

Achievement Standard 1.3 Measurement

The metric system uses a number of prefixes

Mega	million	1MW = 100 000W
Kilo	thousand	1kg = 1000g
deci	$\frac{1}{10}$	1db = 0.1bel
centi	$\frac{1}{100}$	1cm = 0.01m
milli	$\frac{1}{1000}$	1mL = 0.001L
micro	$\frac{1}{1000000}$	1MA = 0.000000A

Metric Units

Length and Perimeter

Km, m, cm, mm

Area

km^2 , hectares (ha), m^2 , cm^2

Volume

m^3 , cm^3

Capacity

Litres (L) or millilitres (mL)

Weight

tonnes, kg, g, mg

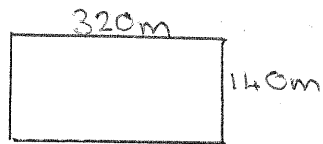
Temperature

$^{\circ}\text{C}$

Common Conversions

1. 1 hectare = $100\text{m} \times 100\text{m}$

e.g.



$$\begin{aligned}\text{Area} &= 3.2 \times 1.4 \\ &= 4.48\text{ha}\end{aligned}$$

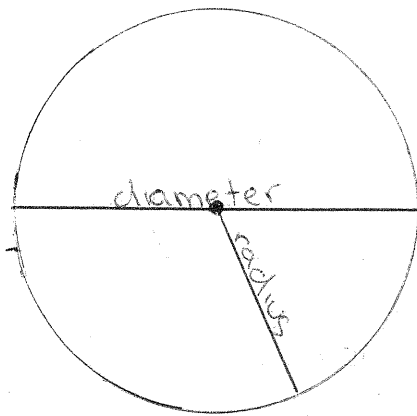
2. $1\text{m}^2 = 1\text{m} \times 1\text{m}$
 $= 100\text{cm} \times 100\text{cm}$
 $= 10000\text{cm}^2$

3. $1\text{km}^2 = 1000\text{m} \times 1000\text{m}$
 $= 1000000\text{m}^2$

4. 1mL of water weighs 1g
1L of water weighs 1kg
 1m^3 of water weighs 1tonne (1000kg)

5. 1cm^3 contains 1mL
 1000cm^3 contains 1L
C.C = cm^3

Circles



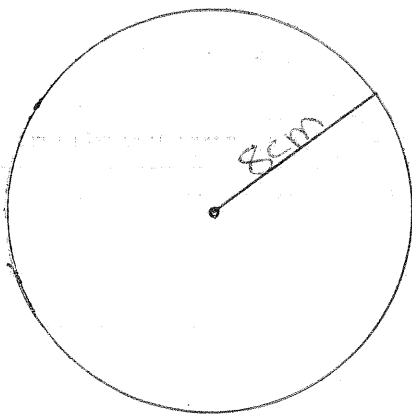
The perimeter of a circle is called the Circumference C

$$C = \pi d \quad \text{or} \quad C = 2\pi r$$

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

Examples

1)



$$C = \pi d$$

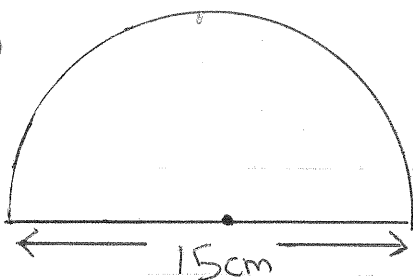
$$C = \pi \times 16$$

$$C = 50.3 \text{ cm (1dp)}$$

$$A = \pi r^2$$

$$A = 201.1 \text{ cm}^2 \text{ (1dp)}$$

2)



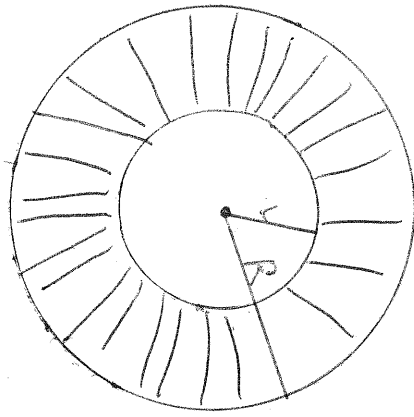
Find the perimeter of this semi-circle

$$P = \frac{1}{2} C + 15$$

$$= \frac{1}{2} (\pi \times 15) + 15$$

$$= 38.56$$

3)



An annulus is a ring

$$A = \pi R^2 - \pi r^2$$

e.g. Find the area of a circular running track with an inner radius of $r = 40\text{m}$ and outer radius $R = 48\text{m}$

$$A = \pi \times 48^2 - \pi \times 40^2$$

$$A = 2211.7\text{m}^2 \text{ (1dp)}$$

4) Find the area of a circle whose circumference is 500m

$$C = \pi \times d$$

$$500 = \pi \times d$$

$$\frac{500}{\pi} = d$$

$$d = 159.2\text{m}$$

$$r = \frac{1}{2} d = 79.6\text{m}$$

$$A = \pi r^2$$

$$A = \pi \times 79.6^2$$

$$A = 19894.4\text{m}^2 \text{ (1dp)}$$

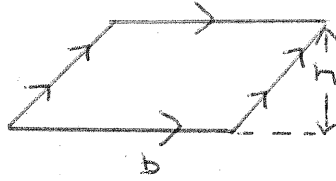
Area

Rectangle



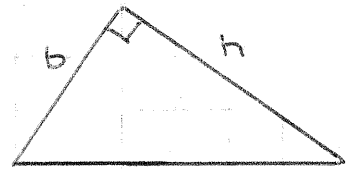
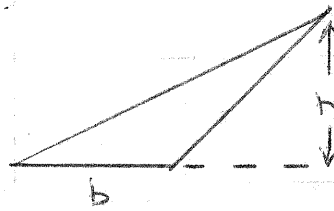
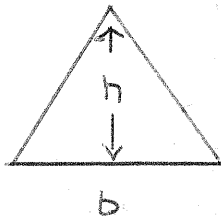
$$\text{Area } A = l \times b$$

Parallelogram



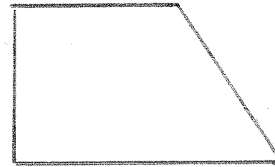
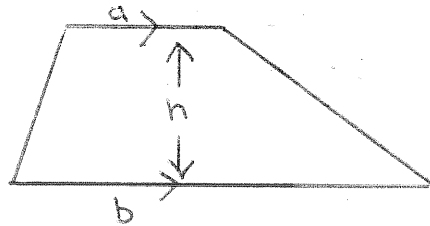
$$\text{Area } A = b \times h \quad (h = \text{vertical height})$$

Triangle



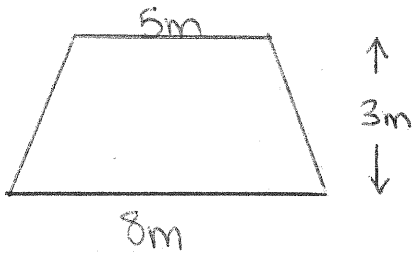
$$\text{Area } A = \frac{1}{2} \times b \times h \quad (h \text{ is } \perp \text{ to } b)$$

Trapezium



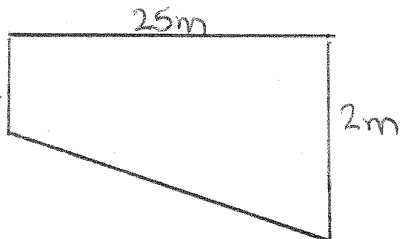
$$A = \frac{1}{2} (a + b) \times h$$

Eg
1)



$$A = \frac{1}{2} (5 + 8) \times 3$$
$$A = 19.5 \text{ m}^2$$

2)



$$A = \frac{1}{2} (1 + 2) \times 25$$
$$A = 37.5 \text{ m}^2$$

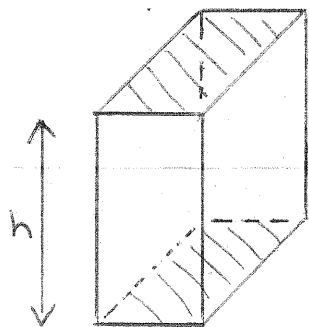
Volume

The volumes we will study are:

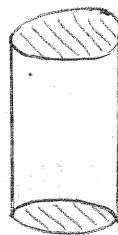
- prisms
- pyramids
- spheres

Prism

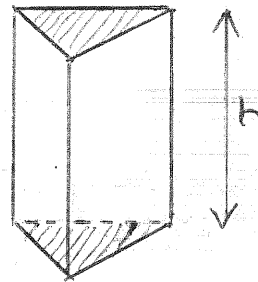
A prism is a 3D shape with the same cross-sectioned area throughout its height, or length.



Rectangular
prism (cuboid)



Circular
prism
(cylinder)



Triangular
prism

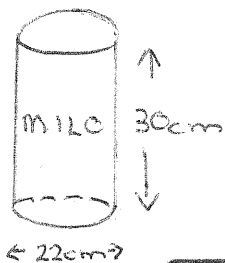
The volume of a prism is given by
 $V = (\text{cross section area}) \times \text{height}$

Examples

- ① The dimensions of a cuboid are length = 12cm.
width = 4cm
height = 20cm

The volume is $V = (\text{base area}) \times h$
 $V = (12 \times 4) \times 20$
 $V = 960 \text{ cm}^3$

②



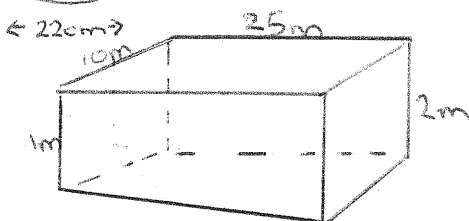
Volume of cylinder = (base area) \times h

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

$$V = \pi \times 11^2 \times 30$$

$$V = 11404 \text{ cm}^3$$

③



The pool is being filled at a rate of 250ml per second. How long will it take to fill?

$$\begin{aligned} \text{Cross-section area} &= \frac{1}{2}(a+b) \times h \\ &= \frac{1}{2}(1+2) \times 25 \\ &= 37.5 \text{ m}^2 \end{aligned}$$

$$V = 37.5 \times 10$$

$$V = 375 \text{ m}^3$$

$$V = 375000 \text{ L}$$

Pool is filling at a rate of 0.25 L/s

$$\text{Time to fill} = \frac{375000}{0.25} \text{ Seconds}$$

$$= 1500000 \text{ s}$$

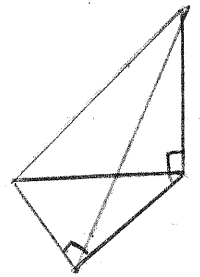
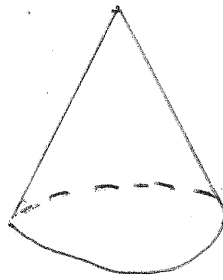
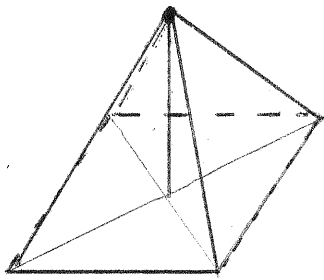
$$= 25000 \text{ minutes}$$

$$= 416 \text{ hours } 40 \text{ min}$$

$$= 17 \text{ Days } 8 \text{ hours } 40 \text{ mins}$$

Pyramids

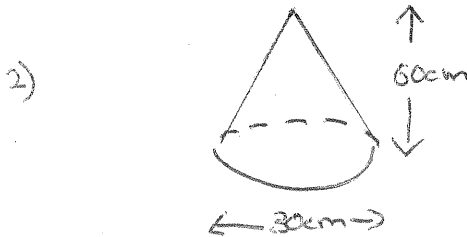
A pyramid is a 3D shape that rises to a vertex



The volume of a pyramid is
 $V = \frac{1}{3} (\text{base area}) \times h$

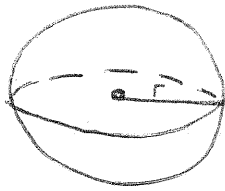
- 1) Cheop's pyramid has a square base of $232\text{m} \times 232\text{m}$ and a height of 148m .
Find the volume of the pyramid.

$$V = \frac{1}{3} (232 \times 232) \times 148$$
$$V = 2655317 \text{ m}^3$$



$$V = \frac{1}{3} (\pi r^2) \times h$$
$$V = \frac{1}{3} \times (\pi \times 15^2) \times 60$$
$$V = 14137.2 \text{ cm}^3$$

Spheres



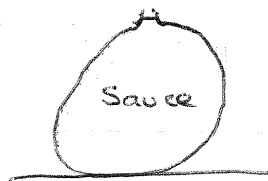
$$V = \frac{4}{3} \pi r^3$$

Examples 1) Find the volume of a sphere of diameter 26cm

$$V = \frac{4}{3} \times \pi \times 13^3$$

$$V = 9202.8 \text{ cm}^3$$

2)



Find the radius if this contains
2L of tomato sauce.

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

$$1000 = \frac{4}{3} \times \pi \times r^3$$

(1L = 1000 cm³)

$$3000 = 4\pi r^3$$
$$\frac{3000}{(4\pi)} = r^3$$

$$r = \sqrt[3]{\frac{3000}{(4\pi)}}$$

$$r = 6.2 \text{ cm (1 d.p.)}$$