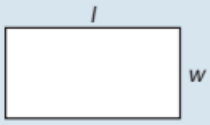
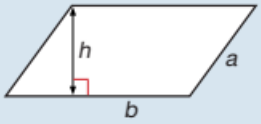
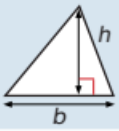
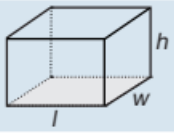
Edexcel GCSE (9-1) Maths Higher 2022: Formulae to learn

Areas

Rectangle = $l \times w$	
Parallelogram = $b \times h$	
Triangle = $\frac{1}{2} b \times h$	

Volumes

Cuboid = $l \times w \times h$	
Cylinder = $\pi r^2 h$	
Volume of pyramid = $\frac{1}{3}$ × area of base × h	

Compound measures

Speed

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

Density

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Pressure

The formula for pressure does not need to be learnt, and will be given within the relevant examination questions.

$$Average\ speed = \frac{Total\ Distance}{Total\ Time}$$

Direct proportionality:
(y is proportional to x, x^2)

$$y \propto x \rightarrow y = kx$$
$$y \propto x^2 \rightarrow y = kx^2$$

Inverse proportionality:
(y is inversely proportional to x, x^2)

$$y \propto \frac{1}{x} \rightarrow y = \frac{k}{x}$$
$$y \propto \frac{1}{x^2} \rightarrow y = \frac{k}{x^2}$$

Sum of interior angles for a regular polygon $= (\text{number of sides} - 2) \times 180$

Interior angle of a regular polygon $= \dfrac{(\text{number of sides} - 2) \times 180}{\text{number of sides}}$

Exterior angle of a regular polygon $= \dfrac{360}{\text{number of sides}}$

Trigonometry common values:

	0°	30°	45°	60°	90°
sin	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
tan	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	–

Percentage of amount:

$$\frac{\text{percentage}}{100} \times \text{amount}$$

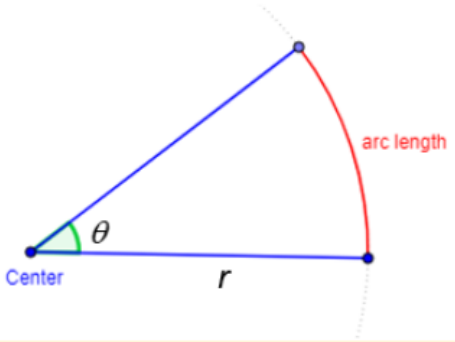
Percentage change:

$$\text{Percentage Change} = \frac{\text{new} - \text{original}}{\text{original}} \times 100$$

Histograms:

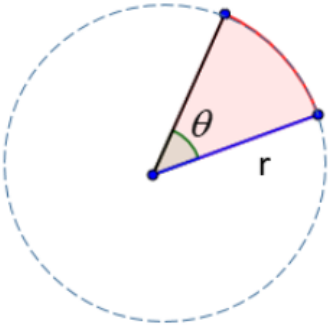
$$\text{Frequency Density} = \frac{\text{frequency}}{\text{class width}}$$

Arc Length and Area of Sector



If θ is measured in degrees then

$$\text{arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$



If θ is measured in degrees then

$$\text{area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

Probability of Compound Events

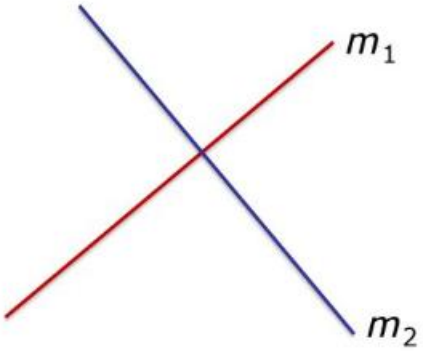
Independent Events

$$P(A \text{ and } B) = P(A) \times P(B)$$

Mutually Exclusive

$$P(A \text{ or } B) = P(A) + P(B)$$

If two lines are perpendicular to each other with gradients m_1 and m_2 then it is true to say



$$m_1 = -\frac{1}{m_2}$$

or

$$m_1 \times m_2 = -1$$

The coordinates of the turning point (maximum/minimum) of a quadratic function written in the "completing the square" form

$$y = a(x+b)^2 + c$$

Is $(-b, c)$.

If the lower bound of a number x is LB and the upper bound is UB then the error interval for x can be written as

$$LB \leq x < UB$$

For example, if x has been rounded to 1.dp. to produce 3.2 then the error interval for x is $3.15 \leq x < 3.25$.

Rules of Indices

For $a \neq 0, b \neq 0$

Rule	Example
$a^x \times a^y = a^{x+y}$	$a^3 \times a^2 = a^{3+2} = a^5$
$a^x \div a^y = a^{x-y}$	$a^6 \div a^2 = a^{6-2} = a^4$
$\left(a^x\right)^y = a^{xy}$	$\left(a^2\right)^3 = a^{2\times 3} = a^6$
$a^0 = 1$	$a^0 = 1$
$a^{-x} = \frac{1}{a^x}$	$a^{-5} = \frac{1}{a^5}$
$a^{\frac{x}{y}} = \sqrt[y]{a^x} = \left(\sqrt[y]{a}\right)^x$	$a^{\frac{3}{5}} = \sqrt[5]{a^3} = \left(\sqrt[5]{a}\right)^3$

Transformation Rules for Functions

Function Notation	Type of Transformation	Change to Coordinate Point
f(x) + d	Vertical translation up d units	(x, y) → (x, y + d)
f(x) – d	Vertical translation down d units	(x, y) → (x, y – d)
f(x + c)	Horizontal translation left c units	(x, y) → (x – c, y)
f(x – c)	Horizontal translation right c units	(x, y) → (x + c, y)
–f(x)	Reflection over x-axis	(x, y) → (x, –y)
f(–x)	Reflection over y-axis	(x, y) → (–x, y)

Graphs of Trigonometric Functions

You need to be able to recognise the graphs of sinθ, cosθ and tanθ

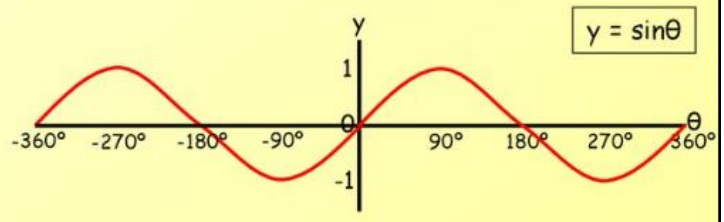
You will have seen all these graphs on your GCSE

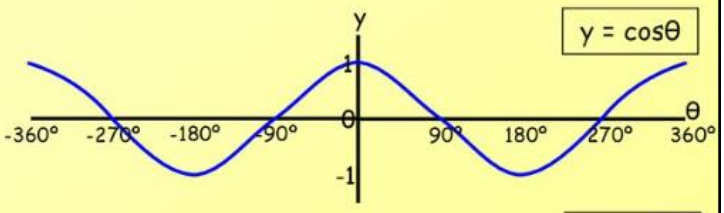
The key points to remember are the peaks/troughs of each, and the points of intersection

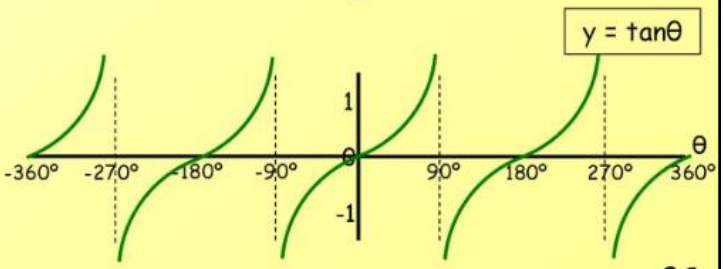
The Cos graph is the same as the Sin graph, but shifted along (it starts at 1 instead of 0)

The Tan graph has lines called asymptotes. These are points the graph approaches but never reaches (90°, 270° etc…)

Period (length of wave) = 360° for Sin and Cos, and 180° for Tan





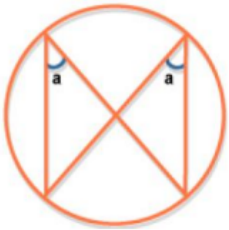


8C

Circle theorems / properties

1) **The angle between a tangent and a radius is a right-angle.**

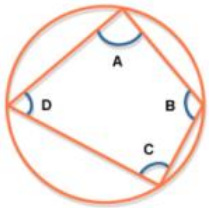
2) **Angles that are subtended by the same chord/arc at the circumference in the same segment are equal.**



3) **An angle that is subtended at the circumference by a diameter is a right-angle.**

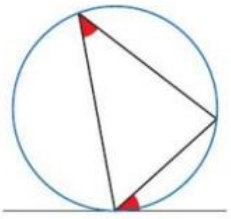
4) **(In the same segment) The angle subtended by a chord/arc at the centre is twice the angle subtended at the circumference.**

5) **Opposite angles in a *cyclic quadrilateral* add up to 180 degrees.**

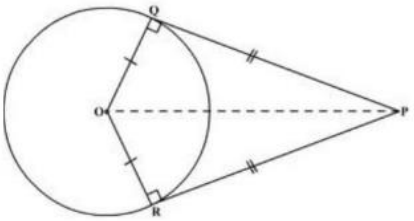


$A + C = 180°$
$D + B = 180°$

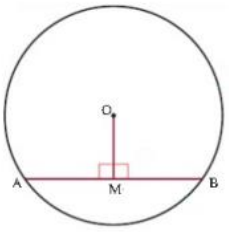
6) **The angle between a radius and a chord is equal to the angle subtended by the chord at the circumference in the opposite segment.**



7) **Tangents to a circle that meet at a point outside the circle are equal in length.**



8) **A line drawn from the centre of a circle to the midpoint of a chord meets the chord at a right-angle.**



Shortened forms (you can quote these in an exam)

1) The angle between a tangent and a radius is a right-angle.

2) Angles in the same segment are equal.

3) Angles in a semicircle are 90°.

4) The angle at the centre is twice the angle at the circumference.

5) Opposite angles in a cyclic quadrilateral add up to 180°.

6) The alternate segment theorem.

7) Tangents to a circle that meet at an external point are equal.

8) The perpendicular bisector of a chord passes through the centre of the circle.

Calculating the total population using capture recapture

To work out an estimate for the total population we use the formula:

$$\frac{M}{N} = \frac{R}{T}$$

where:

M = Total marked

N = Total population

R = Number of marked recaptured

T = Total recaptured on second visit