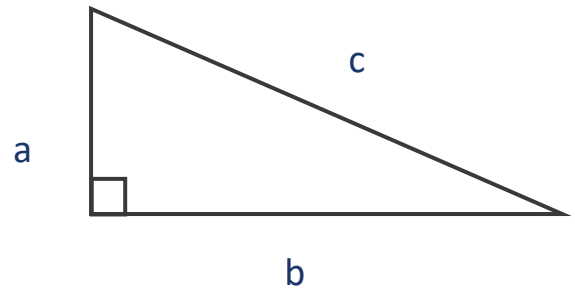
National 5 Maths Formula List

Pythagoras' Theorem

Pythagoras' Theorem states that for any right-angled triangle the 'sum of the squares of the two short sides equals the square of the long side.'



For the above triangle with short sides a and b, and long side c we have $a^2 + b^2 = c^2$

Circles

Circumference

$C = \pi d$ where d is the diameter

Area

$A = \pi r^2$ where r is the radius

Arc Length

Arc length $= \frac{angle}{360} \; x \; \pi d$

Sector Area

Sector area $= \frac{angle}{360} \; x \; \pi r^2$

Vectors

Magnitude (Length) of a Vector

For the vector $\underline{a} = \begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix}$, the magnitude of $\underline{a}$, denoted $|\underline{a}|$, is given by

$|\underline{a}| = \sqrt{{a_1}^2 + {a_2}^2 + {a_3}^2}$

Comparing Data

Interquartile Range $= Q_3 - Q_1$

Semi-Interquartile Range $= \frac{Q_3 - Q_1}{2}$

Standard Deviation

S. D. $= \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$

S. D. $= \sqrt{\frac{\sum x^2 - (\sum x)^2 / n}{n - 1}}$

Where n is the number of data points in the set, $\bar{x}$ is the mean, and $\sum$ means 'the sum of', indicating to add the values together

Straight Lines

Gradient of a Straight Line

For any two points on a line (x_1, y_1) and (x_2, y_2) the gradient is given by:

$m = \frac{y_2 - y_1}{x_2 - x_1}$

Equation of a Straight Line

$y = mx + c$ where m is the gradient and c is the $y-$ intercept

$y - b = m(x - a)$ where (a, b) is any point on the line and m is the gradient

Quadratic Equations

The roots of the quadratic equation $ax^2 + bx + c = 0$ are given by

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

For the quadratic equation $ax^2 + bx + c = 0$ the discriminant is defined by $b^2 - 4ac$

If $b^2 - 4ac < 0$ the quadratic equation has zero solutions / roots

If $b^2 - 4ac = 0$ the quadratic equation has one solution / root

If $b^2 - 4ac > 0$ the quadratic equation has two solutions / roots

Graphs of Quadratic Functions

For the quadratic $ax^2 + bx + c$ written in the form $(x + p)^2 + q$ the co-ordinates of the turning point is $(-p, q)$. For example, for $y = (x - 3)^2 + 4$, the turning point is $(3, 4)$.

Rules for Indices

$a^m \; x \; a^n = a^{m+n}$

$a^m \div a^n = a^{m-n}$

$(a^m)^n = a^{mn}$

$a^{-m} = \frac{1}{a^m}$

$a^0 = 1$

Trigonometry

The Sine Rule

For any triangle with angles A, B & C and corresponding sides a, b & c we have

$\frac{a}{Sin\, A} = \frac{b}{Sin\, B} = \frac{c}{Sin\, C}$ or $\frac{Sin\, A}{a} = \frac{Sin\, B}{b} = \frac{Sin\, C}{c}$

The Cosine Rule

For any triangle with angles A, B & C and corresponding sides a, b & c we have

$a^2 = b^2 + c^2 - 2bc\, Cos\, A$

This form of the Cosine Rule is best used for finding lengths

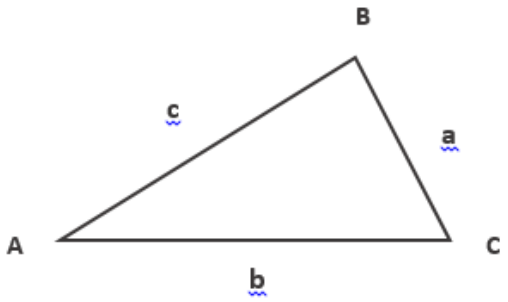
We can also write the Cosine Rule as

$$Cos\, A = \frac{b^2 + c^2 - a^2}{2bc}$$

This form of the Cosine Rule is best used for finding angles

The Area of a Non-Right Triangle

The area of any triangle ABC is given by $Area = \frac{1}{2}ab\ Sin\ C$



When using this formula notice that you need to have any two sides of a triangle and the angle between those sides

Trigonometric Identities

$\frac{\sin x}{\cos x} = \tan x$

$sin^2x + cos^2x = 1$

Note that sin^2x means $(\sin x)^2$ not $\sin(x^2)$

Volume

Volume of a cone = $\frac{1}{3}\pi r^2 h$

Volume of a pyramid = $\frac{1}{3}x\ base\ area\ x\ height$

Volume of a sphere = $\frac{4}{3}\pi r^3$