

IB Mathematics: Analysis and Approaches (AA)

Standard Level (SL) and Higher Level (HL)



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Complete Subject Brief & Syllabus Breakdown

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1 Introduction to Mathematics: Analysis and Approaches

The International Baccalaureate (IB) Diploma Programme Mathematics: Analysis and Approaches (AA) course is designed for students who enjoy developing their mathematics to a high level of analytical and formal thinking. The course places a strong emphasis on constructing, communicating, and justifying correct mathematical arguments.

It is highly recommended for students who wish to pursue university studies in mathematics, engineering, physical sciences, or economics. The course is offered at both **Standard Level (SL)** and **Higher Level (HL)**.

1.1 Key Features of the Course

- **Analytical Focus:** Emphasis on algebraic methods, mathematical rigor, and formal proof.
- **Technology Support:** Development of strong technology skills using Graphic Display Calculators (GDC), while maintaining a deep understanding of non-calculator analytical techniques.
- **Mathematical Exploration:** A compulsory internal assessment component allowing students to investigate an area of mathematics of their choice.

2 Core Syllabus Framework

The syllabus is divided into five core topics, which are shared between SL and HL, with HL students exploring topics in greater depth and covering additional advanced content.

2.1 Topic 1: Number and Algebra

- **SL Content:** Scientific notation, arithmetic and geometric sequences/series, sigma notation, financial applications (compound interest), laws of logarithms and exponents, binomial theorem.
- **HL Additional Content:** Permutations and combinations, extension of the binomial theorem to fractional and negative indices, partial fractions, complex numbers (Cartesian, polar, and Euler forms, De Moivre's theorem), systems of linear equations.

2.2 Topic 2: Functions

- **SL Content:** Concept of a function, domain, range, inverse and composite functions, graphing techniques, transformations of graphs, quadratic functions, reciprocal functions, exponential and logarithmic functions.
- **HL Additional Content:** Factor and remainder theorems, graphing rational functions, odd and even functions, self-inverse functions, solving inequalities, absolute value functions.

2.3 Topic 3: Geometry and Trigonometry

- **SL Content:** Right-angled and non-right-angled trigonometry (sine and cosine rules, area of a triangle), radian measure, arc length and sector area, trigonometric identities ($\sin^2 \theta + \cos^2 \theta = 1$, double angle formulas), trigonometric functions and transformations.
- **HL Additional Content:** Compound angle identities, reciprocal and inverse trigonometric functions, vector geometry (lines in 2D and 3D space, scalar and vector products, intersections of lines and planes).

2.4 Topic 4: Statistics and Probability

- **SL Content:** Sampling techniques, data presentation (histograms, box plots), measures of central tendency and dispersion, bivariate data (Pearson's product-moment correlation coefficient, linear regression), probability concepts, Venn diagrams, tree diagrams, discrete and continuous random variables, binomial and normal distributions.
- **HL Additional Content:** Bayes' theorem, expectation and variance equations, continuous random variable probability density functions, formal proofs using integration.

2.5 Topic 5: Calculus

- **SL Content:** Introduction to limits, differentiation from first principles, derivative rules (power, product, quotient, and chain rules), tangents and normals, local extrema and points of inflexion, optimization, indefinite and definite integration, fundamental theorem of calculus, kinematic applications.
- **HL Additional Content:** Continuity and differentiability, limits involving l'Hôpital's rule, implicit differentiation, related rates, integration by substitution and parts, volumes of revolution, solving first-order differential equations (variables separable and integrating factor methods), Maclaurin series.

3 Assessment Structure

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

3.1 Standard Level (SL) Assessment

Component	Format / Description	Duration	Weighting
Paper 1	Technology-free (Short & extended response)	90 mins	40%
Paper 2	Technology-required (Short & extended response)	90 mins	40%
Internal Assessment	Mathematical Exploration (Individual coursework)	—	20%

Table 1: IB Math AA SL Assessment Structure

Component	Format / Description	Duration	Weighting
Paper 1	Technology-free (Short & extended response)	120 mins	30%
Paper 2	Technology-required (Short & extended response)	120 mins	30%
Paper 3	Problem-solving/In-depth investigation	60 mins	20%
Internal Assessment	Mathematical Exploration (Individual coursework)	—	20%

Table 2: IB Math AA HL Assessment Structure

3.2 Higher Level (HL) Assessment

4 The Internal Assessment (Mathematical Exploration)

The Internal Assessment (IA) is a short report written by the student based on an investigation of any area of mathematics that interests them. It is assessed against five criteria:

- A. Presentation:** Organization, coherence, and clarity of the report.
- B. Mathematical Communication:** Appropriate use of notation, symbols, terminology, and graphs.
- C. Personal Engagement:** Evidence of independent thinking, creativity, and critical reflection.
- D. Reflection:** Evaluation of the meaningfulness and limitations of the mathematical approach.
- E. Use of Mathematics:** Accuracy and depth of the mathematical knowledge and techniques applied.



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