

IB Mathematics: Applications and Interpretation (AI)

Standard Level (SL) and Higher Level (HL)



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Complete Subject Brief & Syllabus Breakdown
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Contents

1	Introduction to Mathematics: Applications and Interpretation	2
1.1	Key Features of the Course	2
2	Core Syllabus Framework	2
2.1	Topic 1: Number and Algebra	2
2.2	Topic 2: Functions	3
2.3	Topic 3: Geometry and Trigonometry	3
2.4	Topic 4: Statistics and Probability	3
2.5	Topic 5: Calculus	3
3	Assessment Structure	4
3.1	Standard Level (SL) Assessment	4
3.2	Higher Level (HL) Assessment	4
4	The Internal Assessment (Mathematical Exploration)	5



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1 Introduction to Mathematics: Applications and Interpretation

The International Baccalaureate (IB) Diploma Programme Mathematics: Applications and Interpretation (AI) course is designed for students who are interested in understanding how mathematics can be applied to real-world situations.

The course places a strong emphasis on mathematical modelling, statistical analysis, problem-solving, and the interpretation of mathematical results within practical contexts.

Students develop the ability to use mathematics to investigate patterns, analyse data, make predictions, and evaluate the validity of mathematical models.

Technology plays a central role in the course, particularly through the use of Graphic Display Calculators (GDC) and other mathematical software.

The course is particularly relevant for students interested in university studies involving business, economics, social sciences, psychology, geography, biological sciences, and other disciplines that use applied mathematics.

At Higher Level, the course also provides substantial mathematical preparation for quantitative university programmes, subject to individual university entry requirements.

The course is offered at both **Standard Level (SL)** and **Higher Level (HL)**.

1.1 Key Features of the Course

- **Applied Mathematical Focus:** Emphasis on using mathematics to solve practical problems and interpret results in real-world contexts.
- **Technology Integration:** Extensive use of Graphic Display Calculators (GDC), spreadsheets, graphing software, and statistical tools to explore mathematical relationships.
- **Mathematical Modelling:** Development and evaluation of models representing real-world phenomena, including financial, scientific, and social applications.
- **Statistical Reasoning:** Strong emphasis on analysing data, identifying relationships, testing hypotheses, and making informed decisions.
- **Mathematical Exploration:** A compulsory internal assessment allowing students to investigate an area of mathematics connected to their interests.

2 Core Syllabus Framework

The syllabus is divided into five core topics, which are shared between SL and HL.

Higher Level students study additional mathematical concepts and explore more sophisticated applications, models, and statistical techniques.

2.1 Topic 1: Number and Algebra

- **SL Content:** Scientific notation, approximation and percentage errors, arithmetic and geometric sequences and series, financial applications including compound interest, depreciation, annuities and loan repayments, laws of exponents and logarithms, and the use of technology to solve practical numerical problems.

- **HL Additional Content:** Laws of logarithms and exponential equations in greater depth, complex numbers in Cartesian form and their operations, matrices and matrix operations, inverse matrices, and applications of matrices to systems of linear equations and mathematical modelling.

2.2 Topic 2: Functions

- **SL Content:** Concept of a function, domain and range, function notation, linear and quadratic models, exponential models, direct and inverse variation, graphing and interpreting functions, piecewise-defined functions, and the use of technology to identify patterns and model real-world data.
- **HL Additional Content:** Composite and inverse functions, transformations of functions, polynomial, rational, logarithmic and logistic models, more advanced function analysis, and the construction and evaluation of mathematical models using technology.

2.3 Topic 3: Geometry and Trigonometry

- **SL Content:** Distance and midpoint calculations, three-dimensional geometry, surface area and volume of geometric solids, right-angled and non-right-angled trigonometry, sine and cosine rules, area of triangles, bearings, and applications of geometry to navigation and practical measurement.
- **HL Additional Content:** Radian measure, arc length and sector area, trigonometric functions and equations, modelling periodic phenomena, vectors in two and three dimensions, scalar products, vector equations, and applications of vectors to geometry and motion.

2.4 Topic 4: Statistics and Probability

- **SL Content:** Sampling techniques, presentation and interpretation of data, histograms, cumulative frequency diagrams, box plots, measures of central tendency and dispersion, Pearson's correlation coefficient, Spearman's rank correlation, linear regression, probability rules, Venn diagrams, tree diagrams, conditional probability, binomial and normal distributions, and hypothesis testing using the chi-squared test and the t -test.
- **HL Additional Content:** More advanced probability distributions, including the Poisson distribution, combinations of random variables, confidence intervals, further hypothesis testing, non-linear regression, and more sophisticated statistical analysis and interpretation.

2.5 Topic 5: Calculus

- **SL Content:** Introduction to differentiation, interpretation of derivatives as rates of change and gradients, differentiation of polynomial functions, tangents to curves, local maxima and minima, optimization in practical contexts, introduction to integration, definite integrals, and applications to areas and accumulated change.

- **HL Additional Content:** Differentiation of exponential, logarithmic and trigonometric functions, product, quotient and chain rules, second derivatives, related rates, more advanced optimization, integration techniques, applications of definite integrals, differential equations, slope fields, and numerical methods including Euler's method.

3 Assessment Structure

Students are assessed through external examinations at the end of the two-year course and a compulsory internal assessment.

Unlike Mathematics: Analysis and Approaches, **all external examination papers in Mathematics: Applications and Interpretation require the use of technology.**

Students are expected to demonstrate mathematical understanding, apply appropriate methods, interpret results, and evaluate their answers in context.

3.1 Standard Level (SL) Assessment

Component	Format / Description	Duration	Weighting
Paper 1	Technology-required. Short-response questions.	90 mins	40%
Paper 2	Technology-required. Extended-response questions involving problem-solving and interpretation.	90 mins	40%
Internal Assessment	Mathematical Exploration (Individual coursework).	—	20%

Table 1: IB Math AI SL Assessment Structure

3.2 Higher Level (HL) Assessment

Component	Format / Description	Duration	Weighting
Paper 1	Technology-required. Short-response questions.	120 mins	30%
Paper 2	Technology-required. Extended-response questions involving problem-solving and interpretation.	120 mins	30%
Paper 3	Technology-required. Two extended problem-solving questions involving mathematical investigation and interpretation.	60 mins	20%
Internal Assessment	Mathematical Exploration (Individual coursework).	—	20%

Table 2: IB Math AI HL Assessment Structure

4 The Internal Assessment (Mathematical Exploration)

The Internal Assessment (IA) is an individual mathematical investigation in which students explore a topic of personal interest.

In Mathematics: Applications and Interpretation, students are encouraged to investigate real-world situations using mathematical models, statistical techniques, or other appropriate mathematical methods.

Possible areas of investigation include financial modelling, population growth, sports statistics, environmental data, transportation, business trends, and mathematical patterns.

The exploration should demonstrate mathematical understanding, effective communication, appropriate use of technology, and critical reflection on the results.

It is assessed against five criteria:

- A. Presentation:** Organization, coherence, and clarity of the mathematical exploration.
- B. Mathematical Communication:** Appropriate use of mathematical notation, symbols, terminology, graphs, tables, and diagrams.
- C. Personal Engagement:** Evidence of independent thinking, personal interest, creativity, and ownership of the investigation.
- D. Reflection:** Interpretation of results, evaluation of the mathematical model, consideration of assumptions and limitations, and reflection on the significance of the findings.
- E. Use of Mathematics:** Appropriate selection and application of mathematical techniques, mathematical accuracy, and demonstration of understanding at the relevant SL or HL level.



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