IB Math Revision
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FORMULA POSTER

IB Mathematics: Analysis & Approaches SL

2021 syllabus · v2 Oct 2026

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formula-sheet-slaa
Interactive version

★ Learn it: not in the IB formula booklet 🕮 In the booklet

Prior learning

🕮 Area: parallelogram, triangle, trapezoid: $A = bh$, $A = \frac{1}{2}bh$, $A = \frac{1}{2}(a+b)h$

🕮 Circle: $A = \pi r^2$, $C = 2\pi r$

Scan to practise

🕮 Volume: cuboid, cylinder, prism: $V = lwh$, $V = \pi r^2 h$, $V = Ah$

🕮 Curved surface of a cylinder: $A = 2\pi rh$

🕮 Distance; midpoint: $d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$, $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

★ **Pythagoras:** $a^2 + b^2 = c^2$ → Any right-angled triangle, in 2D or 3D

★ **Right-angled trig:** $\sin\theta = \frac{\text{opp}}{\text{hyp}}$, $\cos\theta = \frac{\text{adj}}{\text{hyp}}$, $\tan\theta = \frac{\text{opp}}{\text{adj}}$ → Sides and angles in right-angled triangles, bearings, elevation

★ **Laws of indices:** $a^m a^n = a^{m+n}$, $\frac{a^m}{a^n} = a^{m-n}$, $(a^m)^n = a^{mn}$, $a^{-n} = \frac{1}{a^n}$, $a^{\frac{m}{n}} = \sqrt[n]{a^m}$ → Simplifying powers and roots without a calculator

★ **Standard form:** $a \times 10^k$, $1 \le a < 10$, $k \in \mathbb{Z}$ → Converting numbers to and from standard form

1 Number & algebra

🕮 Arithmetic sequence: $u_n = u_1 + (n-1)d$

🕮 Arithmetic series: $S_n = \frac{n}{2}(2u_1 + (n-1)d)$ $= \frac{n}{2}(u_1 + u_n)$

🕮 Geometric sequence: $u_n = u_1 r^{n-1}$

Scan to practise

🕮 Geometric series, $r \neq 1$: $S_n = \frac{u_1(r^n-1)}{r-1}$ $= \frac{u_1(1-r^n)}{1-r}$

🕮 Sum to infinity, $|r| < 1$: $S_\infty = \frac{u_1}{1-r}$

🕮 Compound interest (k times a year, n years, r%): $FV = PV\left(1 + \frac{r}{100k}\right)^{kn}$

🕮 Exponents & logs: $a^x = b \iff x = \log_a b$, $a^x = e^{x \ln a}$, $\log_a a^x = x = a^{\log_a x}$

🕮 Laws of logs: $\log_a xy = \log_a x + \log_a y$, $\log_a \frac{x}{y} = \log_a x - \log_a y$, $\log_a x^m = m \log_a x$

🕮 Change of base: $\log_b a = \frac{\log_c a}{\log_c b}$

★ **Special values:** $\log_a 1 = 0$, $\log_a a = 1$, $\ln e = 1$, $e^{\ln x} = x$ → Simplifying logarithm expressions exactly

🕮 Binomial theorem, $n \in \mathbb{N}$: $(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \cdots + \binom{n}{r}a^{n-r}b^r + \cdots + b^n$

🕮 Binomial coefficient: $\binom{n}{r} = {}^nC_r = \frac{n!}{r!\,(n-r)!}$

★ **General term:** $T_{r+1} = \binom{n}{r}a^{n-r}b^r$ → Find a specified term, coefficient or constant term

Watch for: Answer exactly what is asked: the coefficient or the term

Deductive proof: work from one side to the other, one justified step per line.

Watch for Decide whether the question wants one term (u_n) or a total (S_n)

Calculator find sums of sequences; use the TVM finance solver: keystrokes at ibmathrevision.com/calculator-skills

2 Functions

🕮 Gradient; forms of a line: $m = \frac{y_2-y_1}{x_2-x_1}$, $y = mx + c$, $ax + by + d = 0$, $y - y_1 = m(x - x_1)$

★ **Parallel; perpendicular lines:** $m_1 = m_2$; $m_1 m_2 = -1$ → Equation of a parallel or perpendicular line through a point

🕮 Quadratic: axis of symmetry: $x = -\frac{b}{2a}$

🕮 Quadratic formula; discriminant: $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$, $\Delta = b^2 - 4ac$

Scan to practise

★ **Roots:** $\Delta > 0$ **two distinct real,** $\Delta = 0$ **one repeated,** $\Delta < 0$ **no real roots** → Count real roots; quadratic inequalities with a sketch

★ **Vertex form, vertex** (h, k)**; intercept form:** $y = a(x-h)^2 + k$; $y = a(x-p)(x-q)$ → Finding a turning point, a range, or transformations of $y = x^2$

★ **Composite; inverse:** $(f \circ g)(x) = f(g(x))$; $f(f^{-1}(x)) = x$ → Finding $f^{-1}(x)$: swap x and y, then make y the subject

Watch for: $f^{-1}(a)$ means solve $f(x) = a$

★ **Graph of** f^{-1}**: reflect** $y = f(x)$ **in** $y = x$**; domain of** f^{-1} **= range of** f → Sketch $y = f^{-1}(x)$ and state its domain and range

Watch for: The domain of f^{-1} is the range of f

★ **Translations:** $f(x) + b$ **up** b**;** $f(x - a)$ **right** a → Sketch $y = f(x) +$ a and $y = f(x + a)$, tracking key points

Watch for: Describe each transformation with its type and value

★ **Stretches:** $pf(x)$ **vertical** $\times p$**;** $f(qx)$ **horizontal** $\times \frac{1}{q}$ → Vertical and horizontal stretches: state the scale factor

Watch for: Name each transformation: "vertical stretch, scale factor 3"

★ **Reflections:** $-f(x)$ **in the** x**-axis;** $f(-x)$ **in the** y**-axis** → Reflect graphs in the axes; apply transformations in order

★ $y = \frac{ax+b}{cx+d}$ **asymptotes:** $x = -\frac{d}{c}$, $y = \frac{a}{c}$ → Sketching reciprocal-type graphs; domains and ranges

Watch for: Asymptotes are equations: $y = \ldots$, not "$HA = \ldots$"

★ **Exponential ↔ log:** $y = a^x \iff x = \log_a y$; e^x **and** $\ln x$ **are inverses** → Growth and decay problems combining exponential and log equations

Watch for Write asymptotes and axes of symmetry as equations

Calculator find intersections and max/min; solve equations: keystrokes at ibmathrevision.com/calculator-skills

3 Geometry & trigonometry

🕮 3D distance: $d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$

🕮 3D midpoint: $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}, \frac{z_1+z_2}{2}\right)$

🕮 Pyramid; cone: $V = \frac{1}{3}Ah$; $V = \frac{1}{3}\pi r^2 h$, curved $A = \pi rl$

🕮 Sphere: $V = \frac{4}{3}\pi r^3$, $A = 4\pi r^2$

Scan to practise

🕮 Sine rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

🕮 Cosine rule: $c^2 = a^2 + b^2 - 2ab\cos C$, $\cos C = \frac{a^2+b^2-c^2}{2ab}$

🕮 Area of a triangle: $A = \frac{1}{2}ab\sin C$

★ **Ambiguous case: given** a, b, A **with** A **acute, two triangles if** $b \sin A < a < b$ → When two triangles fit: find both angles, decide which are valid

🕮 Arc; sector (θ in radians): $l = r\theta$, $A = \frac{1}{2}r^2\theta$

★ **Radians:** π **rad** $= 180°$ → Convert between degrees and radians

Watch for: Check the GDC angle mode: radians for calculus

🕮 Identities: $\tan\theta = \frac{\sin\theta}{\cos\theta}$, $\cos^2\theta + \sin^2\theta = 1$

🕮 Double angle: $\sin 2\theta = 2\sin\theta\cos\theta$, $\cos 2\theta = \cos^2\theta - \sin^2\theta = 2\cos^2\theta - 1 = 1 - 2\sin^2\theta$

★ **Exact values at** $0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}$**:** $\sin$ **:** $0, \frac{1}{2}, \frac{\sqrt{2}}{2}, \frac{\sqrt{3}}{2}, 1$**;** $\cos$ **: reverse order;** $\tan$ **:** $0, \frac{1}{\sqrt{3}}, 1, \sqrt{3}$**, undefined** → Every non-calculator trig question

Watch for: Learn exact values at 0, $\frac{\pi}{6}$, $\frac{\pi}{4}$, $\frac{\pi}{3}$, $\frac{\pi}{2}$ and related angles

★ **Symmetry:** $\sin(\pi - \theta) = \sin\theta$, $\cos(\pi - \theta) = -\cos\theta$, $\cos(-\theta) = \cos\theta$, $\sin(-\theta) = -\sin\theta$ → Exact values for any angle from the unit circle

★ $y = a\sin(b(x - c)) + d$, $b > 0$**: amplitude** $|a|$**, period** $\frac{2\pi}{b}$**, principal axis** $y = d$ → Matching a graph to its equation, and modelling

Watch for: Radians for trigonometric models

★ $\sin x = k$**:** $x = \arcsin k$ **or** $\pi - \arcsin k$**, then add** $2\pi n$**; keep solutions in the interval** → Solving trig equations over an interval: the calculator gives one answer

Watch for: Sketch the graph and count the solutions in the interval first

Watch for Check the angle mode: radians for arcs, sectors and models

Calculator solve equations: keystrokes at ibmathrevision.com/calculator-skills

4 Statistics & probability

🕮 Interquartile range: $IQR = Q_3 - Q_1$

🕮 Mean ($n = \sum f_i$): $\bar{x} = \frac{\sum f_i x_i}{n}$

★ **Outliers:** $x < Q_1 - 1.5\,IQR$ **or** $x > Q_3 + 1.5\,IQR$ → Box plots and "is this value an outlier?" questions

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★ **Variance (s.d.** σ**):** $\sigma^2 = \frac{\sum f(x-\mu)^2}{n}$ $= \frac{\sum f x^2}{n} - \mu^2$ → Spread of data; check with technology

★ **Data** $\times a$ **then** $+b$**:** mean $\to a\bar{x} + b$, s.d. $\to |a|\sigma$ → Questions that change units or scale marks

★ **Regression: use** y **on** x **to predict** y**,** x **on** y **to predict** x**; interpolate, don't extrapolate** → Choose the y-on-x or x-on-y line for a prediction

🕮 Probability: $P(A) = \frac{n(A)}{n(U)}$, $P(A) + P(A') = 1$

🕮 Combined events: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

🕮 Mutually exclusive: $P(A \cup B) = P(A) + P(B)$

🕮 Independent: $P(A \cap B) = P(A)P(B)$

🕮 Conditional: $P(A \mid B) = \frac{P(A \cap B)}{P(B)}$

🕮 Expected value: $E(X) = \sum x\,P(X = x)$

★ **Valid distribution; fair game:** $\sum P(X = x) = 1$; $E(\text{gain}) = 0$ → Find an unknown probability; decide whether a game is fair

★ **Binomial** $X \sim B(n, p)$**:** $P(X = r) = \binom{n}{r}p^r(1-p)^{n-r}$ → Fixed number of independent trials

Watch for: $P(X \ge 1) = 1 - P(X = 0)$, not $1 - P(X \le 1)$

🕮 Binomial mean, variance: $E(X) = np$, $\text{Var}(X) = np(1-p)$

🕮 Standardised normal: $z = \frac{x-\mu}{\sigma}$

★ **Normal: about 68%, 95%, 99.7% of values lie within 1, 2, 3 s.d. of** μ → Estimate probabilities from the symmetry of the normal curve

Watch for Write the distribution and probability statement first

Calculator find mean, SD and quartiles; do a normal distribution; do binomial and Poisson; do regression: keystrokes at ibmathrevision.com/calculator-skills

5 Calculus

🕮 Power rule: $f(x) = x^n \Rightarrow f'(x) = nx^{n-1}$

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🕮 Standard derivatives: $(\sin x)' = \cos x$, $(\cos x)' = -\sin x$, $(e^x)' = e^x$, $(\ln x)' = \frac{1}{x}$

🕮 Chain rule: $y = g(u)$, $u = f(x) \Rightarrow \frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$

🕮 Product rule: $\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$

🕮 Quotient rule: $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$

★ **Linear inside:** $\frac{d}{dx}e^{kx} = ke^{kx}$, $\frac{d}{dx}\sin kx = k\cos kx$, $\frac{d}{dx}\ln(kx) = \frac{1}{x}$ → Composite functions such as e^{2x} and $\sin(4x+1)$

★ **Tangent; normal gradient at** $x = a$**:** $y - f(a) = f'(a)(x - a)$; $m_{\text{normal}} = -\frac{1}{f'(a)}$ → Any "find the equation of the tangent / normal" question

★ **Increasing / decreasing:** $f'(x) > 0$; $f'(x) < 0$ → Where a function is increasing or decreasing

★ **Stationary points:** $f'(x) = 0$ **:** $f'' < 0$ **max,** $f'' > 0$ **min** → Optimisation and curve sketching

Watch for: Fastest rate means maximise the derivative

★ **Concave up** $f'' > 0$**; point of inflexion:** $f'' = 0$ **and** f'' **changes sign** → Concave up or down; points of inflexion

🕮 Integral of x^n, $n \neq -1$: $\int x^n\,dx = \frac{x^{n+1}}{n+1} + C$

🕮 Standard integrals: $\int \frac{1}{x}\,dx = \ln|x| + C$, $\int \sin x\,dx = -\cos x + C$, $\int \cos x\,dx = \sin x + C$, $\int e^x\,dx = e^x + C$

★ **Linear inside:** $\int f(ax+b)\,dx = \frac{1}{a}F(ax+b) + C$ → Integrals like $(3x-1)^4$, e^{2x+1} or $\cos(5x)$

★ **Reverse chain rule:** $\int f'(g(x))g'(x)\,dx = f(g(x)) + C$ → Integrate $f'(x)[f(x)]^n$, $\frac{f'(x)}{f(x)}$ or $f'(x)e^{f(x)}$ by inspection

★ **Definite integral:** $\int_a^b f'(x)\,dx = f(b) - f(a)$ → From f' to f : integrate, add $+ C$, use the given point

Watch for: Show $F(\text{upper}) - F(\text{lower})$ with both values

🕮 Area, curve and x-axis: $A = \int_a^b |y|\,dx$

★ **Area between two curves:** $A = \int_a^b |f(x) - g(x)|\,dx$ → Shaded-region questions

🕮 Kinematics: $v = \frac{ds}{dt}$, $a = \frac{dv}{dt} = \frac{d^2s}{dt^2}$

🕮 Distance travelled $t_1 \to t_2$: $\int_{t_1}^{t_2} |v(t)|\,dt$

★ **Displacement** $t_1 \to t_2$**:** $\int_{t_1}^{t_2} v(t)\,dt$ → Displacement or position from velocity, with a boundary condition

Watch for Integrate, add $+ C$, then use the given point to find C

Calculator find derivatives and integrals; find intersections and max/min: keystrokes at ibmathrevision.com/calculator-skills

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