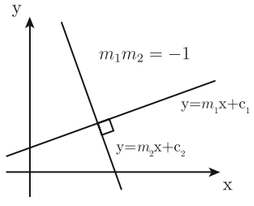
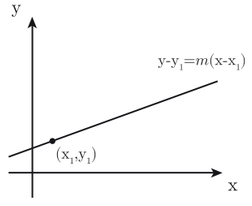
A LEVEL MATHEMATICS FORMULAE

Students must be able to use the following formulae and identities, without them being provided, either in these or equivalent forms.
These results will only be provided if they are the starting point for a proof or to be proven.

SCAN ME

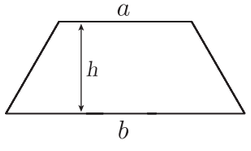
Geometry



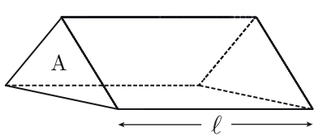


Area of a Trapezium:

$$A = \frac{1}{2}(a+b)h$$



Volume of a prism = area of cross section x length



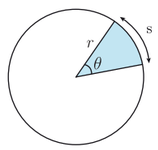
Circumference C and area A of a circle, radius r and diameter d

$C = 2\pi r = \pi d$ and $A = \pi r^2$

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:

Arc length of segment $s = r\theta$

and shaded area $A = \frac{1}{2}r^2\theta\,, \quad \theta$ in radians



Vector magnitude:

$$|x\,\boldsymbol{i} + y\,\boldsymbol{j} + z\,\boldsymbol{k}| = \sqrt{x^2+y^2+z^2}$$

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Quadratic Equations

$ax^2 + bx + c = 0$ has roots $x = \dfrac{-b \pm \sqrt{b^2-4ac}}{2a}$

Laws of Indices

$x^a x^b = x^{a+b} \qquad x^{-a} = \dfrac{1}{x^a} \qquad \dfrac{x^a}{x^b} = x^{a-b}$

$(x^a)^b = x^{ab} \qquad x^{\frac{1}{a}} = \sqrt[a]{x} \qquad x^{\frac{a}{b}} = \left(\sqrt[b]{x}\right)^a$

Laws of Logarithms

$x = a^n \Leftrightarrow n = \log_a x\,, \quad a, x > 0$

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

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

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

Sequences

General term of an arithmetic progression:

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

General term of a geometric progression:

$u_n = ar^{n-1}$

Differentiation

$\dfrac{d}{dx}x^n = nx^{n-1}$

$\dfrac{d}{dx}\sin(kx) = k\cos(kx)$

$\dfrac{d}{dx}\cos(kx) = -k\sin(kx)$

$\dfrac{d}{dx}e^{kx} = ke^{kx}$

$\dfrac{d}{dx}\ln x = \dfrac{1}{x}$

$\dfrac{d}{dx}(f(x)+g(x)) = \dfrac{d}{dx}f(x) + \dfrac{d}{dx}g(x)$

$\dfrac{d}{dx}(f(x)g(x)) = \dfrac{d}{dx}(f(x))g(x) + f(x)\dfrac{d}{dx}g(x)$

$\dfrac{d}{dx}f(g(x)) = \dfrac{d}{dg}f(g) \times \dfrac{d}{dx}g(x)$

Note that we sometimes write $\dfrac{d}{dx}f(x)$ as $f'(x)$

Integration

$\int x^n\,dx = \dfrac{1}{n+1}x^{n+1} + C, \quad n \neq -1$

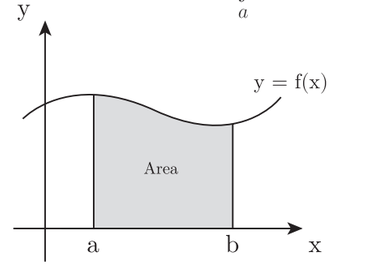
$\int \cos(kx)\,dx = \dfrac{1}{k}\sin(kx) + C$

$\int \sin(kx)\,dx = -\dfrac{1}{k}\cos(kx) + C$

$\int e^{kx}\,dx = \dfrac{1}{k}e^{kx} + C$

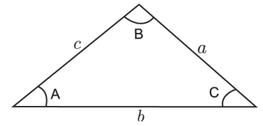
$\int \dfrac{1}{x}\,dx = \ln|x| + C, \qquad x \neq 0$

Area under a curve $= \int_a^b y\,dx \ (y>0)$



Trigonometry

In the triangle ABC



$\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

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

Area $= \dfrac{1}{2}ab\sin C$

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

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

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

Note that, for example, $\cos^2 A$ means $(\cos A)^2$

$\sin(2A) = 2\sin A\cos A \qquad \cos(2A) = \cos^2 A - \sin^2 A$

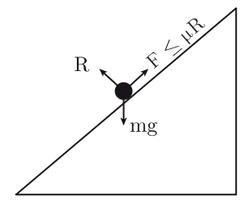
$\tan(2A) = \dfrac{2\tan A}{1-\tan^2 A}$

Mechanics

Newton's second law: $F = ma$

$v = \dfrac{dr}{dt} \qquad a = \dfrac{dv}{dt} = \dfrac{d^2r}{dt^2}$

$r = \int v\,dt + C \qquad v = \int a\,dt + C$



Statistics

The mean of a set of data:

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{\sum_{i=1}^{n} f_i x_i}{\sum_{i=i}^{n} f_i}$$

The standard Normal variable:

$$Z = \frac{X-\mu}{\sigma} \quad \text{where} \quad X \sim N(\mu, \sigma^2)$$