Further Maths formula sheet

Core pure and selected optional statistics and mechanics · Checked against the exam boards' booklets on 11 October 2026

An original MathsDaily revision sheet, not an official exam booklet. Each formula is labelled to show whether it is printed in the AQA and Pearson Edexcel A-level Further Mathematics booklets you get in the exam, or must be learned. OCR prints its formulae inside each question paper, so OCR students should check the list in a recent paper.

In AQA and Edexcel booklets: Printed in both the AQA and the Pearson Edexcel formulae booklets used in the exam.

AQA booklet only: Printed in the AQA booklet but not the Edexcel booklet.

Edexcel booklet only: Printed in the Pearson Edexcel booklet but not the AQA booklet.

Learn: not in the booklets: Not printed in the AQA or Edexcel booklets. You are expected to know it.

Complex numbers

Cartesian and modulus–argument form

LEARN: NOT IN THE BOOKLETS

$z = x + iy = r(\cos\theta + i\sin\theta) = re^{i\theta}$; $r = |z| = \sqrt{(x^2 + y^2)}$; $zz^* = |z|^2$

Choose θ in the correct quadrant; principal argument $-\pi < \theta \leq \pi$.

Multiplication and division

LEARN: NOT IN THE BOOKLETS

$|z_1z_2| = |z_1||z_2|$, $\arg(z_1z_2) = \arg z_1 + \arg z_2$; $|z_1/z_2| = |z_1|/|z_2|$, $\arg(z_1/z_2) = \arg z_1 - \arg z_2$

De Moivre's theorem and roots of unity

In AQA and Edexcel booklets

$[r(\cos\theta + i\sin\theta)]^n = r^n(\cos n\theta + i\sin n\theta)$

$z^n = 1$ has roots $z = e^{2\pi ki/n}$, $k = 0, 1, \ldots, n - 1$

The n roots of $z^n = w$ are $r^{1/n}\, e^{i(\theta + 2\pi k)/n}$, $k = 0, \ldots, n - 1$ (learn this general form).

Loci in the Argand diagram

LEARN: NOT IN THE BOOKLETS

$|z - a| = r$: circle, centre a, radius r; $|z - a| = |z - b|$: perpendicular bisector of a and b; $\arg(z - a) = \theta$: half-line from a

Matrices

2 × 2 determinant and inverse

LEARN: NOT IN THE BOOKLETS

For $M = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$: $\det M = ad - bc$; $M^{-1} = \frac{1}{(ad - bc)}\begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$

M^{-1} exists only if $\det M \neq 0$. $(AB)^{-1} = B^{-1}A^{-1}$. $|\det M|$ is the area scale factor.

Transformation matrices

In AQA and Edexcel booklets

Rotation through θ anticlockwise about O: $\begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix}$

Reflection in $y = x\tan\theta$: $\begin{pmatrix} \cos 2\theta & \sin 2\theta \\ \sin 2\theta & -\cos 2\theta \end{pmatrix}$

Applying A then B is the single matrix BA. The AQA booklet also prints 3D rotations about the x-, y- and z-axes.

Invariant points and eigenvalues

LEARN: NOT IN THE BOOKLETS

Invariant point: $Mx = x$. Eigenvalues: $\det(M - \lambda I) = 0$; eigenvectors satisfy $(M - \lambda I)v = 0$, $v \neq 0$

Eigenvalues are in AQA Further Maths content; check your specification.

Series, roots and proof

Standard sums

In AQA and Edexcel booklets

$\Sigma_{r=1}^{n} r^2 = n(n + 1)(2n + 1)/6$; $\Sigma_{r=1}^{n} r^3 = n^2(n + 1)^2/4$

$\Sigma_{r=1}^{n} r = n(n + 1)/2$ is printed in the Edexcel booklet only.

Roots of polynomials

LEARN: NOT IN THE BOOKLETS

$ax^2 + bx + c$: $\alpha + \beta = -b/a$, $\alpha\beta = c/a$
$ax^3 + bx^2 + cx + d$: $\Sigma\alpha = -b/a$, $\Sigma\alpha\beta = c/a$, $\alpha\beta\gamma = -d/a$

$a \neq 0$. Use substitution (e.g. $w = 2x + 1$) to form equations with transformed roots.

Method of differences and proof by induction

LEARN: NOT IN THE BOOKLETS

If $u_r = f(r) - f(r + 1)$, then $\Sigma_{r=1}^{n} u_r = f(1) - f(n + 1)$.
Induction: prove the base case; assume true for $n = k$; prove for $n = k + 1$; conclude.

Maclaurin series

In AQA and Edexcel booklets

$f(x) = f(0) + xf'(0) + x^2f''(0)/2! + \ldots + x^rf^{(r)}(0)/r! + \ldots$
$e^x = 1 + x + x^2/2! + \ldots$; $\ln(1 + x) = x - x^2/2 + x^3/3 - \ldots$ $(-1 < x \leq 1)$
$\sin x = x - x^3/3! + x^5/5! - \ldots$; $\cos x = 1 - x^2/2! + x^4/4! - \ldots$

The Edexcel booklet also prints $\arctan x = x - x^3/3 + x^5/5 - \ldots$ $(-1 \leq x \leq 1)$.

Hyperbolic functions and further calculus

Hyperbolic definitions

LEARN: NOT IN THE BOOKLETS

$\sinh x = (e^x - e^{-x})/2$; $\cosh x = (e^x + e^{-x})/2$; $\tanh x = \sinh x / \cosh x$

Learn these: the booklets give identities, not the definitions.

Hyperbolic identities and inverses

In AQA and Edexcel booklets

$\cosh^2 x - \sinh^2 x = 1$
$\operatorname{arsinh} x = \ln(x + \sqrt{(x^2 + 1)})$; $\operatorname{arcosh} x = \ln(x + \sqrt{(x^2 - 1)})$ $(x \geq 1)$; $\operatorname{artanh} x = \frac{1}{2} \ln((1 + x)/(1 - x))$ $(|x| < 1)$

Inverse trigonometric and hyperbolic calculus

In AQA and Edexcel booklets

$\frac{d}{dx} \arcsin x = 1/\sqrt{(1 - x^2)}$; $\frac{d}{dx} \arctan x = 1/(1 + x^2)$; $\int 1/(a^2 + x^2)\, dx = (1/a) \arctan(x/a) + c$; $\int 1/\sqrt{(a^2 - x^2)}\, dx = \arcsin(x/a) + c$

Corresponding sinh, cosh and tanh results are printed too.

Volumes of revolution and mean value

LEARN: NOT IN THE BOOKLETS

About the x-axis: $V = \pi\int_a^b y^2\, dx$; about the y-axis: $V = \pi\int x^2\, dy$; mean value of f on $[a, b] = (1/(b - a))\int_a^b f(x)\, dx$

Polar coordinates

In AQA and Edexcel booklets

$x = r\cos\theta$, $y = r\sin\theta$; area $= \frac{1}{2}\int_\alpha^\beta r^2\, d\theta$

θ in radians. Only the area formula is printed; learn the conversions.

Arc length and surface area (option content)

In AQA and Edexcel booklets

$s = \int\sqrt{(1 + (dy/dx)^2)}\,dx$; $S = 2\pi\int y\sqrt{(1 + (dy/dx)^2)}\,dx$ (about the x-axis)

Parametric forms are printed too.

Vectors and differential equations

Scalar product and angles

LEARN: NOT IN THE BOOKLETS

$\mathbf{a}\cdot\mathbf{b} = |\mathbf{a}||\mathbf{b}|\cos\theta = a_1b_1 + a_2b_2 + a_3b_3$; perpendicular $\Leftrightarrow \mathbf{a}\cdot\mathbf{b} = 0$

The booklets use a·b in other results but do not state this definition.

Vector product, lines and planes

In AQA and Edexcel booklets

$\mathbf{a}\times\mathbf{b} = |\mathbf{a}||\mathbf{b}|\sin\theta\,\hat{\mathbf{n}}$; line $\mathbf{r} = \mathbf{a} + \lambda\mathbf{b}$; plane $\mathbf{r} = \mathbf{a} + \lambda\mathbf{b} + \mu\mathbf{c}$ or $\mathbf{r}\cdot\mathbf{n} = \mathbf{a}\cdot\mathbf{n}$

Cartesian plane: $n_1x + n_2y + n_3z = d$.

First-order linear equations

LEARN: NOT IN THE BOOKLETS

$dy/dx + P(x)y = Q(x)$: integrating factor $I = e^{\int P\,dx}$; then $d/dx\,(Iy) = IQ$

Divide first so the coefficient of dy/dx is 1.

Second-order linear equations

LEARN: NOT IN THE BOOKLETS

$ay'' + by' + cy = 0$, auxiliary equation $am^2 + bm + c = 0$:
distinct real m_1, m_2: $y = Ae^{m_1x} + Be^{m_2x}$; repeated m: $y = (A + Bx)e^{mx}$; $m = p \pm qi$: $y = e^{px}(A\cos qx + B\sin qx)$

For $f(x) \neq 0$ add a particular integral to the complementary function.

Simple harmonic motion

LEARN: NOT IN THE BOOKLETS

$\ddot{x} = -\omega^2x \Rightarrow x = A\cos\omega t + B\sin\omega t$; period $T = 2\pi/\omega$; $v^2 = \omega^2(a^2 - x^2)$

a is the amplitude.

Numerical methods

AQA booklet only

Euler: $y_{n+1} = y_n + h\,f(x_n, y_n)$; Simpson's rule (n even): $\int_a^b y\,dx \approx (h/3)[y_0 + 4(y_1 + y_3 + \ldots) + 2(y_2 + y_4 + \ldots) + y_n]$; mid-ordinate rule

Not in the Edexcel booklet.

Further statistics and mechanics (options)

Poisson distribution

In AQA and Edexcel booklets

$X \sim Po(\lambda)$: $P(X = x) = e^{-\lambda}\lambda^x/x!$; $E(X) = Var(X) = \lambda$

Events occur singly, independently and at a constant average rate.

Chi-squared test

In AQA and Edexcel booklets

$X^2 = \Sigma(O - E)^2/E$; degrees of freedom: (rows − 1)(columns − 1) for contingency tables

Combine classes so each expected frequency is at least 5.

Work, energy and power

LEARN: NOT IN THE BOOKLETS

Work = $Fs\cos\theta$; KE = $\frac{1}{2}mv^2$; GPE = mgh; power $P = Fv$

Work–energy principle: work done by non-conservative forces = change in mechanical energy.

Circular motion

Edexcel booklet only

$v = r\omega$; acceleration towards centre = $v^2/r = r\omega^2$

Printed in the Edexcel booklet; AQA students must learn it.

Centres of mass

In AQA and Edexcel booklets

$\bar{x} = \Sigma mx/\Sigma m$; triangular lamina: ⅔ along median from vertex; solid hemisphere: 3r/8 from centre; solid cone: h/4 from base

Checklist: formulae to learn

None of these is printed in the AQA or Edexcel booklets. Tick each one when you can write it from memory.

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☐ Volumes of revolution and mean value

Vectors and differential equations

☐ Scalar product and angles

☐ First-order linear equations

☐ Second-order linear equations

☐ Simple harmonic motion

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Official sources

AQA: Formulae for A-level Mathematics (7356/7357), v1.2, August 2017
AQA: Formulae and statistical tables for A-level Mathematics and Further Mathematics, v1.5, February 2018
AQA: current formulae booklet versions
Pearson Edexcel: Mathematical Formulae and Statistical Tables, Issue 1, July 2017 (A level Maths and Further Maths)
OCR: AS and A Level Mathematics A (H230, H240): formulae are printed in each question paper
Department for Education: AS and A level maths subject content, including formulae requirements
Department for Education: AS and A level further maths subject content

Booklet contents can change: always use the version your exam board supplies for the current series.