# Y10 Working with Circles

## What do I need to be able to do?

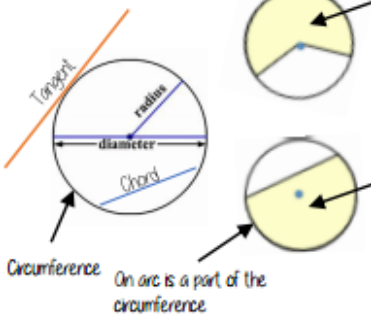
**By the end of this unit you should be able to:**

- 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
**Frustrum:** 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.

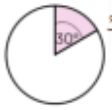
## Parts of a circle (R)




## Fractional parts of a circle

A circle is made up of 360°

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




30° represents $\frac{30}{360}$ of a full circle

$\frac{30}{360} = \frac{1}{12}$

$\frac{270}{360}$ of a full circle (in degrees)

$\frac{6}{8}$ of a full circle (in equal parts)

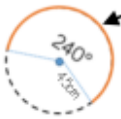
$\frac{3}{4}$ of a full circle

The fraction of the circle is as $\frac{\theta}{360}$

$\theta$ represents the degrees in the sector

## Arc length

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




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

$= \frac{240}{360} \times 9\pi$

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

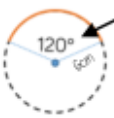
**Perimeter**

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

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

## Sector area

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




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

$= \frac{120}{360} \times 36\pi$

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

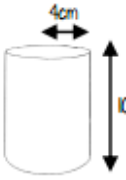
## Volume of a cone and a cylinder

Volume Cylinder = $\pi r^2 h$

A cylinder is a prism – cross section is a circle

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

A cone is a pyramid with a circular base




$V = \pi r^2 h$
$= \pi \times 42 \times 10$
$= \pi \times 160$
$= 160\pi$ cm$^3$

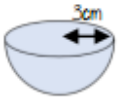
Give your answer in terms of $\pi$ means **NOT** in terms of pi

$= 502.7$cm$^3$


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




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

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

$= \frac{4}{3} \times \pi \times 27 = 36\pi$

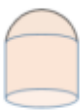
A hemisphere is half the volume of the overall sphere

$= 36\pi \div 2$
$= 18\pi$

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

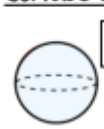
NOTE: This is now a **cubed** value

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



## Surface area of a sphere

Surface area = $4\pi r^2$



Radius = 5cm

Surface area = $4\pi r^2$
$= 4 \times \pi \times 5^2$
$= 4 \times \pi \times 25$
$= 100\pi$

The curved surface area of a sphere

A hemisphere has the curved surface AND a flat circular face

$= 100\pi \div 2 = 50\pi$
$= 50\pi + \pi \times 5^2$
Hemisphere $= 75\pi$

## Surface area of cones and cylinders

Surface area cylinder = $2\pi r^2 + \pi dh$


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

Curved surface area Cone = $\pi rl$


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

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