

YEAR 10 — GEOMETRY...

Working with circles

What do I need to be able to do?

By the end of this unit you should be able to:

- Recognise and label parts of a circle
- Calculate fractional parts of a circle
- Calculate the length of an arc
- Calculate the area of a sector
- Understand and use volume of a cone, cylinder and sphere.
- Understand and use surface area of a cone, cylinder and sphere.

Keywords

Circumference: the length around the outside of the circle — the perimeter

Area: the size of the 2D surface

Diameter: the distance from one side of a circle to another through the centre

Radius: the distance from the centre to the circumference of the circle

Tangent: a straight line that touches the circumference of a circle

Chord: a line segment connecting two points on the curve

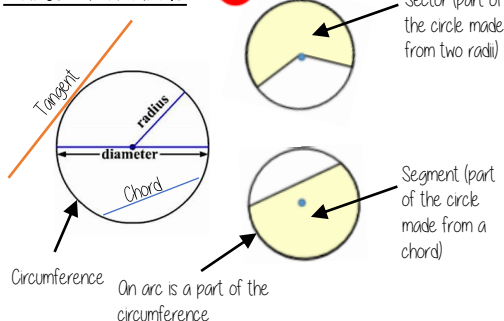
Frustum: a pyramid or cone with the top cut off

Hemisphere: half a sphere

Surface area: the total area of the surface of a 3D shape.

Parts of a circle

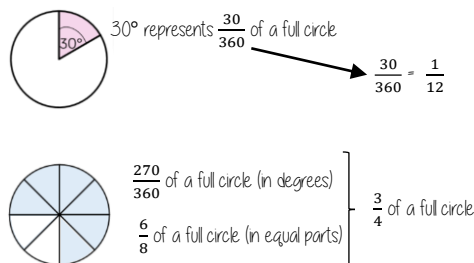
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Fractional parts of a circle

A circle is made up of 360°

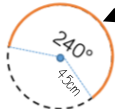
Formula to remember:
Area of a circle = πr^2
Circumference of a circle = πd or $2\pi r$



The fraction of the circle is as $\frac{\theta}{360}$
 θ represents the degrees in the sector

Arc length

Remember an arc is part of the circumference
Circumference of the whole circle = $\pi d = \pi \times 9 = 9\pi$



$$\text{Arc length} = \frac{\theta}{360} \times \text{circumference}$$

$$= \frac{240}{360} \times 9\pi = \frac{2}{3} \times 9\pi = 6\pi$$

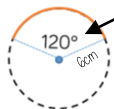
Perimeter

Perimeter is the length around the outside of the shape
This includes the arc length and the radii that enclose the shape

$$\text{Perimeter} = \frac{\theta}{360} \times \text{circumference} + 2r = 6\pi + 9$$

Sector area

Remember a sector is part of a circle
Area of the whole circle = $\pi r^2 = \pi \times 6^2 = 36\pi$



$$\text{Sector area} = \frac{\theta}{360} \times \text{area of circle}$$

$$= \frac{120}{360} \times 36\pi = \frac{1}{3} \times 36\pi = 12\pi$$

Volume of a cone and a cylinder

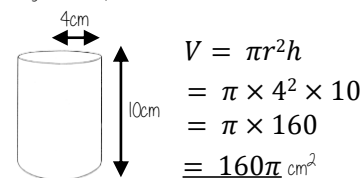
$$\text{Volume Cylinder} = \pi r^2 h$$



$$\text{Volume Cone} = \frac{1}{3} \pi r^2 h$$

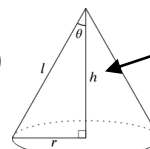
A cylinder is a prism — cross section is a circle

A cone is a pyramid with a circular base



$$\begin{aligned} V &= \pi r^2 h \\ &= \pi \times 4^2 \times 10 \\ &= \pi \times 160 \\ &= 160\pi \text{ cm}^2 \end{aligned}$$

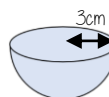
Give your answer in terms of π'
means NOT in terms of pi $\approx 502.7 \text{ cm}^2$



The height of a cone is the perpendicular height from the vertex to the base

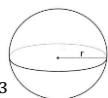
Look out for trigonometry or Pythagoras theorem — the radius forms the base of a right-angled triangle

Volume of a sphere



$$\begin{aligned} \text{Volume Sphere} &= \frac{4}{3} \pi r^3 \\ &= \frac{4}{3} \times \pi \times 3^3 \\ &= \frac{4}{3} \times \pi \times 27 = 36\pi \end{aligned}$$

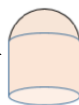
A hemisphere is half the volume of the overall sphere
 $= 36\pi \div 2 = 18\pi$



$$\text{Volume Sphere} = \frac{4}{3} \pi r^3$$

NOTE: This is now a cubed value

Look out for hemispheres being placed on other 3D shapes, e.g. cones and cylinders



Surface area of a sphere



Radius = 5cm

$$\text{Surface area} = 4\pi r^2$$

$$\begin{aligned} &= 4 \times \pi \times 5^2 \\ &= 4 \times \pi \times 25 \\ &= 100\pi \end{aligned}$$

The curved surface area of a sphere

$$\text{Surface area} = 4\pi r^2$$

A hemisphere has the curved surface AND a flat circular face



$$= 100\pi \div 2 = 50\pi$$

$$= 50\pi + \pi \times 5^2$$

$$\text{Hemisphere} = 75\pi$$

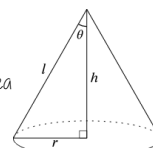
Surface area of cones and cylinders

$$\text{Surface area cylinder} = 2\pi r^2 + \pi d h$$



The area of two circles (top and bottom face) + the area of the curved face

The length of shape B is the circumference of the circles



$$\text{Curved surface area Cone} = \pi r l$$

Look out for the use of Pythagoras to calculate the length l

Total surface area = curved face + circle face (area of base)