IB DP MATHS AA · EXAM SPECIAL · SL & HL · CHECKED AGAINST THE CURRENT AA FORMULA BOOKLETS · ~8 MIN READ

IB Maths AA Formula Booklet: What Is Given and What to Memorise

What the IB Maths AA formula booklet (SL and HL) contains, topic by topic, and the formulas, values and facts it leaves out that you must memorise, plus how to use the booklet quickly in the exam.

What the booklet contains | SL must-memorise list | HL must-memorise list | Exact values | Calculus rules | Statistics facts | Using the booklet fast

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No tag = **SL and HL** HL ONLY HL students only FORMULA BOOKLET given in the exam

M1 A1 how marks are awarded highlight = comes up again and again HANDY worth memorising

Test yourself at the end

IN 30 SECONDS

- **You get a clean copy of the formula booklet in every AA exam,** SL and HL. It's about 10 pages and is organised by syllabus topic.
- **It doesn't contain everything you need.** Exact trig values, the second derivative test, the rules for transformations and many statistical facts are missing.
- **Examiners say students lose marks by not knowing what's in it,** or by copying a formula without writing it in the context of the question.

BY THE END YOU CAN

- Know what the AA booklet gives you, topic by topic.
- Memorise the results it leaves out.
- Find any formula in seconds during the exam.

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1 What the booklet contains

AA SL booklet

Topic	Given
Number and algebra	Arithmetic and geometric sequences and series (including the infinite sum), compound interest, log definition and laws, change of base, binomial theorem, ${}^{n}C_{r}$
Functions	Straight-line forms and gradient, axis of symmetry, quadratic formula, discriminant $\Delta = b^2 - 4ac$
Geometry and trigonometry	Areas and volumes (prisms, pyramids, cones, spheres, cylinders), 3D distance and midpoint, sine and cosine rules, $\frac{1}{2}ab\sin C$, arc length and sector area (radians), $\tan\theta = \sin\theta/\cos\theta$, Pythagorean identity, double-angle identities for sin and cos
Statistics and probability	IQR, mean of a frequency table, probability rules, conditional probability, independence, E(X), binomial mean and variance, $z = (x - \mu)/\sigma$
Calculus	Derivatives of x^n, sin x, cos x, e^x, ln x; chain, product and quotient rules; $\int x^n\,dx$; integrals of 1/x, sin x, cos x, e^x; area under a curve; kinematics ($a = dv/dt$, distance and displacement integrals)

Extra in the AA HL booklet

Topic	Given (HL only)
Number and algebra	Permutations ${}^{n}P_{r}$, the extended binomial theorem, complex numbers in Cartesian, polar and Euler form, De Moivre's theorem
Functions	Sum and product of the roots of a polynomial
Geometry and trigonometry	Reciprocal trig functions and their Pythagorean identities, compound-angle identities, $\tan 2\theta$, vector magnitude, scalar and vector products, angle between vectors, vector, parametric and Cartesian equations of lines and planes, area of a parallelogram $\lvert v \times w \rvert$
Statistics and probability	Bayes' theorem (two and three events), variance and standard deviation, E(aX + b) and Var(aX + b), continuous random variables (mean, variance)
Calculus	First principles, derivatives of tan, sec, cosec, cot, a^x, $\log_a x$, arcsin, arccos, arctan; integrals of a^x, $1/(a^2 + x^2)$, $1/\sqrt{a^2 - x^2}$; integration by parts; area with respect to y; volumes of revolution; Euler's method; integrating factor; Maclaurin series of e^x, $\ln(1 + x)$, sin x, cos x, arctan x

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2 What you must memorise: SL and HL

Algebra and functions

- **Index laws:** $a^m a^n = a^{m+n}$, $(a^m)^n = a^{mn}$, $a^{-n} = 1/a^n$, $a^{1/n} = \sqrt[n]{a}$, $a^0 = 1$.
- **Special logs:** $\log_a 1 = 0$, $\log_a a = 1$, $\ln e = 1$, $e^{\ln x} = x$.
- **What Δ tells you:** $\Delta > 0$ two real roots; $\Delta = 0$ one repeated root (the curve touches the axis, or a line is a tangent); $\Delta < 0$ no real roots.
- **Vertex form:** $y = a(x - h)^2 + k$ has vertex (h, k).
- **Parallel lines** have equal gradients; **perpendicular** gradients multiply to -1.
- **Inverse functions:** swap x and y, rearrange; the domain of f^{-1} is the range of f; the graph reflects in $y = x$.
- **Transformations:** $f(x) + a$ (up a); $f(x - a)$ (right a); $af(x)$ (vertical stretch, factor a); $f(ax)$ (horizontal stretch, factor $1/a$); $-f(x)$ (reflect in x-axis); $f(-x)$ (reflect in y-axis).
- **Rational functions $(x + b)/(cx + d)$:** vertical asymptote $x = -d/c$, horizontal asymptote $y = 1/c$.

Trigonometry

- **Exact values** of sin, cos and tan at 0, π/6, π/4, π/3, π/2, and the unit-circle signs (CAST). See the Paper 1 non-calculator guide.
- **180° = π radians.** The booklet's arc and sector formulas need radians.
- **Graphs:** $y = a \sin(b(x - c)) + d$ has amplitude $|a|$, period $2\pi/b$, principal axis $y = d$. The period of $\tan(bx)$ is **π/b**, not $2\pi/b$.
- **The ambiguous case:** the sine rule can give two triangles when you are finding an angle.

Statistics and probability

- **Standard deviation (SL):** not given; use the GDC.
- **Outliers:** below $Q_1 - 1.5 \times \text{IQR}$ or above $Q_3 + 1.5 \times \text{IQR}$.
- **Normal distribution:** symmetric about μ; about 68% within 1σ, 95% within 2σ, 99.7% within 3σ.
- **Discrete distribution:** the probabilities add up to 1.
- **Regression:** use the line of y on x to predict y; interpolation is reliable, extrapolation isn't.

Calculus

- **Stationary points:** $f'(x) = 0$. **Second derivative test:** $f'' > 0$ minimum, $f'' < 0$ maximum.
- **Points of inflection:** $f''(x) = 0$ **and** f'' changes sign.
- **Increasing/decreasing:** $f'(x) > 0$ / $f'(x) < 0$.
- **Tangent and normal:** $y - y_1 = m(x - x_1)$, normal gradient $-1/m$.
- **Reverse chain rule:** $\int f(ax + b)\,dx = (1/a)F(ax + b) + C$, e.g. $\int e^{3x}\,dx = \frac{1}{3}e^{3x} + C$.
- **Area between two curves:** $\int |f(x) - g(x)|\,dx$ between the intersection points.
- **Kinematics:** $v = ds/dt$; speed $= |v|$; the particle changes direction where $v = 0$ and changes sign.

3 What you must memorise: HL extras HL

- **Polynomials:** factor theorem ($p(a) = 0 \Leftrightarrow (x - a)$ is a factor); remainder theorem (remainder = $p(a)$); complex roots of real polynomials come in conjugate pairs.
- **Complex numbers:** $z\,z^* = |z|^2$, $|z_1 z_2| = |z_1||z_2|$, $\arg(z_1 z_2) = \arg z_1 + \arg z_2$; the n-th roots of unity are spaced $2\pi/n$ apart.
- **Proof:** the structure of induction and of proof by contradiction.
- **Vectors:** angle between a line and a plane uses **sin θ** with the normal; perpendicular vectors have $v \cdot w = 0$; parallel vectors have $v \times w = 0$.
- **Calculus:** implicit differentiation, related rates (chain rule with dt), l'Hôpital's rule (only for 0/0 or ∞/∞), integration by substitution, partial fractions.
- **Useful integrals not given:** $\int \sec^2 x\,dx = \tan x + C$; $\int \tan x\,dx = -\ln|\cos x| + C$ (or $\ln|\sec x| + C$).
- **Continuous random variables:** the pdf integrates to 1; the median m satisfies $\int f(x)\,dx = 0.5$ up to m; the mode is where f(x) is greatest.
- **Differential equations:** separating variables; the substitution $y = vx$ for homogeneous equations.
- **Maclaurin series by substitution:** $e^{x^2} = 1 + x^2 + x^4/2! + \ldots$, using the booklet's e^x series.

4 Using the booklet fast

- **Learn the layout during the course.** The topics follow the syllabus order (1 to 5), and each formula is labelled with its syllabus section number.
- **Write the formula in the context of the question** before substituting. Examiners give method marks for, e.g., "a/sin 40° = 12/sin 75°", not for the general formula copied out.
- **Check the conditions** printed next to formulas: $r \neq 1$, $|r| < 1$, θ in radians, $f(x) > 0$ for area.

COMMON MISTAKE

Spending exam time searching for a formula that isn't in the booklet. Learn the lists above so you know straight away.

LINKING QUESTION

For each topic in full see Trig identities, equations and graphs, Differentiation and Random variables, binomial and normal distributions. The AI version is the AI formula booklet guide.

Test yourself — cover the answers first

QUICK CHECK

1. Is the second derivative test in the AA formula booklet?
2. Is the period of tan(bx) $2\pi/b$?
3. Which trig identities does the AA SL booklet give?
4. Is Bayes' theorem in the SL booklet?
5. HL Is $\int \sec^2 x\,dx$ given in the HL booklet?

Show answers

1. no
2. no, it is π/b
3. tan θ = sin θ/cos θ, $\cos^2\theta + \sin^2\theta = 1$, sin 2θ and cos 2θ
4. no, only in the HL booklet
5. no, but d/dx tan x = $\sec^2 x$ is, so it follows

Stuck on a question?

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