STUDY FORMULA BOOKLET

Edexcel International GCSE Maths A 4MA1 Higher formulae sheet

The Higher sheet prints the arithmetic series sum, quadratic formula, sine and cosine rules, triangle area, and cone, cylinder, prism and sphere formulae. Pythagoras and everything else you must recall.

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

Based on the official **International GCSE Mathematics, Formulae sheet (Higher Tier), Pearson Edexcel 4MA1, as printed on page 2 of the 2025 question paper (code P78903A)**, with what to learn and exam tips added by CuratedPrep.

Arithmetic series

Sum to n terms of an arithmetic series
a is the first term and d is the common difference.

$$S_n = \frac{n}{2}[2a + (n-1)d]$$

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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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Prism

Volume of a prism
The cross section is the same along the whole length.

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

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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

nth term of an arithmetic sequence

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

The sheet prints only the sum. The specification says you must know and use the nth term.

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.

Volume of a cuboid

$$V = lwh$$

The prism rule on the sheet also covers it: area of cross section (lw) times length (h).

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.

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.

Pythagoras' theorem

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

c is the hypotenuse, the side opposite the right angle. Not printed on the Edexcel sheet.

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.

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

$$\text{angle sum} = (n-2) \times 180^\circ, \quad \text{exterior angle} = \frac{360^\circ}{n}$$

n is the number of sides. The specification words the sum as (2n - 4) right angles. For a regular polygon, interior angle = 180 degrees minus the exterior angle.

Bearings

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

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 of obtuse angles

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

Used with the sine and cosine rules, where an angle can be obtuse.

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.

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.

Speed and density

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

Edexcel states that the formula for pressure will be given in the question, so it is not on this list.

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.

Percentage of a quantity and percentage change

$$15\%\text{ of }120 = \frac{15}{100} \times 120, \qquad \text{percentage change} = \frac{\text{new} - \text{old}}{\text{old}} \times 100$$

Percentage multipliers and reverse percentages

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

For a sale price after a 30 percent reduction, the multiplier is 0.7.

Compound interest and depreciation

$$\text{amount} = P\left(1 + \frac{r}{100}\right)^n$$

P is the starting amount, r the percentage per period and n the number of periods. For depreciation use (1 - r/100). Not printed on the sheet.

Index laws

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

Standard form

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

Example: 150 000 000 = 1.5 × 10^8.

Ratio and direct proportion

$$y = kx$$

Share an amount in a ratio by finding the value of one part: total divided by the sum of the ratio parts.

Repeated percentage change

$$\text{final} = \text{start} \times m_1 \times m_2 \times \ldots$$

Multiply the multipliers. A 30 percent rise then a 20 percent fall is x1.3 then x0.8, which is x1.04 overall.

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.

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.

Fractional and negative powers

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

Difference of two squares

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

Completing the square

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

For y = (x + p)^2 + q the turning point is (-p, q).

Direct and inverse proportion

$$y = kx,\ y = kx^2,\ y = kx^3,\ y = k\sqrt{x}, \qquad y = \frac{k}{x},\ y = \frac{k}{x^2},\ y = \frac{k}{x^3},\ y = \frac{k}{\sqrt{x}}$$

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.

Transformations of y = f(x)

$$f(x) + a, \quad f(x + a), \quad af(x), \quad f(ax)$$

f(x) + a moves up by a. f(x + a) moves left by a. af(x) stretches vertically by factor a. f(ax) stretches horizontally by factor 1/a.

Straight lines

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

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. 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.

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.

Sets

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

n(A) is the number of elements in set A.

Histograms and quartiles

$$\text{frequency density} = \frac{\text{frequency}}{\text{class width}}, \qquad \text{IQR} = Q_3 - Q_1$$

On a cumulative frequency graph read the median at n/2, the lower quartile at n/4 and the upper quartile at 3n/4.

Probability: independent and dependent events

$$P(A \text{ and } B) = P(A) \times P(B) \text{ (independent)}, \qquad P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

On a tree diagram multiply along the branches and add between branches. Without replacement, the second branch probabilities change.

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.

Probability

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

All probabilities lie from 0 (impossible) to 1 (certain).

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

- Pythagoras and SOHCAHTOA are not printed, but the sine rule, cosine rule and triangle area are, so check the sheet before recalling 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.
- The sheet gives the curved surface area of cones and cylinders only. Add the base circles for a total surface area.
- Check the units before substituting: convert cm to m, or cm^3 to litres, first. The pressure formula is given in the question if needed.

Based on: Pearson Edexcel International GCSE Mathematics (Specification A) 4MA1, Higher Tier formulae sheet printed in the question paper; Pearson Edexcel International GCSE Mathematics (Specification A) specification, Issue 2, Appendix 5: Higher Tier formulae sheet, and the Higher Tier 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.