International Baccalaureate®
Baccalauréat International
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Diploma Programme

Mathematics: applications and interpretation SL formula booklet

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

Version 1.0

STANDARD LEVEL

Contents

Topic 1: Number and algebra – SL

1.2	The nth term of an arithmetic sequence The sum of n terms of an arithmetic sequence	$u_n = u_1 + (n-1)d$ $S_n = \frac{n}{2}\left(2u_1 + (n-1)d\right)$; $S_n = \frac{n}{2}(u_1 + u_n)$
1.3	The nth term of a geometric sequence The sum of n terms of a finite geometric sequence	$u_n = u_1 r^{n-1}$ $S_n = \frac{u_1(r^n - 1)}{r-1} = \frac{u_1(1-r^n)}{1-r}$, $r \neq 1$
1.4	Compound interest	$FV = PV \times \left(1 + \frac{r}{100k}\right)^{kn}$, 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
1.5	Exponents and logarithms	$a^x = b \Leftrightarrow x = \log_a b$, where $a > 0, b > 0, a \neq 1$
1.6	Percentage error	$\varepsilon = \left\lvert \frac{v_A - v_E}{v_E} \right\rvert \times 100\%$, where v_E is the exact value and v_A is the approximate value of v

Topic 2: Functions – SL

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

Prior learning – SL	
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)	$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$

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

Topic 4: Statistics and probability – SL

4.2	Interquartile range	$\text{IQR} = Q_3 - Q_1$
4.3	Mean, $\overline{x}$, of a set of data	$\overline{x} = \dfrac{\sum_{i=1}^{k} f_i x_i}{n}$, where $n = \sum_{i=1}^{k} f_i$
4.5	Probability of an event A	$\text{P}(A) = \dfrac{n(A)}{n(U)}$
	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	$\text{P}(A \mid B) = \dfrac{\text{P}(A \cap B)}{\text{P}(B)}$
	Independent events	$\text{P}(A \cap B) = \text{P}(A)\,\text{P}(B)$
4.7	Expected value of a discrete random variable X	$\text{E}(X) = \sum_{i=1}^{k} x_i\ \text{P}(X = x_i)$
4.8	Binomial distribution $X \sim \text{B}(n, p)$	
	Mean	$\text{E}(X) = np$
	Variance	$\text{Var}(X) = np(1-p)$

Topic 5: Calculus – SL

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