INTERNATIONAL BACCALAUREATE · DIPLOMA

IB Maths: Analysis and Approaches

SL formula booklet

Every formula you get in the exam, SL content only, in syllabus order

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Prior learning

	Area of a parallelogram	$A = bh$ (b base, h height)
	Area of a triangle	$A = \frac{1}{2}(bh)$ (b base, h height)
	Area of a trapezoid	$A = \frac{1}{2}(a+b)h$ (a, b parallel sides, h height)
	Area of a circle	$A = \pi r^2$ (r radius)
	Circumference of a circle	$C = 2\pi r$ (r radius)
	Volume of a cuboid	$V = lwh$ (l length, w width, h height)
	Volume of a cylinder	$V = \pi r^2 h$ (r radius, h height)
	Volume of a prism	$V = Ah$ (A area of cross-section, h height)
	Area of the curved surface of a cylinder	$A = 2\pi rh$ (r radius, h height)
	Distance between (x_1, y_1) and (x_2, y_2)	$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$
	Midpoint of the segment from (x_1, y_1) to (x_2, y_2)	$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

Topic 1: Number and algebra

1.2	The nth term of an arithmetic sequence	$u_n = u_1 + (n-1)d$
	The sum of n terms of an arithmetic sequence	$S_n = \frac{n}{2}(2u_1 + (n-1)d); \quad S_n = \frac{n}{2}(u_1 + u_n)$
1.3	The nth term of a geometric sequence	$u_n = u_1 r^{n-1}$
	The sum of n terms of a finite geometric sequence	$S_n = \frac{u_1(r^n - 1)}{r - 1} = \frac{u_1(1 - r^n)}{1 - r}, \quad r \neq 1$
1.4	Compound interest	$FV = PV \times \left(1 + \frac{r}{100k}\right)^{kn}$ FV future value, PV present value, n number of years, k compounding periods per year, r% nominal annual rate of interest
1.5	Exponents and logarithms	$a^x = b \iff x = \log_a b, \quad a > 0,\ b > 0,\ a \neq 1$
1.7	Exponents and logarithms	$\log_a xy = \log_a x + \log_a y \qquad \log_a \frac{x}{y} = \log_a x - \log_a y$ $\log_a x^m = m \log_a x \qquad \log_a x = \frac{\log_b x}{\log_b a}$
1.8	The sum of an infinite geometric sequence	$S_\infty = \frac{u_1}{1 - r}, \quad \lvert r \rvert < 1$
1.9	Binomial theorem	$(a+b)^n = a^n + {}^n\mathrm{C}_1 a^{n-1}b + \cdots + {}^n\mathrm{C}_r a^{n-r}b^r + \cdots + b^n$ ${}^n\mathrm{C}_r = \frac{n!}{r!(n-r)!}$

Topic 2: Functions

2.1	Equations of a straight line	$y = mx + c; \quad ax + by + d = 0; \quad y - y_1 = m(x - x_1)$
	Gradient formula	$m = \frac{y_2 - y_1}{x_2 - x_1}$

2.6	Axis of symmetry of the graph of a quadratic	$f(x) = ax^2 + bx + c \Rightarrow \text{axis of symmetry } x = -\frac{b}{2a}$
2.7	Solutions of a quadratic equation	$ax^2 + bx + c = 0 \Rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, \quad a \neq 0$
	Discriminant	$\Delta = b^2 - 4ac$
2.9	Exponential and logarithmic functions	$a^x = e^{x \ln a}; \quad \log_a a^x = x = a^{\log_a x}, \quad a, x > 0, \ a \neq 1$

Topic 3: Geometry and trigonometry

3.1	Distance between (x_1, y_1, z_1) and (x_2, y_2, z_2)	$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$
	Midpoint of the segment from (x_1, y_1, z_1) to (x_2, y_2, z_2)	$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}, \frac{z_1 + z_2}{2}\right)$
	Volume of a right pyramid	$V = \frac{1}{3}Ah$ (A area of the base, h height)
	Volume of a right cone	$V = \frac{1}{3}\pi r^2 h$ (r radius, h height)
	Area of the curved surface of a cone	$A = \pi r l$ (r radius, l slant height)
	Volume of a sphere	$V = \frac{4}{3}\pi r^3$ (r radius)
	Surface area of a sphere	$A = 4\pi r^2$ (r radius)
3.2	Sine rule	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
	Cosine rule	$c^2 = a^2 + b^2 - 2ab\cos C; \quad \cos C = \frac{a^2 + b^2 - c^2}{2ab}$
	Area of a triangle	$A = \frac{1}{2}ab\sin C$
3.4	Length of an arc	$l = r\theta$ (r radius, θ angle in radians)
	Area of a sector	$A = \frac{1}{2}r^2\theta$ (r radius, θ angle in radians)
3.5	Identity for $\tan\theta$	$\tan\theta = \frac{\sin\theta}{\cos\theta}$
3.6	Pythagorean identity	$\cos^2\theta + \sin^2\theta = 1$
	Double angle identities	$\sin 2\theta = 2\sin\theta\cos\theta$ $\cos 2\theta = \cos^2\theta - \sin^2\theta = 2\cos^2\theta - 1 = 1 - 2\sin^2\theta$

Topic 4: Statistics and probability

4.2	Interquartile range	$\text{IQR} = Q_3 - Q_1$
4.3	Mean $\bar{x}$ of a set of data	$\bar{x} = \frac{\sum_{i=1}^{k} f_i x_i}{n}, \quad \text{where } n = \sum_{i=1}^{k} f_i$
4.5	Probability of an event A	$\text{P}(A) = \frac{n(A)}{n(U)}$
	Complementary events	$\text{P}(A) + \text{P}(A') = 1$
4.6	Combined events	$\text{P}(A \cup B) = \text{P}(A) + \text{P}(B) - \text{P}(A \cap B)$
	Mutually exclusive events	$\text{P}(A \cup B) = \text{P}(A) + \text{P}(B)$
	Conditional probability	$\text{P}(A \mid B) = \frac{\text{P}(A \cap B)}{\text{P}(B)}$
	Independent events	$\text{P}(A \cap B) = \text{P}(A)\text{P}(B)$
4.7	Expected value of a discrete random variable X	$\text{E}(X) = \sum x\text{P}(X = x)$

4.8	Binomial distribution $X \sim \mathrm{B}(n, p)$: mean and variance	$\mathrm{E}(X) = np \qquad \mathrm{Var}(X) = np(1-p)$
4.12	Standardized normal variable	$z = \dfrac{x-\mu}{\sigma}$

Topic 5: Calculus

5.3	Derivative of x^n	$f(x) = x^n \Rightarrow f'(x) = nx^{n-1}$
5.5	Integral of x^n	$\displaystyle\int x^n \,\mathrm{d}x = \frac{x^{n+1}}{n+1} + C, \quad n \neq -1$
	Area between the curve $y = f(x)$ and the x-axis, where $f(x) > 0$	$\displaystyle A = \int_a^b y \,\mathrm{d}x$
5.6	Derivative of $\sin x$	$f(x) = \sin x \Rightarrow f'(x) = \cos x$
	Derivative of $\cos x$	$f(x) = \cos x \Rightarrow f'(x) = -\sin x$
	Derivative of e^x	$f(x) = \mathrm{e}^x \Rightarrow f'(x) = \mathrm{e}^x$
	Derivative of $\ln x$	$f(x) = \ln x \Rightarrow f'(x) = \dfrac{1}{x}$
	Chain rule	$y = g(u)$, where $u = f(x) \Rightarrow \dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{\mathrm{d}y}{\mathrm{d}u} \times \dfrac{\mathrm{d}u}{\mathrm{d}x}$
	Product rule	$y = uv \Rightarrow \dfrac{\mathrm{d}y}{\mathrm{d}x} = u\dfrac{\mathrm{d}v}{\mathrm{d}x} + v\dfrac{\mathrm{d}u}{\mathrm{d}x}$
	Quotient rule	$y = \dfrac{u}{v} \Rightarrow \dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{v\dfrac{\mathrm{d}u}{\mathrm{d}x} - u\dfrac{\mathrm{d}v}{\mathrm{d}x}}{v^2}$
5.9	Acceleration	$a = \dfrac{\mathrm{d}v}{\mathrm{d}t} = \dfrac{\mathrm{d}^2 s}{\mathrm{d}t^2}$
	Distance travelled from t_1 to t_2	$\text{distance} = \displaystyle\int_{t_1}^{t_2} \lvert v(t) \rvert \,\mathrm{d}t$
	Displacement from t_1 to t_2	$\text{displacement} = \displaystyle\int_{t_1}^{t_2} v(t) \,\mathrm{d}t$
5.10	Standard integrals	$\displaystyle\int \frac{1}{x}\,\mathrm{d}x = \ln\lvert x \rvert + C \qquad \int \sin x \,\mathrm{d}x = -\cos x + C$ $\displaystyle\int \cos x \,\mathrm{d}x = \sin x + C \qquad \int \mathrm{e}^x \,\mathrm{d}x = \mathrm{e}^x + C$
5.11	Area of the region enclosed by a curve and the x-axis	$\displaystyle A = \int_a^b \lvert y \rvert \,\mathrm{d}x$