INTERNATIONAL BACCALAUREATE
DIPLOMA PROGRAMME 2008
MATHEMATICS

In BOLD and RED: suitable for AUTOGRAPH

AUTOGRAPH PAGE

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IB MATHEMATICAL STUDIES SL (Standard Level)

(first examined 2006)

Studies TOPIC 1: INTRODUCTION TO THE G. D. CALCULATOR

1.1 Arithmetic calculations; data; lists

Studies TOPIC 2: NUMBER AND ALGEBRA

2.1 Natural Numbers:$\mathbb{N}$; Integers:$\mathbb{Z}$; Rational numbers: $\mathbb{Q}$; Real numbers: $\mathbb{R}$
2.2 Approximation; sig. fig.
2.3 Standard form
2.4 SI units
2.5 Arithmetic sequences
2.6 Geometric sequences
2.7 **Two simultaneous equations; solving quadratic equations** — **2D**

Studies TOPIC 3: SETS, LOGIC AND PROBABILITY

3.1 Set theory; prime numbers
3.2 Venn diagrams
3.3 Sample space
3.4 Symbolic logic
3.5 Compound statements
3.6 Truth tables
3.7 Logical equivalence
3.8 Probability
3.9 Venn diagrams; tree diagrams; cards, **2-dice** — **Extras: "2-dice"**
3.10 Combined events/conditional probability

Studies TOPIC 4: FUNCTIONS

4.1 **Functions: domain and range** — **2D**
4.2 **Linear functions, y = mx + c**
4.3 **Quadratic functions: vertex, symmetry x = −b/(2a)** — **2D**
4.4 **$y = a^x$, $a^{\lambda x}$, $ka^{\lambda x} + c$; exponential growth and decay**
4.5 **Trig (degrees): y = asin(bx) + c; y = acos(bx) + c**
4.7 **Graph sketching; rational graphs** — **2D**
4.8 **Solving equations and intersections**

Studies TOPIC 5: GEOMETRY AND TRIGONOMETRY	Autograph
5.1 **Coordinate geometry; distance, mid points** 5.2 **Straight lines: y = mx + c and ax + by + d = 0; perpendicular lines** 5.3 Right-angled trig 5.4 Sine and cosine rules 5.5 3D shapes: surface area and volume; New shapes from mid-points	**2D**
Studies TOPIC 6: STATISTICS	
6.1 **Discrete, continuous** 6.2 **Frequency polygons** 6.3 **Grouped data, histogram (equal classes); stem and leaf diagrams** 6.4 **Cumulative Frequency, box plots, percentiles, quartiles** 6.5 **Mean, median, mode, percentile** 6.6 **Inter-quartile range, standard deviation; population and sample**	**STATISTICS** **STATISTICS**
6.7 **Scatter diagrams, line of best fit; correlation** 6.8 **Regression line (y on x)** 6.9 Hypothesis testing; contingency tables. Chi-squared test	**2D**
Studies TOPIC 7: INTRODUCTORY DIFFERENTIAL CALCULUS	
7.1 **Gradient of chord PQ and P => Q; tangent to a curve** 7.2 **Basic principles for ax^n: f'(x) and f"(x)** 7.3 **Gradient of a curve; equation of tangent** 7.4 **Increasing and decreasing functions** 7.5 **Max and min; point of inflexion with zero gradient**	**2D** **2D**
Studies TOPIC 8: FINANCIAL MATHEMATICS	
8.1 Currency conversions 8.2 Simple interest 8.3 Compound interest 8.4 Tables; inflation	
Studies PROJECT (20%) **involving the collection of information or the generation of measurements, and the analysis and evaluation of the information or measurements.**	**STATISTICS** **2D**

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IB MATHEMATICS SL (Standard Level)

(first examined 2008)

SL TOPIC 1: ALGEBRA

1.1 APs, GPs; population growth
1.2 Exponents and logarithms; change of base
1.3 Binomial Theorem; Pascal's Triangle

SL TOPIC 2: FUNCTIONS AND EQUATIONS

2.1 **Domain and range; Composite Functions f(g(x)). Inverse function** — **2D**
2.2 **Graphing functions; vertical and horizontal asymptotes; roots**
2.3 **Transformation of graphs: translation, stretch, reflection in axes. Trig graphs. The inverse function; reflection in y = x** — **2D**
2.4 **Reciprocal function and y = 1/x**
2.5 **The quadratic: axis of symmetry x = −b/a; completing the square** — **2D**
2.6 **The quadratic: roots; discriminant**
2.7 **$y = a^x$ and its inverse: $y = \log_a x$**
2.8 **$y = e^x$ and y = lnx** — **2D**

SL TOPIC 3: CIRCULAR FUNCTIONS AND TRIGONOMETRY

3.1 **Radians** — **2D**
3.2 **sinθ and cosθ and the unit circle; tanθ = sinθ/cosθ; $\cos^2\theta + \sin^2\theta = 1$** — **Extras: "Trig"**
3.3 **Double angle formulae**
3.4 **Graphs of sinx, cosx, tanx; f(x) = asin(b(x + c)) + d** — **2D**
3.5 **Solving trig equations**
3.6 Sine and cosine rules

SL TOPIC 4: MATRICES

4.1 Matrix : element, row, column, order
4.2 Matrix algebra
4.3 2D and 3D Determinants; 2D inverse
4.4 **Solving linear equations (2D and 3D)** — **2D**

SL TOPIC 5: VECTORS

5.1 **2D and 3D vectors; distance between two points. Sum, difference; zero vector, negative vector; Scalar multiplication, magnitude, unit vector.** — **2D**
5.2 **Scalar product; perpendicular vectors; angle between two vectors** — **3D**
5.3 **Vector equation of a line; angle between two lines**
5.4 **Intersection of two lines**

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SL TOPIC 6: STATISTICS AND PROBABILITY		
6.1	**Population and sample statistics; discrete and continuous**	 **STATISTICS**
6.2	**Box and whisker plots;** **grouped data; histogram (equal class intervals)**	 **STATISTICS**
6.3	**Mean, median, mode, quartiles; standard deviation**	
6.4	**Cumulative frequency graph; percentiles.**	
6.5	Probability	
6.6	Probability: combined events	
6.7	Conditional probability	
6.8	Venn diagrams]	
6.9	**Discrete probability distribution, eg: P(X=x) = 5/18, 6/18, 7/18** Expected value for discrete data	 **STATISTICS**
6.10	**Binomial distribution; its mean**	
6.11	**Normal Distribution; Standardisation; inverse calculations**	 **STATISTICS**
SL TOPIC 7: CALCULUS		
7.1	Ideas of limit and convergence **Basic principles; Derivative of x^n, sinx, cosx, tanx, e^x, lnx** **Gradient; rate of change; Equations of tangents and normals**	 **2D**
7.2	**Chain rule, product and quotient rules; Second derivative**	
7.3	**Local max and min; points of inflexion**	 **2D**
7.4	**Integration: x^n, sinx, cosx, 1/x and e^x**	
7.5	**Area under a curve; between two curves;** **Volume of revolution about x-axis**	 **3D**
7.6	**Displacement, velocity, acceleration, and time** **Area under v-t represents distance.**	
7.7	**Horizontal and vertical asymptotes** **Second derivative: points of inflexion with non-zero gradient**	 **2D**
SL PORTFOLIO (20%)		
	Mathematical investigation **Mathematical modelling**	 **STATISTICS**  **2D,**  **3D**

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IB MATHEMATICS HL (Higher Level)

(first examined 2008) *[ITALIC = same as IB MATHEMATICS SL syllabus]*

HL TOPIC 1 - CORE: ALGEBRA

1.1 *APs, GPs; population growth*
1.2 *Exponents and logarithms; change of base*
1.3 *Binomial Theorem; Pascal's Triangle*
1.4 Proof by induction
1.5 **Complex numbers: Cartesian/polar form; modulus and argument; Argand diagram** — **ARGAND [v.3.5]**
1.6 **Sum, product and quotient**
1.7 **De Moivre's Theorem; roots and powers** — **ARGAND [v.3.5]**
1.8 **Complex conjugates**

HL TOPIC 2 - CORE: FUNCTIONS AND EQUATIONS

2.1 *Domain and range; Composite Functions f(g(x)). Inverse function.* — **2D**
2.2 *Graphing functions; vertical and horizontal asymptotes; roots*
2.3 *Transformation of graphs: translation, stretch, reflection in axes. Trig graphs. The inverse function; reflection in y = x* **y = 1/f(x); graphs with absolute value, eg y = |f(x)|, y f(|x|)** — **2D**
2.4 *Reciprocal function and y = 1/x* — **2D**
2.5 *The quadratic: axis of symmetry x = −b/a; completing the square*
2.6 *The quadratic: roots; discriminant*
2.7 *$y = a^x$ and its inverse: $y = \log_a x$* — **2D**
2.8 *$y = e^x$ and y = lnx*
2.9 **Inequalities: in one variable; g(x) ≥ f(x), one linear and one quadratic**
2.10 **Roots of polynomial equations; repeated roots** — **2D**

HL TOPIC 3 – CORE: CIRCULAR FUNCTIONS AND TRIGONOMETRY

3.1 *Radians*
3.2 *sinθ and cosθ and the unit circle; tanθ = sinθ/cosθ; cos²θ + sin²θ = 1;* **1 + tan²θ = sec²θ ; 1 + cot²θ = scs²θ; secθ, cscθ, cosθ.** — **2D** **Extras: "Trig"**
3.3 *Double angle formulae;* **Compound angle Identities** — **2D**
3.4 *Graphs: sinx, cosx, tanx, asin(b(x + c)) + d* **Inverse trig: arcsinx, arccosx, arctanx** — **2D**
3.5 *Solving trig equations*
3.6 *Sine and cosine rules*

HL TOPIC 4 – CORE: MATRICES

4.1 Matrix : element, row, column, order
4.2 Matrix algebra
4.3 2D and 3D Determinants; 2D inverse
4.4 *Solving linear equations (2D and 3D)* — **2D, 3D**

HL TOPIC 5 – CORE: VECTORS

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5.1	*2D and 3D vectors; distance between two points.* *Sum, difference; zero vector, negative vector;* *Scalar multiplication, magnitude, unit vector.*	2D, 3D
5.2	*Scalar product; perpendicular vectors; angle between two vectors*	2D, 3D
5.3	*Vector equation of a line; angle between two lines* **Parametric form: $x = x_o + \lambda l$, $y = y_o + \lambda m$, $z = z_o + \lambda n$**	
5.4	*Intersecting and* **skew** *lines;* *Intersection of two lines*	2D, 3D
5.5	**Vector product (cross product)**	
5.6	**Vector equation of a plane; Equation of plane: ax + by + cz = d**	2D, 3D
5.7	**Intersections: line and plane, two planes, three planes.** **Angle between: line and plane, two planes**	

HL TOPIC 6 - CORE: STATISTICS AND PROBABILITY

6.1	*Population and sample statistics; discrete and continuous*	STATISTICS
6.2	*Box and whisker plots;* *grouped data; histogram (equal class intervals)*	STATISTICS
6.3	*Mean, median, mode, quartiles; standard deviation*	
6.4	*Cumulative frequency graph; percentiles.*	
6.5	*Probability*	
6.6	*Probability: combined events*	
6.7	*Conditional probability*	
6.8	*Venn diagrams*	
6.9	*Discrete probability distribution, eg: P(X=x) = 5/18, 6/18, 7/18* **Continuous probability density functions** *Expected value* and Variance *for discrete data*	STATISTICS
6.10	*Binomial distribution; its mean* **and variance** **Poisson distribution: its mean and variance**	STATISTICS
6.11	*Normal Distribution; Standardisation; inverse calculations*	

HL TOPIC 7 – CORE: CALCULUS

7.1	**Ideas of limit and convergence, eg sinθ/θ** *Basic principles; Derivative of x^n, sinx, cosx, tanx, e^x, lnx* *Gradient; rate of change; Equations of tangents and normals*	2D
7.2	*Chain rule, product and quotient rules; Second derivative*	2D
7.3	*Local max and min; points of inflexion*	
7.4	*Integration: x^n, sinx, cosx, 1/x and e^x*	2D
7.5	*Area under a curve; between two curves;* *Volume of revolution about x-axis*	
7.6	*Displacement, velocity, acceleration, and time* *Area under v-t represents distance.*	2D
7.7	*Horizontal and vertical asymptotes* *Second derivative: points of inflexion with non-zero gradient*	
7.8	**Implicit differentiation**	2D
7.9	**Further Integration (substitution; parts)**	
7.10	**First Order Differential Equations (variable separable)**	

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IB MATHEMATICS HL (Higher Level)

OPTIONAL SYLLABUS CONTENT

HL TOPIC 8 – OPTION: STATISTICS AND PROBABILITY (CONTINUED)

8.1 Expectation algebra

8.2 **Cumulative distribution functions** — **STATISTICS**

Discrete distributions: uniform, Bernoulli, binomial, negative binomial, Poisson, geometric, hypergeometric — **STATISTICS**

Continuous distributions: uniform, exponential, normal

8.3 **Central limit theorem**

8.4 **Confidence intervals for the mean of a population**

Confidence intervals for the proportion of successes in a population — **STATISTICS**

8.5 **Null and alternative hypotheses: Type I and type II errors**

One-tailed and two-tailed test

8.9 X^2 Goodness of fit test

HL TOPIC 9 – OPTION: SETS, RELATIONS AND GROUPS

9.1 Sets; De Morgan's Laws

9.2 Ordered pairs

9.3 Functions and inverse functions

9.4 Binary operations

9.5 Associative, distributive, commutative

9.6 Identity element; inverse

9.7 Axioms of a group

9.8 Groups

9.9 Finite and infinite groups

9.10 Cyclic groups

9.11 Subgroups, Lagrange theorems

9.12 Isomophism of groups

HL TOPIC 10 – OPTION: SERIES AND DIFFERENTIAL EQUATIONS

10.1 Infinite sequences

10.2 Convergence

10.3 Convergent series

10.4 Power series

10.5 Taylor polynomials

Maclaurin series: e^x, sinx, cosx, arctanx, ln(1+x), $(1+x)^p$ — **2D**

Limits of the form f(x)/g(x)

L'Hôpital's Rule and/or the Taylor series

10.6 **First order differential equations - slope fields**

y' = f(x,y): Numerical solution, Euler's Method — **2D**

Homogeneous DEs, y' = f(y/x)

y' + P(x)y = Q(x) using Integrating factor

HL TOPIC 11 – OPTION: DISCRETE MATHEMATICS

11.1 Division and Euclidean algorithms
11.2 Integers in different bases
11.3 Linear diophantine equations
11.4 Modular arithmetic
11.5 Fermat's little theorem
11.6 Graphs
11.7 Trails and circuits
11.8 Adjacency matrix
11.9 Graph algorithms
11.10 Travelling Salesman

HL PORTFOLIO (20%)

Mathematical investigation
Mathematical modeling

STATISTICS
2D, 3D

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IB FURTHER MATHEMATICS SL (Standard Level)

FM Topic 1 GEOMETRY

1.1 **Triangles; Nine-point Circle; Euler Line** — **2D**

1.2 Euclid's theorem for right-angled triangle
Proportional division of a line; harmonic ratio

1.3 **Circle Geometry; equation of a circle; cyclic quadrilaterals**
Intersecting Chords theorem — **2D**

1.4 Apollonius' circle theorem; Stewart's theorem; Menelaus' theorem;
Ceva's theorem; Simpson's line; Ptolemy's th.; angle bisector theorem

Loci of straight lines and circles [not conic sections] — **2D [v 3.5]**

FM Topic 2 = HL TOPIC 8 – OPTION: STATISTICS AND PROBABILITY
FM Topic 3 = HL TOPIC 9 – OPTION: SETS, RELATIONS AND GROUPS
FM Topic 4 = HL TOPIC 10 – OPTION: SERIES AND DIFF. EQUATIONS
FM Topic 5 = HL TOPIC 11 – OPTION: DISCRETE MATHEMATICS

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May 2009