



★ not on the 0580 list of formulas — learn it. **Ext** = Extended tier only (Papers 2 and 4). Everything else is on the list printed on the paper.

Number

- ★ Indices: $a^m \times a^n = a^{m+n}$,
 $a^m \div a^n = a^{m-n}$, $(a^m)^n = a^{mn}$,
 $a^0 = 1$, $a^{-n} = \frac{1}{a^n}$
- ★ Fractional indices **Ext**: $a^{\frac{1}{n}} = \sqrt[n]{a}$,
 $a^{\frac{m}{n}} = (\sqrt[n]{a})^m$
- ★ Standard form: $A \times 10^n$,
 $1 \leq A < 10$, $n \in \mathbb{Z}$
- ★ Sets:
 $n(A \cup B) = n(A) + n(B) - n(A \cap B)$
- ★ Percentage change:
 $\frac{\text{new} - \text{original}}{\text{original}} \times 100\%$
- ★ Reverse percentage **Ext**:
 $\text{original} = \frac{\text{new}}{1 \pm \frac{\%}{100}}$
- ★ Simple interest (rate $r\%$ a year, n years): $I = \frac{Pnr}{100}$
- ★ Compound interest:
 $A = P\left(1 + \frac{r}{100}\right)^n$
- ★ Growth and decay **Ext**: $y = a \times k^n$:
 $k > 1$ growth, $0 < k < 1$ decay
- ★ Surds **Ext**: $\sqrt{ab} = \sqrt{a}\sqrt{b}$,
 $\frac{a}{\sqrt{b}} = \frac{a\sqrt{b}}{b}$, $\frac{1}{c \pm \sqrt{b}} = \frac{c \mp \sqrt{b}}{c^2 - b}$
- ★ Recurring decimal: $x = 0.\dot{4}5$, so
 $100x - x = 45$ and $x = \frac{45}{99} = \frac{5}{11}$ **Ext**
- ★ Bounds: a value to the nearest u lies
in $\left[x - \frac{u}{2}, x + \frac{u}{2}\right)$
- ★ Bounds in calculations: for the largest
 $a - b$ or $a \div b$ use the upper bound of a
with the lower bound of b **Ext**

Algebra & graphs

- Quadratic formula, $ax^2 + bx + c = 0$
Ext: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
- ★ Completing the square **Ext**:
 $x^2 + bx + c = \left(x + \frac{b}{2}\right)^2 - \frac{b^2}{4} + c$
- ★ Difference of two squares **Ext**:
 $a^2 - b^2 = (a + b)(a - b)$
- ★ Linear sequence, n th term:
 $u_n = a + (n - 1)d$
- ★ Exponential sequence **Ext**:
 $u_n = ar^{n-1}$
- ★ Proportion **Ext**: $y \propto x^n \Rightarrow y = kx^n$;
 $y \propto \frac{1}{x^n} \Rightarrow y = \frac{k}{x^n}$
- ★ Functions **Ext**: $fg(x) = f(g(x))$;
 f^{-1} : swap x, y and rearrange

★ Inequalities: multiplying or dividing by
a negative number reverses the sign

★ Straight line: $y = mx + c$, gradient m ,
 y -intercept c ; vertical line $x = k$

★ Gradient from two points **Ext**:
 $m = \frac{y_2 - y_1}{x_2 - x_1}$

★ Midpoint; length **Ext**:
 $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$,
 $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

★ Parallel lines: $m_1 = m_2$

★ Perpendicular lines **Ext**:
 $m_1 \times m_2 = -1$

★ Differentiation **Ext**: $y = ax^n \Rightarrow \frac{dy}{dx}$
 $= anx^{n-1}$

★ Turning points: $\frac{dy}{dx} = 0$; the gradient
of the curve at $x = a$ is the value of $\frac{dy}{dx}$
at a **Ext**

Geometry & mensuration

★ Angles: on a straight line 180° ; around
a point 360° ; in a triangle 180°

★ Polygons (n sides):
interior sum $= (n - 2) \times 180^\circ$,
exterior angle (regular) $= \frac{360^\circ}{n}$

★ Circle theorems: angle in a semicircle
 $= 90^\circ$; tangent $\perp$ radius

★ More circle theorems: angle at centre
 $= 2 \times$ angle at circumference; angles in
the same segment are equal; opposite
angles of a cyclic quadrilateral sum to
 180° ; alternate segment theorem;
tangents from a point are equal; the
perpendicular bisector of a chord
passes through the centre **Ext**

Triangle: $A = \frac{1}{2}bh$

★ Parallelogram; trapezium: $A = bh$;
 $A = \frac{1}{2}(a + b)h$

Circle: $A = \pi r^2$, $C = 2\pi r$

★ Arc; sector (angle θ):
 $\text{arc} = \frac{\theta}{360} \times 2\pi r$, $\text{sector} = \frac{\theta}{360} \times \pi r^2$

Curved surface: cylinder; cone (slant l):
 $A = 2\pi rh$; $A = \pi rl$

Sphere, surface area: $A = 4\pi r^2$

Prism; pyramid: $V = Al$; $V = \frac{1}{3}Ah$

Cylinder; cone: $V = \pi r^2 h$; $V = \frac{1}{3}\pi r^2 h$

Sphere, volume: $V = \frac{4}{3}\pi r^3$

★ Similar shapes, scale factor k : lengths
 $\times k$

★ Similar shapes: areas $\times k^2$, volumes
 $\times k^3$ **Ext**

Trigonometry & vectors

★ Pythagoras: $a^2 + b^2 = c^2$

★ SOHCAHTOA: $\sin \theta = \frac{\text{opp}}{\text{hyp}}$,
 $\cos \theta = \frac{\text{adj}}{\text{hyp}}$, $\tan \theta = \frac{\text{opp}}{\text{adj}}$

★ Bearings: measured clockwise from
north, written with 3 figures

★ Exact values **Ext**: $\sin 30^\circ = \frac{1}{2}$,
 $\cos 60^\circ = \frac{1}{2}$, $\tan 45^\circ = 1$,
 $\sin 60^\circ = \frac{\sqrt{3}}{2}$, $\sin 45^\circ = \frac{\sqrt{2}}{2}$

Sine rule **Ext**: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule **Ext**:
 $a^2 = b^2 + c^2 - 2bc \cos A$

Area of a triangle **Ext**: $\frac{1}{2}ab \sin C$

★ Obtuse angles **Ext**:

$\sin(180^\circ - x) = \sin x$,
 $\cos(180^\circ - x) = -\cos x$

★ Vectors: add and subtract column
vectors component by component;
 $k\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} kx \\ ky \end{pmatrix}$ **Ext**

★ Magnitude; position vectors **Ext**:

$\left|\begin{pmatrix} x \\ y \end{pmatrix}\right| = \sqrt{x^2 + y^2}$, $\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$

Probability & statistics

★ Probability: $P(\text{not } A) = 1 - P(A)$;
expected frequency $= n \times P(A)$

★ Relative frequency:
 $\frac{\text{frequency of the outcome}}{\text{number of trials}}$

★ Mutually exclusive:
 $P(A \text{ or } B) = P(A) + P(B)$

★ Independent:
 $P(A \text{ and } B) = P(A) \times P(B)$

★ Conditional **Ext**: $P(A | B) = \frac{P(A \cap B)}{P(B)}$

★ Tree diagrams: multiply along
branches, add the outcomes you want

★ Without replacement: the second-
branch probabilities change (one fewer
item) **Ext**

★ Mean from a frequency table:
 $\bar{x} = \frac{\sum fx}{\sum f}$

★ Estimated mean, grouped data (class
midpoints m) **Ext**: $\bar{x} \approx \frac{\sum fm}{\sum f}$

★ Median position (n values in order):
 $\frac{n+1}{2}$ th value

★ Range: largest — smallest

★ Interquartile range **Ext**: $Q_3 - Q_1$

★ Histogram **Ext**:
frequency density $= \frac{\text{frequency}}{\text{class width}}$