

Extra information not in official formula sheets

In the official formula sheets you need to become familiar with all the symbols and equations used.

VCE Mathematical methods

HSC Mathematics

CBSE AISSE Mathematics

Algebra:

$$(a + b)^2 = a^2 + 2ab + b^2$$

$$a^2 - b^2 = (a - b)(a + b)$$

Solve $ax^2 + bx + c = 0$	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
	Sum of roots = $-b/a$ Product of roots = c/a Discriminant = $b^2 - 4ac$

$$1 = 0! = 0^0 = 1^0$$

Binomial theorem k^{th} term of $(a + b)^n$ is $C_k^n a^{n-k} b^k$ for $k = 0, 1, \dots, n$.

$$\log_e(x) = \ln(x) = \ln x = \text{natural log of } x$$

$$\log_a(b) = \log_e(b)/\log_e(a)$$

Surd: irrational number e.g. $\sqrt{2}$

Geometry and trigonometry:

Sides of some right-angled triangles:

3, 4, 5; 5, 12, 13; 7, 24, 25; 8, 15, 17; 9, 40, 41; 12, 35, 37;

20, 21, 29;

$1/\sqrt{2}, 1/\sqrt{2}, 1$

$1, \sqrt{3}, 2$

$$\sin(-x) = -\sin(x)$$

$$\cos(-x) = \cos(x)$$

$$\tan(-x) = -\tan(x)$$

$$\sec(x) = 1/\cos(x)$$

$$\operatorname{cosec}(x) = 1/\sin(x)$$

$$\cot(x) = 1/\tan(x)$$

$$\cot(x) = \tan(90^\circ - x)$$

$$\cos(x) = \sin(90^\circ - x)$$

$$\operatorname{cosec}(x) = \sec(90^\circ - x)$$

$$1 + \sin(2x) = (\sin(x) + \cos(x))^2$$

$$\cos(x)^{-1} = \pi/2 - \sin^{-1}(x)$$

Rule for positive result in quadrant (start at top right and rotate anti-clockwise):

ASTC: all science teachers count. (meaning all, sine, tangent, cosine)

Surface area of sphere: $4 \pi r^2$

Area of a triangle given vertex coordinates: $(1/2) | a_x(b_y - c_y) + b_x(c_y - a_y) + c_x(a_y - b_y) |$

Curved surface area of a cone: $\pi r l$, where l is the length of the cone side.

Two triangles are similar if: two angles are the same (AA), or three sides are in proportion.
Two triangles are congruent if: three sides are the same (SSS), or two sides are the same and the included angle is the same (SAS).

Statistics:

Approximate % for $\Pr(X)$ within 1, 2 or 3 standard deviations: 68, 95, 99.7 .

Binomial formula term. $C_n^N \quad p^n (1 - p)^{N-n}$

Binomial distribution. $\mu = n p \quad \text{var} = n p (1 - p) = \sigma^2$

$C_n^N = (N!) / (n! (N-n)!) =$ number of ways of choosing n from N when order is unimportant such as cards.

$(n!) C_n^N = (N!) / (N-n)! =$ number of ways of choosing n from N when order is important such as a race.

Z-score = standardised score = $(x - \mu) / \sigma$

VCE Further Mathematics

Residual = actual – predicted.

Bearing is measured anticlockwise in degrees.

Networks and decision maths

In Euler's formula: $v =$ vertices, $f =$ faces, $e =$ edges.

For triangle: $v + f = e + 2$ becomes $3 + 2 = 3 + 2$. The triangle has 2 faces: inside and outside.

Euler path: must include every edge just once.

Hamiltonian circuit: goes through each vertex only once and ends at start.

Degree of a vertex = number of edges. For a loop both ends count.

Degree of a graph = largest vertex degree.

Correlation:

Correlation = $r =$ Pearsons correlaton = Pearsons product-moment correlation. (Range -1 to 1)

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Coefficient of determination = r^2

Series:

Arithmetic series: $a + (a + d) + \dots + (a + (n - 1)d) = (n/2)[2a + (n - 1)d] = (n/2)(a + l)$

Geometric series: $a + ar + ar^2 + \dots + ar^{(n - 1)} = a(1 - r^n)/(1 - r)$, $r \neq 1$.

Infinite geometric series: $a + ar + ar^2 + \dots = a/(1 - r)$, $|r| < 1$.

geometry and trigonometry

Pythagoras theorem $c^2 = a^2 + b^2$

business-related mathematics

R = annual interest rate

N = payments/year

P = principal

T = time in years

I = interest paid

Simple interest: $I = PRT/100$

Compound interest: $I = P(1 + R/(100N))^{NT} - P$

Hire purchase:

$r_f = (100 I M)/(PN)$ = flat rate of interest paid for hire purchase

I = total interest paid = repayments – principal repayments

P = principal – deposit

M = number of repayments/year

N = total number of repayments or periods

$r_e = r_f(2N)/(2N + 1)$ = effective rate of interest

CBSE AISSE Mathematics**Section Formula:**

To find x between x_1 and x_2 in ratio m:n $x = (m x_1 + n x_2)/(m + n)$

Operators:

Associative $(a*b)*c = a*(b*c)$

Commutative $a*b = b*a$

Statistics:

Mode calculation from highest range r_1 in a frequency distribution.

L = minimum within range r_1 .

h = range width.

Mode = $L + (f_1 - f_0)/(2f_1 - f_0 - f_2)$

Empirical relationship between three measures of central tendencies:

$3 \times \text{median} = \text{mode} + 2 \times \text{mean}$

Vectors:

Projection of vector **a** on **b** = $(\mathbf{a} \cdot \mathbf{b})/|\mathbf{b}|^2 \mathbf{b}$

Differential equations:

$y_1 = dy/dx$

$y_2 = d^2y/dx^2$

Calculus:

$$\int e^x (f(x) + f'(x)) dx = e^x f(x) + c$$

VCE Physics

Photon energy $E = hf = hc/\lambda$

Relativistic mass $m = m_0 \gamma$ (γ always >1)

Total energy as seen by observer $E_{\text{total}} = E_k + E_{\text{rest}} = mc^2$

Time dilation $t = t_0 \gamma$ $t_0 =$ proper time of observed. $t =$ time for observer.

Length contraction $L = L_0 / \gamma$ $L_0 =$ proper length of observed. $L =$ length for observer.

Stress $\sigma = F/A$

Strain $\varepsilon = (\Delta L)/L$

Young's modulus $E = \text{stress/strain}$

Capacitor time constant $\tau = R C$

Extra data:

Mass of proton $m_p = 938.3 \text{ MeV equivalent energy or } \text{MeV}/c^2$

Mass of neutron $m_n = 939.6 \text{ MeV equivalent energy or } 1.675 \times 10^{-27} \text{ kg}$

Speed of sound in air 340 m/s