

Maths Formula (starred* formula are for Higher tier only)

Rules of Indices

Rule 1: When you multiply indices of the same number you **add** the powers.

For example: $5^4 \times 5^3 = 5^{4+3} = 5^7$

Rule 2: When you divide indices of the same number you **subtract** the powers.

For example:

$$\frac{5^5}{5^3} = 5^{5-3} = 5^2$$

***Rule 3:** Indices outside a bracket **multiply**.

For example: $(3^2)^4 = 3^{2 \times 4} = 3^8$

***Rule 4:** Negative indices mean **reciprocal**, i.e. 'one over....' or 'put on the bottom of a fraction'.

For example:

$$3^{-2} = \frac{1}{3^2} = \frac{1}{9}$$

***Rule 5:** When the power is a fraction the top of the fraction (numerator) is a power and the bottom of the fraction is a root.

For example:

power ——— $8^{2/3}$ ——— root

8

***Rule 6:** Anything to a power of 1 is just itself and we normally don't bother putting the 1 there.

For example: 5^1 is just 5.

Anything to a power of 0 is equal to 1, it doesn't matter what number it is!

For example: $10^0 = 1$, $2^0 = 1$, $x^0 = 1$, etc.

The nth Term

n^{th} term = $dn + (a - d)$

For example: 6, 11, 16, 21, ... for this sequence $d = 5$, $a = 6$

Angle Formulae

Rule 1: Angles around a single point add up to 360° .

Rule 2: Angles on a straight line add up to 180° .

Rule 3: Vertically opposite angles are equal. (This is when two straight lines cross!).

Rule 4: Angles in a triangle add up to 180° .

Rule 5: Angles in a quadrilateral add up to 360° .

Parallel Lines

When a straight line crosses two parallel lines there are more angle facts we can look for and use!

Rule 1: Corresponding angles are equal - these are angles in a letter 'F'.

Rule 2: Alternate angles are equal - these are angles in a letter 'Z'.

Rule 3: Supplementary or Co-interior angles add up to 180° - these are angles in a letter 'U' or 'C' (when the 'U' and the 'C' are made of three straight sides, of course).

*Sin, Cos, Tan

SOHCAHTOA

***Rule 1:** Sine is Opposite over Hypotenuse

***Rule 2:** Cos is Adjacent over Hypotenuse

***Rule 3:** Tan is Opposite over Adjacent

Pythagoras

Rule:

The square on the hypotenuse is equal to the sum of the squares on the other two sides

or, $a^2 + b^2 = c^2$

Area

Square: Area = Length²

Rectangle: Area = Length x Width

Right-angled Triangle: Area = $\frac{1}{2}$ x Base x Height

Other Triangle: Area = $\frac{1}{2}$ x Base x Perpendicular Height

Parallelogram: Area = Base x Perpendicular Height

Circle: Area = πr^2

Trapezium: Area = $\frac{1}{2}(a + b) \times h$

*Surface Area

**Curved Surface of a Cylinder:* Area = $2\pi rh$

**Surface of a Sphere:* Area = $4\pi r^2$

**Curved Surface of a Cone:* Area = πrl

Volume

Cube: Volume = Length³

Cuboid: Volume = Length x Width x Height

Prism: Volume = Area of Cross-section x Length

Cylinder: Volume = πr^2h

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

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

Polygons and their angles

Polygon Interior: Sum of interior angles = (number of sides – 2) x 180

Polygon Exterior: Sum of exterior angles = 360

Polygon Interior and Exterior: One interior + one exterior = 180

For a regular polygon with 'n' sides, *External angle:*

$$\frac{360}{n}$$

For a regular polygon with 'n' sides, *Internal angle:*

$$180 - \frac{360}{n}$$

Circles

Circumference = $2\pi r$ or, Circumference = πd

Area = πr^2

Similarity

$$\text{Scale Factor} = \frac{\text{New Length}}{\text{Old Length}}$$

Graphs

The equation of a straight line is $y = mx + c$

The gradient, m:

$$m = \frac{\text{Change in y-values}}{\text{Change in x-values}}$$

Quadratic functions are written in the form $y = ax^2 + bx + c$

*Cubics are in the form $y = ax^3 + bx^2 + cx + d$

In a pie chart, to find out the frequency that each section represents measure the angle for the section then:

$$\text{Frequency} = \frac{\text{Angle}}{360} \times \text{Total Frequency}$$

Probability

If we call a particular event 'A' then the probability of A happening is:

$$p(A) = \frac{\text{Number of different ways A can happen}}{\text{Total number of outcomes}}$$

**The 'and' rule:*

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

**The 'or' rule:*

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