IB mathematics higher level subject brief

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The IB Diploma Programme, for students aged 16 to 19, is an academically challenging and balanced programme of education that prepares students for success at university and life beyond. Students take courses in six different subject groups, maintaining both breadth and depth of study. Mathematics higher level is in group 5, mathematics and computer sciences. In addition, three core elements—the extended essay, theory of knowledge and creativity, action, service—are compulsory and central to the philosophy of the programme.

About the IB: For over 40 years the IB has built a reputation for high-quality, challenging programmes of education that develop internationally minded young people who are well prepared for the challenges of life in the 21st century and able to contribute to creating a better, more peaceful world.

The IB subject briefs illustrate key course components in the IB Diploma Programme.

Overview of the mathematics higher level course and curriculum model

I. Course description and aims

The IB Diploma Programme mathematics higher level course is for students with a strong background in mathematics and competence in a range of analytical and technical skills. Students will be likely to include mathematics as a major component of university studies—either in its own right or within courses such as physics, engineering or technology. The course focuses on developing important mathematical concepts in a comprehensive, coherent and rigorous way through a balanced approach.

Students are encouraged to apply their mathematical knowledge to solve problems set in a variety of meaningful contexts and to justify and prove results. Students develop insights into mathematical form and structure and become intellectually equipped to appreciate the links between concepts in different topic areas. They will also be urged to develop the skills needed to continue their mathematical growth in other learning environments. In addition, the course will enable students to:

- appreciate the multicultural and historical perspectives of all group 5 courses
- enjoy the courses and develop an appreciation of the elegance, power and usefulness of the subjects
- develop logical, critical and creative thinking
- develop an understanding of the principles and nature of the subject
- employ and refine their powers of abstraction and generalization
- develop patience and persistence in problem-solving
- appreciate the consequences arising from technological developments
- transfer skills to alternative situations and to future developments
- communicate clearly and confidently in a variety of contexts
- appreciate the multiplicity of cultural and historical perspectives of mathematics, including the international dimension of mathematics.

II. Curriculum model overview

Mathematics higher level

Core	190 hours of instruction on seven topics • Algebra • Functions and equations • Circular functions and trigonometry • Matrices • Vectors • Statistics and probability • Calculus	190 hours
Options	40 hours in one of the following topics • Statistics and probability • Sets, relations and groups • Series and differential equations • Discrete mathematics	40 hours
Portfolio	Two individual pieces of work based on mathematical investigation and mathematical modelling	10 hours
Total teaching hours		**240 hours**

III. Assessment model

Assessment for mathematics higher level

The IB assesses student work as direct evidence of achievement against the stated goals of the Diploma Programme courses, which are to provide students with:

- a broad and balanced, yet academically demanding, programme of study
- the development of critical-thinking and reflective skills
- the development of research skills
- the development of independent learning skills
- the development of intercultural understanding
- a globally recognized university entrance qualification.

Assessment for mathematics higher level (continued)

The assessments aim to test all students' knowledge and understanding of key concepts through various activities that demonstrate their ability to:

- read, interpret and solve a given problem using appropriate mathematical terms
- organize and present information and data in tabular, graphical and/or diagrammatic forms
- know and use appropriate notation and terminology
- formulate a mathematical argument and communicate it clearly
- select and use appropriate mathematical strategies and techniques
- demonstrate an understanding of both the significance and the reasonableness of results
- recognize patterns and structures in a variety of situations, and make generalizations
- recognize and demonstrate an understanding of the practical applications of mathematics
- use appropriate technological devices as mathematical tools
- demonstrate an understanding of and the appropriate use of mathematical modelling.

Students' success in the mathematics higher level course is measured by combining their grades on external and internal assessment.

The internal assessment is of each student's portfolio, which consists of two pieces of work demonstrating ability in mathematical investigation, to highlight that investigation is fundamental to the study of mathematics; and mathematical modelling, to translate a real-world problem into mathematics.

Assessment at a glance

Type of assessment	Format of assessment	Time (hours)	Weighting of final grade (%)
External			**80**
Paper 1	Short- and extended-response questions (no calculator allowed)	2	30
Paper 2	Short- and extended-response questions (with graphic display calculator required)	2	30
Paper 3	Extended-response questions based on syllabus options(with graphic display calculator required)	1	20
Internal			**20**
Portfolio	Two pieces of work on different areas of the syllabus representing mathematical investigation and mathematical modelling.		

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IV. Sample questions

The following questions appeared in previous IB Diploma Programme mathematics higher level examinations.*

1. A room has nine desks arranged in three rows of three desks. Three students sit in the room. If the students randomly choose a desk find the probability that two out of the front three desks are chosen.
(Paper 1)

2. Let $f(x) = \frac{x+4}{x+1}$, $x \neq -1$ and $g(x) = \frac{x-2}{x-4}$, $x \neq 4$.

Find the set of values of x such that $f(x) \leq g(x)$. (Paper 2)

3. Calculate $\lim_{x \to 0} \left(\frac{1}{x} - \frac{1}{\sin x} \right)$.

(Paper 3)

* The syllabus for examinations current until 2014

Learn more about how the IB Diploma Programme prepares students for success at university by going online to www.ibo.org/universities or email us at recognition@ibo.org.