IB DP MATHS AI · EXAM SPECIAL · SL & HL · CHECKED AGAINST THE CURRENT AI FORMULA BOOKLETS · ~7 MIN READ

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

What the IB Maths AI formula booklet (SL and HL) contains and the facts it leaves out, from Voronoi diagrams, sinusoidal models and outliers to χ^2 degrees of freedom, eigenvalues and graph theory, plus tips for using it in the exam.

What the booklet contains · SL must-memorise list · HL must-memorise list · Models · Statistics & tests · Graph theory · Matrices & DEs · Using the booklet fast

RS by Riyaz Sir
mentorriyaz.in

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

- **The AI formula booklet is short** (about 6 pages at SL, 10 at HL), because AI expects you to use the GDC for most statistics and finance.
- **What isn't in it decides many marks:** how to build a Voronoi boundary, the parameters of a sinusoidal model, the outlier rule, χ^2 degrees of freedom, and the graph-theory facts at HL.
- **AI SL trigonometry uses degrees.** The SL booklet gives arc length and sector area in degrees; the HL booklet adds the radian versions.

BY THE END YOU CAN

- Know what the AI booklet gives you at SL and HL.
- Memorise the facts and methods it leaves out.
- Use the booklet quickly and accurately in the exam.

1 What the booklet contains

AI SL booklet

Topic	Given
Number and algebra	Arithmetic and geometric sequences and series, compound interest, log definition, percentage error
Functions	Straight-line forms and gradient, axis of symmetry of a quadratic
Geometry and trigonometry	Areas and volumes of standard solids, 3D distance and midpoint, sine and cosine rules, ½ab sin C, arc length and sector area **in degrees**
Statistics and probability	IQR, mean of a frequency table, probability rules, conditional probability, independence, E(X), binomial mean and variance
Calculus	Derivative of x^n, $\int x^n\,dx$, area under a curve, **trapezoidal rule**

Extra in the AI HL booklet

Topic	Given (HL only)
Number and algebra	Infinite geometric sum, log laws, complex numbers (Cartesian, polar, Euler form), 2×2 determinant and inverse, $M^n = PD^nP^{-1}$
Functions	Quadratic formula, discriminant, logistic function
Geometry and trigonometry	Arc and sector in radians, $\cos^2\theta + \sin^2\theta = 1$ and $\tan\theta = \sin\theta/\cos\theta$, transformation matrices (reflection, stretches, enlargement, rotations), vector magnitude, line equations, scalar and vector products, angle between vectors, area of a parallelogram
Statistics and probability	$E(aX + b)$, $Var(aX + b)$, linear combinations of independent variables, unbiased variance s^2_{n-1}, Poisson mean and variance, transition matrices $T^n s_0 = s_n$
Calculus	Derivatives of sin, cos, tan, e^x, ln x; chain, product, quotient rules; standard integrals; areas with respect to x or y; volumes of revolution; kinematics including $a = v\,dv/ds$; Euler's method (single and coupled); exact solution of coupled linear DEs

2 What you must memorise: SL

Numbers and finance

- **Percentage change** = (new − old)/old × 100%.
- **Standard form:** $a \times 10^k$ with $1 \le a < 10$. Never write calculator notation (3.2E5).
- **Bounds:** a value rounded to the nearest 10 lies in [x − 5, x + 5).
- **Finance:** the TVM entries (N, I%, PV, PMT, FV, P/Y, C/Y) aren't in the booklet. See the GDC guide.
- **Depreciation:** use compound interest with a negative rate (r = −15 for 15% per year).

Models

- **Sinusoidal $y = a\sin(b(x - c)) + d$ (degrees):** amplitude $a = (\max - \min)/2$; principal axis $d = (\max + \min)/2$; period = 360°/b.
- **Exponential $y = k\,a^x + c$:** c is the horizontal asymptote; $a > 1$ growth, $0 < a < 1$ decay.
- **Direct and inverse variation:** $y = kx^n$; for inverse, $n < 0$.

Geometry and Voronoi diagrams

- **Perpendicular gradient** = −1/m. Not in the booklet, and essential for Voronoi boundaries.
- **Perpendicular bisector of AB:** passes through the midpoint of AB with gradient $-1/m_{AB}$.
- **Voronoi vertex:** equidistant from three sites; the largest empty circle is centred on a vertex (or on the boundary).
- **Bearings:** measured clockwise from north, written with three figures (065°).
- **Angles of elevation and depression** are measured from the horizontal.

Statistics and probability

- **Outliers:** below $Q_1 - 1.5 \times IQR$ or above $Q_3 + 1.5 \times IQR$.
- **Correlation strength:** describe r as strong, moderate or weak, positive or negative, and say "linear".
- **χ^2 test for independence:** expected frequency = (row total × column total)/grand total; degrees of freedom = (rows − 1)(columns − 1); every expected frequency must be at least 5.
- **χ^2 goodness of fit:** degrees of freedom = number of categories − 1.
- **Normal distribution:** symmetric about μ; about 68%, 95% and 99.7% within 1, 2 and 3 standard deviations.
- **Binomial conditions:** fixed number of trials, two outcomes, constant probability, independent trials.

Calculus

- **Stationary points:** $f'(x) = 0$; increasing where $f'(x) > 0$.
- **Tangent:** $y - y_1 = m(x - x_1)$; **normal** gradient $-1/m$.
- **Optimisation:** set the derivative to 0, solve, and check it's a maximum or minimum (a sketch or sign change is enough at SL).

3 What you must memorise: HL extras HL

- **Eigenvalues:** solve $\det(M - \lambda I) = 0$. The steady state of a Markov chain is the eigenvector for $\lambda = 1$, scaled so the entries add to 1.
- **Phase portraits:** real eigenvalues of opposite sign give a saddle; both negative a stable node (sink); both positive an unstable node (source); complex eigenvalues give a spiral (or circles if the real part is 0).
- **Second-order DEs:** convert to a coupled system with $y = dx/dt$.
- **Graph theory:** the sum of the degrees is twice the number of edges; an Eulerian circuit needs all degrees even (a trail needs exactly two odd vertices); walks of length k come from A^k.
- **Algorithms:** Kruskal's and Prim's (minimum spanning tree, stop at n − 1 edges), Chinese postman (pair the odd vertices), TSP upper bound (nearest neighbour) and lower bound (deleted vertex: MST of the rest + the two shortest edges to the deleted vertex).
- **Confidence intervals and tests:** use t when σ is unknown; a Type I error rejects a true H_0.
- **Poisson:** used for random, independent events at a constant mean rate; the sum of independent Poisson variables is Poisson.
- **Least squares:** the regression line minimises the sum of squared residuals; R^2 measures how much of the variation the model explains.

4 Using the booklet fast

- **Learn where each topic sits:** the sections follow the syllabus order (1 to 5).
- **Check the units:** SL arc and sector formulas are in **degrees**; the HL radian versions are listed separately.
- **Write the formula with your values** before using the GDC. "Used GDC" alone isn't working.

LINKING QUESTION

See the full topics in Trigonometry, 3D geometry and Voronoi diagrams, Chi-squared and t-tests and Graph theory. The AA version is the AA formula booklet guide.

Test yourself — cover the answers first

QUICK CHECK

1. Is the outlier rule in the AI booklet?
2. What is the period of $y = 3\sin(30x) + 2$ in degrees?
3. How do you find χ^2 degrees of freedom for a 3 × 4 table?

4. Are the SL arc length and sector area formulas in degrees or radians?
5. HL What type of equilibrium do eigenvalues −2 and 3 give?

Show answers

1. no; $Q_1 - 1.5 \times \text{IQR}$ and $Q_3 + 1.5 \times \text{IQR}$ must be memorised
2. 12
3. $(3 - 1)(4 - 1) = 6$
4. degrees
5. a saddle

Stuck on a question?

Send it to me on WhatsApp. I read every message.

Want regular help? Send this to your parent →

Share with a friend

Ask Riyaz Sir