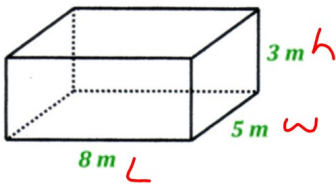


$$Vol = L \times w \times h$$

$$Vol = 8 \times 5 \times 3$$

$$Vol = 120 m^3$$

Determine the **surface area** the shape.



$$SA = 2[(Lw) + (wh) + (Lh)]$$

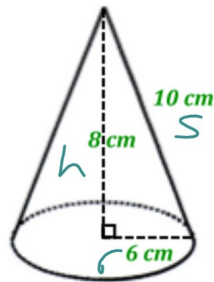
$$SA = 2[(8 \times 5) + (5 \times 3) + (8 \times 3)]$$

$$SA = 2[40 + 15 + 24]$$

$$SA = 2[79]$$

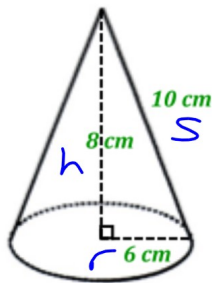
$$SA = 158 m^2$$

Determine the **volume** of the following shape.



$$\begin{aligned} \text{Vol} &= \frac{1}{3} \pi r^2 h \\ \text{Vol} &= \frac{1}{3} \pi (6)^2 (8) \\ \text{Vol} &= \frac{1}{3} \pi (36)(8) \\ \text{Vol} &= 301.6 \text{ cm}^3 \end{aligned}$$

Determine the **surface area** of the shape.

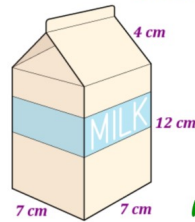


$$\begin{aligned} \text{SA} &= \pi r^2 + \pi r s \\ \text{SA} &= \pi (6)^2 + \pi (6)(10) \\ \text{SA} &= \pi (36) + \pi (60) \\ \text{SA} &= \pi (96) \\ \text{SA} &= 301.6 \text{ cm}^2 \end{aligned}$$

Note: the numerical answers for the volume and surface are the same. This is NOT always the case, it's just how it worked out this time.

The surface area, and/or volume of a **composite** 3D shape can be found by breaking the shape into known shapes and using the appropriate formulas.

Determine the **volume** of the following shape.



Made up of a triangular based prism and a rectangular prism

Need to find the height of

the triangle



$$h^2 = 4^2 - 3.5^2$$

$$h^2 = 3.75$$

$$h = \sqrt{3.75}$$

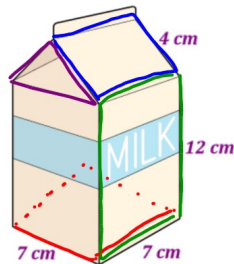
$$h = 1.94 \text{ cm}$$

$$\begin{aligned} \text{Vol}_{\Delta \text{ prism}} &= \frac{b \times h}{2} \times l \\ &= \frac{7 \times 1.94}{2} \times 7 \\ &= 47.5 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Vol}_{\square \text{ prism}} &= l \times w \times h \\ &= 7 \times 7 \times 12 \\ &= 588 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \Rightarrow \text{Total volume} &= 47.5 + 588 \\ &= 635.5 \text{ cm}^3 \end{aligned}$$

Determine the **surface area** of the following shape.



Made up of

1 x square base

4 x side rectangles

2 x slanting rectangles

2 x triangles

Square base

$$= 7 \times 7$$

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

4 x side rectangles

$$= 4 \times 7 \times 12$$

$$= 336 \text{ cm}^2$$

2 x slanting rectangles

$$= 2 \times 7 \times 4$$

$$= 56 \text{ cm}^2$$

2 x triangles

$$= 2 \times 7 \times 1.94 \div 2$$

$$= 13.6 \text{ cm}^2$$

$$\begin{aligned} \text{Total surface area} &= 49 + 336 + 56 + 13.6 \\ &= 454.6 \text{ cm}^2 \end{aligned}$$