



International Baccalaureate®
Baccalauréat International
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Diploma Programme

Mathematics: applications and interpretation formula booklet

For use during the course and in the examinations
First examinations 2021

Version 1.1

Contents

Prior learning

SL and HL	2
HL only	2

Topic 1: Number and algebra

SL and HL	3
HL only	4

Topic 2: Functions

SL and HL	5
HL only	5

Topic 3: Geometry and trigonometry

SL and HL	6
HL only	7

Topic 4: Statistics and probability

SL and HL	9
HL only	10

Topic 5: Calculus

SL and HL	11
HL only	11

Prior learning – SL and HL

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

Prior learning – HL only

Solutions of a quadratic equation	The solutions of $ax^2 + bx + c = 0$ are $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, $a \neq 0$
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Topic I: Number and algebra – SL and HL

SL 1.2	<p>The nth term of an arithmetic sequence</p> <p>The sum of n terms of an arithmetic sequence</p>	$u_n = u_1 + (n-1)d$ $S_n = \frac{n}{2}(2u_1 + (n-1)d); S_n = \frac{n}{2}(u_1 + u_n)$
SL 1.3	<p>The nth term of a geometric sequence</p> <p>The sum of n terms of a finite geometric sequence</p>	$u_n = u_1 r^{n-1}$ $S_n = \frac{u_1(r^n - 1)}{r - 1} = \frac{u_1(1 - r^n)}{1 - r}, r \neq 1$
SL 1.4	<p>Compound interest</p>	$FV = PV \times \left(1 + \frac{r}{100k}\right)^{kn}$ <p>where FV is the future value, PV is the present value, n is the number of years, k is the number of compounding periods per year, $r\%$ is the nominal annual rate of interest</p>
SL 1.5	<p>Exponents and logarithms</p>	$a^x = b \Leftrightarrow x = \log_a b, \text{ where } a > 0, b > 0, a \neq 1$
SL 1.6	<p>Percentage error</p>	$\varepsilon = \left \frac{v_A - v_E}{v_E} \right \times 100\%, \text{ where } v_E \text{ is the exact value and } v_A \text{ is the approximate value of } v$

Topic 2: Functions – SL and HL

SL 2.1	Equations of a straight line	$y = mx + c$; $ax + by + d = 0$; $y - y_1 = m(x - x_1)$
	Gradient formula	$m = \frac{y_2 - y_1}{x_2 - x_1}$
SL 2.5	Axis of symmetry of the graph of a quadratic function	$f(x) = ax^2 + bx + c \Rightarrow$ axis of symmetry is $x = -\frac{b}{2a}$

Topic 3: Geometry and trigonometry – SL and HL

SL 3.1	<p>Distance between two points (x_1, y_1, z_1) and (x_2, y_2, z_2)</p> <p>Coordinates of the midpoint of a line segment with endpoints (x_1, y_1, z_1) and (x_2, y_2, z_2)</p> <p>Volume of a right-pyramid</p> <p>Volume of a right cone</p> <p>Area of the curved surface of a cone</p> <p>Volume of a sphere</p> <p>Surface area of a sphere</p>	$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$ $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}, \frac{z_1 + z_2}{2} \right)$ $V = \frac{1}{3} Ah, \text{ where } A \text{ is the area of the base, } h \text{ is the height}$ $V = \frac{1}{3} \pi r^2 h, \text{ where } r \text{ is the radius, } h \text{ is the height}$ $A = \pi r l, \text{ where } r \text{ is the radius, } l \text{ is the slant height}$ $V = \frac{4}{3} \pi r^3, \text{ where } r \text{ is the radius}$ $A = 4\pi r^2, \text{ where } r \text{ is the radius}$
SL 3.2	<p>Sine rule</p> <p>Cosine rule</p> <p>Area of a triangle</p>	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $c^2 = a^2 + b^2 - 2ab \cos C; \cos C = \frac{a^2 + b^2 - c^2}{2ab}$ $A = \frac{1}{2} ab \sin C$
SL 3.4	<p>Length of an arc</p> <p>Area of a sector</p>	$l = \frac{\theta}{360} \times 2\pi r, \text{ where } \theta \text{ is the angle measured in degrees, } r \text{ is the radius}$ $A = \frac{\theta}{360} \times \pi r^2, \text{ where } \theta \text{ is the angle measured in degrees, } r \text{ is the radius}$

Topic 4: Statistics and probability – SL and HL

SL 4.2	Interquartile range	$\text{IQR} = Q_3 - Q_1$
SL 4.3	Mean, \bar{x} , of a set of data	$\bar{x} = \frac{\sum_{i=1}^k f_i x_i}{n}$, where $n = \sum_{i=1}^k f_i$
SL 4.5	Probability of an event A	$P(A) = \frac{n(A)}{n(U)}$
	Complementary events	$P(A) + P(A') = 1$
SL 4.6	Combined events	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$
	Mutually exclusive events	$P(A \cup B) = P(A) + P(B)$
	Conditional probability	$P(A B) = \frac{P(A \cap B)}{P(B)}$
	Independent events	$P(A \cap B) = P(A) P(B)$
SL 4.7	Expected value of a discrete random variable X	$E(X) = \sum x P(X = x)$
SL 4.8	Binomial distribution $X \sim B(n, p)$	
	Mean	$E(X) = np$
	Variance	$\text{Var}(X) = np(1 - p)$

Topic 5: Calculus – SL and HL

SL 5.3	Derivative of x^n	$f(x) = x^n \Rightarrow f'(x) = nx^{n-1}$
SL 5.5	<p>Integral of x^n</p> <p>Area of region enclosed by a curve $y = f(x)$ and the x-axis, where $f(x) > 0$</p>	$\int x^n dx = \frac{x^{n+1}}{n+1} + C, \quad n \neq -1$ $A = \int_a^b y dx$
SL 5.8	The trapezoidal rule	$\int_a^b y dx \approx \frac{1}{2}h((y_0 + y_n) + 2(y_1 + y_2 + \dots + y_{n-1})),$ <p>where $h = \frac{b-a}{n}$</p>