

A-level Maths

Formulae and identities you'll need to know

Remember:
you'll still need your
GCSE formulae
at A-level

Coordinate geometry

A straight line graph, gradient m passing through (x_1, y_1) has equation

$$y - y_1 = m(x - x_1)$$

Straight lines with gradients m_1 and m_2 are perpendicular when

$$m_1 m_2 = -1$$

Sequences

General term of an arithmetic progression:

$$u_n = a + (n-1)d$$

General term of a geometric progression:

$$u_n = ar^{n-1}$$

Laws of Logarithms

$$x = a^n \Leftrightarrow n = \log_a x$$

for $a > 0$ and $x > 0$

$$\log_a x + \log_a y = \log_a(xy)$$

$$\log_a x - \log_a y = \log_a\left(\frac{x}{y}\right)$$

$$k \log_a x = \log_a(x^k)$$

Kinematics

For motion in a straight line with variable acceleration:

$$v = \frac{dr}{dt} \quad a = \frac{dv}{dt} = \frac{d^2r}{dt^2}$$

$$r = \int v dt \quad v = \int a dt$$

Vectors

$$|xi+yj+zk| = \sqrt{(x^2+y^2+z^2)}$$

Trigonometry

$$\cos^2 A + \sin^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

$$\sin 2A = 2 \sin A \cos A$$

$$\cos 2A = \cos^2 A - \sin^2 A$$

$$\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$$

Laws of Indices

$$a^x a^y = a^{x+y}$$

$$a^x \div a^y = a^{x-y}$$

$$(a^x)^y = a^{xy}$$

Statistics

The mean of a set of data:

$$\bar{x} = \frac{\sum X}{n} = \frac{\sum fX}{\sum f}$$

The standard Normal variable:

$$Z = \frac{X - \mu}{\sigma}$$

where $X \sim N(\mu, \sigma^2)$

Mensuration

For a circle of radius r , where an angle at the centre of θ radians subtends an arc of length s and encloses an associated sector of area A :

$$s = r\theta \quad A = \frac{1}{2}r^2\theta$$

Calculus and Differential Equations

Differentiation

Function	Derivative
x^n	nx^{n-1}
$\sin kx$	$k \cos kx$
$\cos kx$	$-k \sin kx$
e^{kx}	ke^{kx}
$\ln x$	$\frac{1}{x}$
$f(x) + g(x)$	$f'(x) + g'(x)$
$f(x)g(x)$	$f'(x)g(x) + f(x)g'(x)$
$f(g(x))$	$f'(g(x))g'(x)$

Integration

Function	Integral
x^n	$\frac{1}{n+1}x^{n+1} + c, n \neq -1$
$\cos kx$	$\frac{1}{k} \sin kx + c$
$\sin kx$	$-\frac{1}{k} \cos kx + c$
e^{kx}	$\frac{1}{k} e^{kx} + c$
$\frac{1}{x}$	$\ln x + c, x \neq 0$
$f'(x) + g'(x)$	$f(x) + g(x) + c$
$f'(g(x))g'(x)$	$f(g(x)) + c$

Area under a curve:

$$= \int_a^b y \, dx \quad (y \geq 0)$$

Forces and Equilibrium

Weight = mass \times g

Friction:

$$F \leq \mu R$$

Newton's second law in the form:

$$F = ma$$