STUDY FORMULA BOOKLET

Edexcel International GCSE Further Pure Maths 4PM1 formulae sheet

The sheet prints sphere and cone formulae, series sums, the binomial series, the quotient rule, cosine rule and addition formulae. You must learn log laws, calculus rules and vectors.

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

Based on the official **International GCSE in Further Pure Mathematics Formulae sheet (4PM1), Pearson Edexcel, as printed on page 2 of the question paper (code P72864A)**, with what to learn and exam tips added by CuratedPrep.

Mensuration

Surface area of a sphere r is the radius.	$A = 4\pi r^2$	IN THE BOOKLET
Curved surface area of a cone r is the radius of the base. The slant height is the sloping edge, found with Pythagoras.	$A = \pi r \times \text{slant height}$	IN THE BOOKLET
Volume of a sphere r is the radius.	$V = \frac{4}{3}\pi r^3$	IN THE BOOKLET

Series

Arithmetic series: sum to n terms a is the first term and d is the common difference.	$S_n = \frac{n}{2}[2a + (n-1)d]$	IN THE BOOKLET
Geometric series: sum to n terms a is the first term and r is the common ratio (r not equal to 1).	$S_n = \frac{a(1-r^n)}{1-r}$	IN THE BOOKLET
Geometric series: sum to infinity Exists only when |r| < 1.	$S_\infty = \frac{a}{1-r}, \quad \lvert r\rvert < 1$	IN THE BOOKLET
Binomial series Valid for |x| < 1, n a rational number. If n is a positive integer the series stops and is valid for all x. Write (a + bx)^n as a^n(1 + (b/a)x)^n first.	$(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \cdots + \frac{n(n-1)\ldots(n-r+1)}{r!}x^r + \ldots$	IN THE BOOKLET

Calculus

Quotient rule (differentiation) Top derivative times bottom, minus top times bottom derivative, all over bottom squared.	$\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$	IN THE BOOKLET

Trigonometry

Cosine rule In triangle ABC. Use it for two sides and the included angle, or all three sides.	$a^2 = b^2 + c^2 - 2bc\cos A$	IN THE BOOKLET
Tangent in terms of sine and cosine Used to simplify expressions and solve equations.	$\tan\theta = \frac{\sin\theta}{\cos\theta}$	IN THE BOOKLET

Sine of a sum Spec says formal proofs are not required.	$\sin(A+B) = \sin A \cos B + \cos A \sin B$	IN THE BOOKLET
Sine of a difference Sign between the terms matches the sign in the bracket.	$\sin(A-B) = \sin A \cos B - \cos A \sin B$	IN THE BOOKLET
Cosine of a sum The sign flips: plus in the bracket gives minus.	$\cos(A+B) = \cos A \cos B - \sin A \sin B$	IN THE BOOKLET
Cosine of a difference The sign flips: minus in the bracket gives plus.	$\cos(A-B) = \cos A \cos B + \sin A \sin B$	IN THE BOOKLET
Tangent of a sum Denominator sign is opposite to the bracket.	$\tan(A+B) = \dfrac{\tan A + \tan B}{1 - \tan A \tan B}$	IN THE BOOKLET
Tangent of a difference Denominator sign is opposite to the bracket.	$\tan(A-B) = \dfrac{\tan A - \tan B}{1 + \tan A \tan B}$	IN THE BOOKLET

Logarithms

Change of base Use it to write logs in a convenient base, for example base 10 on a calculator.	$\log_a x = \dfrac{\log_b x}{\log_b a}$	IN THE BOOKLET

Learn these: not in the booklet

Laws of logarithms

$\log_a xy = \log_a x + \log_a y, \quad \log_a \dfrac{x}{y} = \log_a x - \log_a y,$

$\log_a x^k = k \log_a x$

Edexcel lists these to learn, not given.

Special logarithm values

$\log_a \dfrac{1}{x} = -\log_a x, \quad \log_a a = 1, \quad \log_a 1 = 0$

Reciprocal logarithm

$\log_a b = \dfrac{1}{\log_b a}$

Also used to solve a^x = b by taking logs of both sides.

Quadratic formula

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

Roots of $ax^2 + bx + c = 0$. Not printed on the sheet.

Discriminant

$b^2 - 4ac > 0$ (two real roots), $b^2 - 4ac = 0$ (equal roots), $b^2 - 4ac < 0$ (no real roots)

Sum and product of roots

$\alpha + \beta = -\dfrac{b}{a}, \qquad \alpha\beta = \dfrac{c}{a}$

Forming an equation from its roots

$x^2 - (\alpha + \beta)x + \alpha\beta = 0$

Expressions such as $\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$ come from these two results.

Factor and remainder theorems

$f(a) = 0 \iff (x - a)$ is a factor; remainder on dividing by $(x - a)$ is $f(a)$

For (ax + b), the remainder is f(-b/a).

nth term of an arithmetic series

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

nth term of a geometric series

$u_n = ar^{n-1}$

Sigma notation

$\sum_{i=1}^{n} a_i = a_1 + a_2 + \cdots + a_n$

Gradient of a line

$m = \dfrac{y_2 - y_1}{x_2 - x_1}$

Equation of a line

$y = mx + c, \qquad y - y_1 = m(x - x_1), \qquad ax + by = c$

Parallel lines have equal gradients; perpendicular lines have $m_1 m_2 = -1$.

Distance between two points

$d^2 = (x_1 - x_2)^2 + (y_1 - y_2)^2$

Point dividing a line in the ratio m : n

$\left(\dfrac{nx_1 + mx_2}{m+n}, \dfrac{ny_1 + my_2}{m+n}\right)$

Between (x_1, y_1) and (x_2, y_2). With m = n this is the midpoint.

Vector between two points

$$\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$$

a and b are the position vectors of A and B.

Magnitude and unit vector

$$|\mathbf{a}| = \sqrt{x^2 + y^2}, \qquad \hat{\mathbf{a}} = \frac{\mathbf{a}}{|\mathbf{a}|}$$

For a = xi + yj.

Point dividing AB in the ratio m : n

$$\mathbf{p} = \frac{n\mathbf{a} + m\mathbf{b}}{m + n}$$

Use vectors to show collinearity, parallel lines and concurrency. If $\alpha_1 a + \beta_1 b = \alpha_2 a + \beta_2 b$ for non-parallel a and b, then $\alpha_1 = \alpha_2$ and $\beta_1 = \beta_2$.

Differentiation of standard functions

$$\frac{d}{dx}x^n = nx^{n-1}, \quad \frac{d}{dx}\sin ax = a\cos ax, \quad \frac{d}{dx}\cos ax = -a\sin ax, \quad \frac{d}{dx}e^{ax} = ae^{ax}$$

Edexcel's Appendix 5 lists these to learn.

Product rule

$$\frac{d}{dx}\left(f(x)g(x)\right) = f'(x)g(x) + f(x)g'(x)$$

Function of a function (chain rule)

$$\frac{d}{dx}f(g(x)) = f'(g(x))\,g'(x)$$

Integration of standard functions

$$\int x^n\,dx = \frac{x^{n+1}}{n+1} + c\ (n \neq -1), \quad \int \sin ax\,dx = -\frac{\cos ax}{a} + c, \quad \int \cos ax\,dx = \frac{\sin ax}{a} + c, \quad \int e^{ax}\,dx = \frac{e^{ax}}{a} + c$$

The spec excludes integrating 1/x. Always add the constant c to an indefinite integral.

Area under a curve

$$\int_a^b y\,dx\ (y \geq 0), \qquad -\int_a^b y\,dx\ (y < 0)$$

Areas below the x-axis come out negative, so take the positive value. Between a curve and the y-axis use the integral of x dy.

Area between two curves

$$\int_a^b [g(x) - f(x)]\,dx$$

g(x) is the upper curve.

Volume of revolution

$$V = \int_a^b \pi y^2\,dx \quad \text{or} \quad \int_c^d \pi x^2\,dy$$

About the x-axis or the y-axis only.

Tangent and normal

$$m_{\text{normal}} = -\frac{1}{m_{\text{tangent}}}$$

Tangent gradient is dy/dx at the point.

Stationary points

$$\frac{dy}{dx} = 0; \quad \frac{d^2y}{dx^2} > 0 \Rightarrow \text{minimum}, \ \frac{d^2y}{dx^2} < 0 \Rightarrow \text{maximum}$$

Justify the nature of the point in maxima and minima problems.

Small changes and connected rates

$$\delta y \approx \frac{dy}{dx}\,\delta x, \qquad \frac{dy}{dt} = \frac{dy}{dx} \times \frac{dx}{dt}$$

Kinematics

$$v = \frac{ds}{dt}, \quad a = \frac{dv}{dt}, \quad s = \int v\,dt, \quad v = \int a\,dt$$

Straight-line motion.

Arc length (radians)

$$s = r\theta$$

θ in radians.

Area of a sector (radians)

$$A = \frac{1}{2}r^2\theta$$

Sine rule

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

Only the cosine rule is printed on the sheet.

Area of a triangle

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

Not printed on the sheet.

Pythagorean identity

$$\cos^2\theta + \sin^2\theta = 1$$

Not printed on the sheet. Edexcel lists it to learn.

Exact trig values

$$\sin 30^\circ = \tfrac{1}{2},\ \cos 60^\circ = \tfrac{1}{2},\ \sin 45^\circ = \cos 45^\circ = \tfrac{\sqrt{2}}{2},\ \sin 60^\circ = \cos 30^\circ = \tfrac{\sqrt{3}}{2},\ \tan 30^\circ = \tfrac{1}{\sqrt{3}},\ \tan 45^\circ = 1,\ \tan 60^\circ = \sqrt{3}$$

Also in radians: π/6, π/4, π/3. Use them to find related values such as 120 and 300 degrees.

Trig ratios of related angles

$$\sin(180^\circ - x) = \sin x, \quad \cos(360^\circ - x) = \cos x, \quad \tan(180^\circ + x) = \tan x$$

Sketch the graph or use the CAST diagram to find all solutions in the interval.

Radians and degrees

$$\pi \text{ rad} = 180^\circ$$

Using the booklet in the exam

- Check which trig facts are printed: the cosine rule and addition formulae are, but the sine rule and sin² + cos² = 1 are not.
- Write the derivative and integral list on your scrap paper at the start, as none of these are on the sheet.
- For the binomial series with non-integer n, state the validity condition |x| < 1 (or the adjusted condition) in your answer.
- In the addition formulae, check the sign: sin keeps the bracket sign, cos flips it, and tan flips it in the denominator.
- A calculator is allowed in every paper, but give exact answers when the question says exact or in terms of π or surds.

Based on: Pearson Edexcel International GCSE Further Pure Mathematics 4PM1, Formulae sheet printed in the question paper; Pearson Edexcel International GCSE Further Pure Mathematics specification, Issue 1, Appendix 4: Formulae sheet and Appendix 5: Formulae to learn. 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.