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:
$(a + b)^2 = a^2 + 2ab + b^2$
$a^2 – b^2 = (a - b) (a + b)$
Binomial theorem k^{th} term of $(a + b)^n$ is $C_k^n\ a^{n-k}\ b^k$ for k = 0, 1,.., n.

Quadratics:

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

Logs exponentials and powers:
$\log_e(x) = \ln(x) = \ln x$ = natural log of x
$\log_a(b) = \log_e(b)/\log_e(a)$
$1 = 0! = 0^0 = 1^0$

Number systems:
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
$\sin(-x) = - \sin(x)$
$\cos(-x) = \cos(x)$
$\tan(-x) = - \tan(x)$
$\sec(x) = 1/\cos(x)$
$\text{cosec}(x) = 1/\sin(x)$
$\cot(x) = 1/\tan(x)$
$\cot(x) = \tan(90^o - x)$
$\cos(x) = \sin(90^o - x)$
$\text{cosec}(x) = \sec(90^o - x)$
$1 + \sin(2x) = (\sin(x) + \cos(x))^2$
$\cos(x)^{-1} = \pi /2 - \sin^{-1}(x)$

Rule for positive result in quadrant (start at top right and rotate anti-clockwise):
ASTC: all science teachers count. (meaning all, sine, tangent, cosine)

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).

Areas and volumes:

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

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

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

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. $\mu = n p$ $\quad$ 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

Statistics
Residual = actual – predicted.

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

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

Coefficient of determination = r^2

Transformations:
Transforming to linearity:

Replace y versus x plot with:

Logarithmic:	y versus $\log_{10}(x)$	or	$\log_{10}(y)$ versus x
Quadratic:	y versus x^2	or	y^2 versus x
Reciprocal:	y versus 1/x	or	1/y versus x

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 path: goes through each vertex only once.
Hamiltonian circuit: goes through each vertex only once and ends at start.
Degree of a vertex = number of edges coming from it. For a loop both ends count.
Degree of a graph = largest vertex degree.
A minimal spanning tree connects all vertices without cycles with a minimum total edge weight.
The critical path is the longest path between the start and finish points.

Series:

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

Geometric series: $a + ar + ar^2 + \ldots ar^{(n - 1)} = a(1 - r^n)/(1 - r)$, r not equal 1.

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

geometry and trigonometry

Pythagoras theorem $c^2 = a^2 + b^2$
True bearing is measured clockwise in degrees from North.

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

Geometry:

Section Formula:

To find x between x1 and x2 in ratio m:n $x = (m\,x_1 + n\,x_2)/(m + n)$

Functions:

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 x median = mode + 2 x mean

Vectors:

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

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

Light and matter:

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

Relativity:

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

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

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 and strain:

Stress $\sigma = F/A$

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

Young's modulus E = stress/strain

Electricity:

Capacitor time constant $\tau = R\ C$

Extra data:

Mass of proton m_p = 938.3 MeV equivalent energy or MeV/c^2

Mass of neutron	m_n = 939.6 MeV equivalent energy or 1.675 x 10^{-27} kg
Speed of sound in air	340 m/s