International Baccalaureate
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Diploma Programme

Mathematical studies SL formula booklet

For use during the course and in the examinations

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Contents

Prior learning

5.0	Area of a parallelogram	$A = b \times h$, where b is the base, h is the height
	Area of a triangle	$A = \frac{1}{2}(b \times h)$, where b is the base, h is the height
	Area of a trapezium	$A = \frac{1}{2}(a+b)h$, 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
	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)	$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$

Topics

Topic 1—Number and algebra

1.2	Percentage error	$\varepsilon = \left\| \frac{v_A - v_E}{v_E} \right\| \times 100\%$, where v_E is the exact value and v_A is the approximate value of v
1.7	The nth term of an arithmetic sequence The sum of n terms of an arithmetic sequence	$u_n = u_1 + (n-1)d$ $S_n = \frac{n}{2}(2u_1 + (n-1)d) = \frac{n}{2}(u_1 + u_n)$
1.8	The nth term of a geometric sequence The sum of n terms of a geometric sequence	$u_n = u_1 r^{n-1}$ $S_n = \frac{u_1(r^n - 1)}{r-1} = \frac{u_1(1-r^n)}{1-r}$, $r \neq 1$
1.9	Compound interest	$FV = PV \times \left(1 + \frac{r}{100k}\right)^{kn}$, where FV = future value, PV = present value, n = number of years, k = number of compounding periods per year, $r\%$ = nominal annual rate of interest

Topic 2—Descriptive statistics

2.5	Mean of a set of data	$\overline{x} = \frac{\sum_{i=1}^{k} f_i x_i}{n}$, where $n = \sum_{i=1}^{k} f_i$
2.6	Interquartile range	$\text{IQR} = Q_3 - Q_1$

Topic 3—Logic, sets and probability

3.3 Truth tables

p	q	$\neg p$	$p \wedge q$	$p \vee q$	$p \veebar q$	$p \Rightarrow q$	$p \Leftrightarrow q$
T	T	F	T	T	F	T	T
T	F	F	F	T	T	F	F
F	T	T	F	T	T	T	F
F	F	T	F	F	F	T	T

3.6

Probability of an event A: $\mathrm{P}(A) = \dfrac{\text{number of outcomes in } A}{\text{total number of outcomes}}$

Complementary events: $\mathrm{P}(A') = 1 - \mathrm{P}(A)$

3.7

Combined events: $\mathrm{P}(A \cup B) = \mathrm{P}(A) + \mathrm{P}(B) - \mathrm{P}(A \cap B)$

Mutually exclusive events: $\mathrm{P}(A \cap B) = 0$

Independent events: $\mathrm{P}(A \cap B) = \mathrm{P}(A)\,\mathrm{P}(B)$

Conditional probability: $\mathrm{P}(A \mid B) = \dfrac{\mathrm{P}(A \cap B)}{\mathrm{P}(B)}$

Topic 5—Geometry and trigonometry

5.1	Equation of a straight line	$y = mx + c;\ \ ax + by + d = 0$
	Gradient formula	$m = \frac{y_2 - y_1}{x_2 - x_1}$
5.3	Sine rule	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
	Cosine rule	$a^2 = b^2 + c^2 - 2bc\cos A;\quad \cos A = \frac{b^2 + c^2 - a^2}{2bc}$
	Area of a triangle	$A = \frac{1}{2}ab\sin C$, where a and b are adjacent sides, C is the included angle
5.5	Area of the curved surface of a cylinder	$A = 2\pi rh$, where r is the radius, h is the height
	Surface area of a sphere	$A = 4\pi r^2$, where r is the radius
	Area of the curved surface of a cone	$A = \pi rl$, where r is the radius, l is the slant height
	Volume of a pyramid	$V = \frac{1}{3}Ah$, where A is the area of the base, h is the vertical height
	Volume of a cuboid	$V = l \times w \times h$, 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 a sphere	$V = \frac{4}{3}\pi r^3$, where r is the radius
	Volume of a cone	$V = \frac{1}{3}\pi r^2 h$, where r is the radius, h is the vertical height
	Volume of a prism	$V = Ah$, where A is the area of cross-section, h is the height

Topic 6—Mathematical models

6.3	Equation of the axis of symmetry for the graph of the quadratic function $y = ax^2 + bx + c$	$x = -\frac{b}{2a}$

Topic 7—Introduction to differential calculus

7.2	Derivative of ax^n	$f(x) = ax^n \quad \Rightarrow \quad f'(x) = nax^{n-1}$
	Derivative of a sum	$f(x) = ax^n,\ g(x) = bx^m \quad \Rightarrow \quad f'(x) + g'(x) = nax^{n-1} + mbx^{m-1}$