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International Baccalaureate Diploma Programme

Mathematics: Applications and Interpretation

Course description

Mathematics: Applications and interpretation Standard level (SL) and Higher level (HL) is appropriate for students who are interested in developing their mathematics for describing our world and solving practical problems. They will also be interested in harnessing the power of technology alongside exploring mathematical models. Students who take Mathematics: Applications and interpretation will be those who enjoy mathematics best when seen in a practical context. This subject is aimed at students who will go on to study subjects such as social sciences, natural sciences, statistics, business, some economics, psychology, and design, for example.

Mathematics: Applications and interpretation emphasises the applied nature of the subject, and also that interpretation of results in context is an important element of the subject. The SL content is a complete subset of the HL content.

AIMS

The aims of the Application and Interpretation course are to enable students to:

1. develop a curiosity and enjoyment of mathematics, and appreciate its elegance and power
2. develop an understanding of the concepts, principles and nature of mathematics
3. communicate mathematics clearly, concisely and confidently in a variety of contexts
4. develop logical and creative thinking, and patience and persistence in problem solving to instil confidence in using mathematics
5. employ and refine their powers of abstraction and generalization
6. take action to apply and transfer skills to alternative situations, to other areas of knowledge and to future developments in their local and global communities
7. appreciate how developments in technology and mathematics influence each other
8. appreciate the moral, social and ethical questions arising from the work of mathematicians and the applications of mathematics
9. appreciate the universality of mathematics and its multicultural, international and historical perspectives
10. appreciate the contribution of mathematics to other disciplines, and as a particular “area of knowledge” in the TOK course
11. develop the ability to reflect critically upon their own work and the work of others
12. independently and collaboratively extend their understanding of mathematics.

TOPICS

Topic	Standard level content	Higher level content
Topic 1 – Number and algebra	scientific notation, arithmetic and geometric sequences and series and their applications in finance including loan repayments, simple treatment of logarithms and exponentials, simple proof, approximations and errors.	laws of logarithms, complex numbers and their practical applications, matrices and their applications for solving systems of equations, for geometric transformations, and their applications to probability
Topic 2 – Functions	creating, fitting and using models with linear, exponential, natural logarithm, cubic and simple trigonometric functions	use of log-log graphs, graph transformations, creating, fitting and using models with further trigonometric, logarithmic, rational, logistic and piecewise functions
Topic 3 – Geometry and trigonometry	volume and surface area of 3d solids, rightangled and non-right-angled trigonometry including bearings, surface area and volume of composite 3d solids, establishing optimum positions and paths using Voronoi diagrams	vector concepts and their applications in kinematics, applications of adjacency matrices, and tree and cycle algorithms
Topic 4 – Statistics and probability	collecting data and using sampling techniques, presenting data in graphical form, measures of central tendency and spread, correlation using Pearson’s product-moment and Spearman’s rank correlation coefficients, regression, calculating probabilities, probability diagrams, the normal distribution, Chi-squared test for independence and goodness of fit	the binomial and Poisson distributions, designing data collection methods, tests for reliability and validity, hypothesis testing and confidence intervals
Topic 5 – Calculus	differentiation including analysing graphical behavior of functions and optimisation, using simple integration and the trapezium/trapezoidal rule to calculate areas of irregular shapes	kinematics and practical problems involving rates of change, volumes of revolution, setting up and solving models involving differential equations using numerical and analytic methods, slope fields, coupled and second-order differential equations in context

The “toolkit” and Mathematical exploration - Investigative, problem-solving and modelling skills development leading to an individual exploration. The exploration is a piece of written work that involves investigating an area of mathematics.

ASSESSMENT

The assessment objectives:

Problem solving is central to learning mathematics and involves the acquisition of mathematical skills and concepts in a wide range of situations, including non-routine, open-ended and real-world problems. Having followed a DP mathematics course, students will be expected to demonstrate the following:

1. Knowledge and understanding: Recall, select and use their knowledge of mathematical facts, concepts and techniques in a variety of familiar and unfamiliar contexts.
2. Problem solving: Recall, select and use their knowledge of mathematical skills, results and models in both abstract and real-world contexts to solve problems.
3. Communication and interpretation: Transform common realistic contexts into mathematics; comment on the context; sketch or draw mathematical diagrams, graphs or constructions both on paper and using technology; record methods, solutions and conclusions using standardized notation; use appropriate notation and terminology.
4. Technology: Use technology accurately, appropriately and efficiently both to explore new ideas and to solve problems.
5. Reasoning: Construct mathematical arguments through use of precise statements, logical deduction and inference and by the manipulation of mathematical expressions.
6. Inquiry approaches: Investigate unfamiliar situations, both abstract and from the real world, involving organizing and analyzing information, making conjectures, drawing conclusions, and testing their validity.

Types of assessment:

A – External assessment

Standard level	Format of assessment	Time (minutes)	Total marks	Weighing of final grade (%)
Paper 1	Technology required. Compulsory short-response questions based on the syllabus.	90	80	40
Paper 2	Technology required. Compulsory short-response questions based on the syllabus.	90	80	40

Higher level	Format of assessment	Time (minutes)	Total marks	Weighing of final grade (%)
Paper 1	Technology required. Compulsory short-response questions based on the syllabus.	120	110	30
Paper 2	Technology required. Compulsory short-response questions based on the syllabus.	120	110	30
Paper 3	Technology required. Two compulsory extended response problem-solving questions.	60	55	20

B – Internal assessment

Standard level Higher Level	Format of assessment	Time (hours)	Total marks	Weighing of final grade (%)
Mathematical Exploration	Internal assessment in mathematics is an individual exploration. This is a piece of written work, approximately 12-20 pages long, that involves investigating an area of mathematics.	10 - 15	20	20

The exploration is an integral part of the course and its assessment, and is compulsory for both SL and HL students. It enables students to demonstrate the application of their skills and knowledge and to pursue their personal interests, without the time limitations and other constraints that are associated with written examinations.

This component is internally assessed by the teacher and externally moderated by the IB at the end of the course.

CACULATOR:

Graphic display calculator - Casio fx-CG50

TEXTBOOKS

Oxford IB Diploma Programme: IB Mathematics: applications and interpretation, Standard Level; OUP 2019

Oxford IB Diploma Programme: IB Mathematics: applications and interpretation, Higher Level; OUP 2019

(Authors: Jane Forrest, Paula Waldman, Jennifer Chang Wathall, Suzanne Doering, David Harris, Nadia Stoyanova Kennedy)

Adapted from:

Mathematics: applications and interpretation guide, First assessment 2021

DP Mathematics, Curriculum review, Summary report to teachers, April 2017

<https://meritclass.com/wp-content/uploads/2020/05/The-Maths-new-Curriculum-Overview-1.pdf>

International Baccalaureate, Diploma Programme Subject Brief, Mathematics: applications and interpretation, First assessments for SL and HL—2021

<https://www.ibo.org/contentassets/5895a05412144fe890312bad52b17044/subject-brief-dp-math-applications-and-interpretations-en.pdf>