STUDY FORMULA BOOKLET

Edexcel International GCSE Maths B 4MB1 formulae sheet

The sheet prints polygon angle sum, trapezium, quadratic formula, sine and cosine rules, cone, pyramid, cylinder, sphere and 2 by 2 matrix formulas. It is not handed out: Paper 2 prints a needed formula at the end of the question.

IN THE BOOKLET printed in the official booklet LEARN IT not printed: students must recall it

Based on the official **International GCSE Mathematics (Specification B), Appendix 4: Formulae sheet, Pearson Edexcel 4MB1 specification, Issue 1, January 2016, page 39. Not handed out in the exam: a formula from it is printed at the end of a Paper 2 question that needs it**, with what to learn and exam tips added by CuratedPrep.

Sum of interior angles of a polygon

Not handed out in the exam. If Paper 2 needs a formula from this sheet, it is printed at the end of that question.

Sum of the interior angles of a polygon
n is the number of sides. In degrees this is (2n - 4) x 90, which equals (n - 2) x 180.

$$(2n - 4) \text{ right angles}$$

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Area of a trapezium

Area of a trapezium
a and b are the parallel sides and h is the perpendicular height between them.

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

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The quadratic equation

Solutions of a quadratic equation
Solves $ax^2 + bx + c = 0$ where a is not zero. Rearrange to equal zero first, and put the whole numerator over 2a.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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Trigonometry

In any triangle ABC, with side a opposite angle A, side b opposite B and side c opposite C.

Sine rule
Use it with a side and its opposite angle known. To find an angle, turn each fraction upside down.

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

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Cosine rule
Use it for two sides and the included angle, or for all three sides.

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

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Area of a triangle
C is the angle between sides a and b.

$$\text{Area} = \frac{1}{2}ab\sin C$$

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Cone

Volume of a cone
r is the radius of the base and h is the perpendicular height.

$$V = \frac{1}{3}\pi r^2 h$$

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Curved surface area of a cone
l is the slant height. Find it from $l^2 = r^2 + h^2$.

$$A = \pi r l$$

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Pyramid

Volume of a pyramid
The height is the perpendicular height from the base to the apex.

$$V = \frac{1}{3} \times \text{base area} \times \text{height}$$

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Matrices

For a 2 by 2 matrix with entries a, b, c, d.

Determinant of a 2 by 2 matrix
Multiply the main diagonal and subtract the product of the other diagonal.

$$\det \begin{pmatrix} a & b \\ c & d \end{pmatrix} = ad - bc$$

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Inverse of a 2 by 2 matrix
Swap a and d, change the signs of b and c, then divide by the determinant. There is no inverse if ad - bc = 0.

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix}^{-1} = \frac{1}{ad - bc} \begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$$

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Cylinder

Volume of a cylinder
r is the radius of the circular end and h is the height.

$$V = \pi r^2 h$$

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Curved surface area of a cylinder
Only the curved side. Add 2π r^2 for the two ends.

$$A = 2\pi r h$$

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Sphere

Volume of a sphere
r is the radius.

$$V = \frac{4}{3}\pi r^3$$

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Surface area of a sphere
r is the radius.

$$A = 4\pi r^2$$

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Learn these: not in the booklet

Area of a rectangle, triangle and parallelogram

$$A = lw, \quad A = \tfrac{1}{2}bh, \quad A = bh$$

b is the base and h is the perpendicular height. Only the trapezium is printed on the sheet.

Circle: circumference and area

$$C = 2\pi r = \pi d, \quad A = \pi r^2$$

r is the radius and d the diameter. For a semicircle, halve the area, and add the diameter to half the circumference for the perimeter.

Arc length and area of a sector

$$l = \frac{\theta}{360} \times 2\pi r, \qquad A = \frac{\theta}{360} \times \pi r^2$$

θ is the angle at the centre in degrees. Radian measure is excluded from this specification.

Volume of a cuboid and of a prism

$$V = lwh, \qquad V = \text{area of cross section} \times \text{length}$$

Neither is printed on the sheet, although the specification lists cuboids and prisms.

Total surface area of a cylinder

$$A = 2\pi r h + 2\pi r^2$$

The sheet prints only the curved surface 2πrh, so add the two circular ends, each πr².

Total surface area of a cone

$$A = \pi r l + \pi r^2$$

The sheet prints only the curved surface πrl, so add the circular base πr². A hemisphere's curved surface is 2πr².

Pythagoras' theorem

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

c is the hypotenuse, the side opposite the right angle. The specification also expects it in 3D and in an acute-angled triangle once an altitude is drawn. Not printed on the sheet.

Pythagoras in three dimensions

$$d^2 = a^2 + b^2 + c^2$$

d is the space diagonal of a cuboid with edges a, b and c. For angles in 3D, draw the right-angled triangle first.

Sine, cosine and tangent in a right-angled triangle

$$\sin\theta = \frac{O}{H}, \quad \cos\theta = \frac{A}{H}, \quad \tan\theta = \frac{O}{A}$$

O is opposite, A is adjacent and H is the hypotenuse. Use $\sin^{-1}$, $\cos^{-1}$ or $\tan^{-1}$ to find an angle, with the calculator in degrees. Not printed on the sheet.

Sine, cosine and tangent of obtuse angles

$$\sin(180^\circ - \theta) = \sin\theta, \quad \cos(180^\circ - \theta) = -\cos\theta, \quad \tan(180^\circ - \theta) = -\tan\theta$$

The specification covers angles up to 180 degrees, as met with the sine and cosine rules.

Angle facts

$$\text{straight line } 180^\circ,\ \text{point } 360^\circ,\ \text{triangle } 180^\circ,\ \text{quadrilateral } 360^\circ$$

Also: vertically opposite angles are equal, and alternate and corresponding angles on parallel lines are equal.

Polygons

$$\text{exterior angle} = \frac{360^\circ}{n}, \quad \text{interior angle} = 180^\circ - \text{exterior angle}$$

n is the number of sides of a regular polygon. The sheet gives the angle sum, (2n - 4) right angles, so you add up the interior angles from that and divide by n.

Bearings

Measured clockwise from north and written with three figures, for example 045 degrees. Back bearing = bearing plus or minus 180 degrees.

Similar shapes

$$\text{area scale factor} = k^2, \quad \text{volume scale factor} = k^3$$

k is the length scale factor, new length divided by original length.

Congruent triangles

Two triangles are congruent if they satisfy SSS, SAS, ASA or RHS.

Circle theorems

The angle at the centre is twice the angle at the circumference. The angle in a semicircle is 90 degrees. Angles in the same segment are equal. Opposite angles of a cyclic quadrilateral add to 180 degrees. The alternate segment theorem. A tangent is perpendicular to the radius, and tangents from one point are equal.

Intersecting chords

$$AX \times XB = CX \times XD$$

For two chords AB and CD crossing at X inside the circle. For secants from an outside point P: PA x PB = PC x PD, and for a tangent PT: PT^2 = PA x PB. The specification names both internal and external chord properties.

Index laws

$$x^m \times x^n = x^{m+n},\ x^m \div x^n = x^{m-n},\ (x^m)^n = x^{mn},\ x^0 = 1,\ x^{-n} = \frac{1}{x^n}$$

The specification includes integer, fractional and negative powers.

Fractional powers

$$a^{1/n} = \sqrt[n]{a}, \quad a^{m/n} = \left(\sqrt[n]{a}\right)^m$$

Take the root first, then the power, to keep the numbers small.

Surds

$$\sqrt{ab} = \sqrt{a}\sqrt{b}, \quad \sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}, \quad (\sqrt{a})^2 = a$$

Rationalise 1/(a + root b) by multiplying top and bottom by a minus root b, which gives a squared minus b on the bottom.

Standard form

$$a \times 10^n, \quad 1 \le a < 10,\ n \text{ an integer}$$

Example: 150 000 000 = 1.5 × 10^8.

Bounds

A value given to the nearest unit u lies from value minus u/2 up to, but not including, value plus u/2. Smallest area uses lower bounds. Lower bound of a difference a - b is the lower bound of a minus the upper bound of b, and of a quotient is lower over upper.

Percentages

$$\text{percentage change} = \frac{\text{new} - \text{old}}{\text{old}} \times 100, \quad \text{increase by } r\% : \times\left(1 + \frac{r}{100}\right), \quad \text{decrease by } r\% : \times\left(1 - \frac{r}{100}\right)$$

For reverse percentages, divide the new value by the multiplier.

Speed and density

$$\text{speed} = \frac{\text{distance}}{\text{time}}, \quad \text{density} = \frac{\text{mass}}{\text{volume}}$$

The specification expects calculations with average speed, and with metric and SI units only.

Metric conversions

$$1\text{ m} = 100\text{ cm},\ 1\text{ cm} = 10\text{ mm},\ 1\text{ m}^2 = 10\,000\text{ cm}^2,\ 1\text{ m}^3 = 1\,000\,000\text{ cm}^3,\ 1\text{ litre} = 1000\text{ cm}^3$$

Square the length factor for area and cube it for volume. Currency conversion rates are always given in the question.

Difference of two squares

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

Completing the square

$$x^2 + bx + c = \left(x + \frac{b}{2}\right)^2 + c - \frac{b^2}{4}$$

The specification lists completing the square as a method for quadratics. For y = $(x + p)^2$ + q the turning point is (-p, q).

Factor theorem

$$(x - a) \text{ is a factor of } f(x) \iff f(a) = 0$$

Applies to cubics, including factors of the form (ax + b) or (ax - b), which have root -b/a or b/a. Use it with algebraic division of a cubic by a linear factor.

Direct and inverse proportion

$$y \propto x,\ y \propto x^2,\ y \propto x^3,\ y \propto \sqrt{x}, \qquad y \propto \frac{1}{x},\ y \propto \frac{1}{x^2},\ y \propto \frac{1}{x^3},\ y \propto \frac{1}{\sqrt{x}}$$

Write y = kx or similar, use the given pair of values to find k, then answer the question.

Functions

$$fg(x) = f(g(x)), \qquad f\left(f^{-1}(x)\right) = x$$

fg means do g first, then f. To find the inverse, swap x and y and rearrange. Exclude any x that makes a denominator zero from the domain.

Straight lines

$$y = mx + c, \quad m = \frac{y_2 - y_1}{x_2 - x_1}, \quad m_1 = m_2 \text{ (parallel)}, \quad m_1 m_2 = -1 \text{ (perpendicular)}$$

m is the gradient and (0, c) is the y-intercept. Equation through a point: y - y1 = m(x - x1). Midpoint of a segment: ((x1 + x2)/2, (y1 + y2)/2).

Differentiation

$$y = ax^n \Rightarrow \frac{dy}{dx} = anx^{n-1}, \qquad \frac{dy}{dx} = 0 \text{ at a stationary point}$$

The gradient of the tangent is dy/dx. Integer powers of x only. A maximum or minimum is decided from the shape of the graph or the gradient either side.

Kinematics

$$v = \frac{ds}{dt}, \qquad a = \frac{dv}{dt}$$

s is displacement, v is velocity and a is acceleration, as functions of time t. The gradient of a speed-time graph is acceleration and the area under it is distance.

Sets

$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$

n(A) is the number of elements in set A. A' is the complement of A, and the universal set contains every element being considered.

Matrix multiplication and the identity matrix

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} e & f \\ g & h \end{pmatrix} = \begin{pmatrix} ae + bg & af + bh \\ ce + dg & cf + dh \end{pmatrix}, \qquad \mathbf{I} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

Row times column, and order matters: AB is not usually BA. Matrices must be compatible in size, up to 3 by 3. Multiplying by I changes nothing, and a zero matrix has every entry 0.

Matrices and transformations

$$\mathbf{AB} \text{ means do } \mathbf{B} \text{ first, then } \mathbf{A}$$

The columns of a transformation matrix are the images of (1, 0) and (0, 1), with the origin unchanged. Reflections in x = 0, y = 0 and y = plus or minus x, rotations about the origin and enlargements with centre the origin all have 2 by 2 matrices.

Vectors

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

The vector from A to B is the position vector of B minus that of A. Multiplying by a scalar multiplies each component. Parallel vectors are scalar multiples of each other. Vectors are in two dimensions only.

Mean, median, mode and range

$$\bar{x} = \frac{\sum x}{n}, \quad \text{range} = \text{largest} - \text{smallest}$$

The median is the middle value of the ordered list; the mode is the most common value.

Estimated mean from grouped data

$$\bar{x} \approx \frac{\sum fx}{\sum f}$$

x is the midpoint of each class and f its frequency. Also find the modal class and the class that contains the median. Cumulative frequency graphs are excluded.

Histograms

$$\text{frequency density} = \frac{\text{frequency}}{\text{class width}}$$

With unequal class widths the bar height is the frequency density, and the area is the frequency.

Probability

$$P(\text{not } A) = 1 - P(A), \quad P(A \text{ or } B) = P(A) + P(B) \text{ (mutually exclusive)}, \quad P(A \text{ and } B) = P(A) \times P(B) \text{ (independent)}$$

All probabilities lie from 0 (impossible) to 1 (certain). On a tree diagram multiply along the branches and add between branches. Without replacement, the second branch probabilities change.

Expected frequency and relative frequency

$$\text{expected frequency} = P(\text{event}) \times \text{number of trials}, \quad \text{relative frequency} = \frac{\text{times it happened}}{\text{number of trials}}$$

Example: a probability of 0.4 over 300 tries gives about 120.

Using the booklet in the exam

- The sheet is not handed out. Learn every formula on it: past Paper 1 questions have not printed them, and Paper 2 prints the one it needs at the end of the question.
- Pythagoras, SOHCAHTOA, arc length and sector area are not on the sheet, so learn them.
- Use the sine rule when you know a side and its opposite angle, and the cosine rule when you know two sides and the angle between them or all three sides.
- In the quadratic formula, rewrite the equation as $ax^2 + bx + c = 0$ first, and keep the whole numerator over 2a.
- For the matrix inverse, work out the determinant first. If ad - bc is zero, there is no inverse, so recheck your entries.

Based on: Pearson Edexcel International GCSE Mathematics (Specification B) 4MB1, Qualification page with the specification and past papers; Pearson Edexcel International GCSE Mathematics (Specification B) specification, Issue 1, January 2016, Appendix 4: Formulae sheet, and the subject content. Statistical tables are calculated by CuratedPrep to the same layout. Updated 31 October 2026. Always practise with the version of the official booklet your exam uses. More free sheets and topic worksheets at curatedprep.com.