International Baccalaureate Diploma Programme Subject Brief

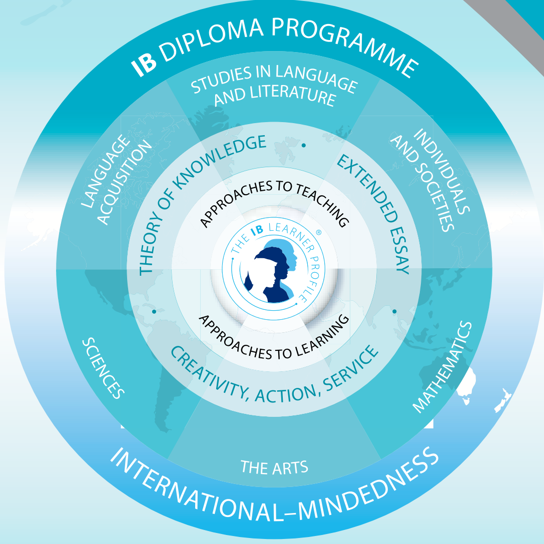
Mathematics:

Further mathematics – Higher level

First assessments 2014 – Last assessments 2020

The IB Diploma Programme (DP) is a rigorous, academically challenging and balanced programme of education designed to prepare students aged 16 to 19 for success at university and life beyond. The DP aims to encourage students to be knowledgeable, inquiring, caring and compassionate, and to develop intercultural understanding, open-mindedness and the attitudes necessary to respect and evaluate a range of viewpoints.

To ensure both breadth and depth of knowledge and understanding, students must choose at least one subject from five groups: 1) their best language, 2) additional language(s), 3) social sciences, 4) experimental sciences, and 5) mathematics. Students may choose either an arts subject from group 6, or a second subject from groups 1 to 5. At least three and not more than four subjects are taken at higher level (240 recommended teaching hours), while the remaining are taken at standard level (150 recommended teaching hours). 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.



These IB DP subject briefs illustrate four key course components.

I. Course description and aims

II. Curriculum model overview

III. Assessment model

IV. Sample questions

I. Course description and aims

The IB DP further mathematics higher level (HL) course caters for students with a very strong background in mathematics who have attained a high degree of competence in a range of analytical and technical skills, and who display considerable interest in the subject. Most of these students will expect to study mathematics at university, either as a subject in its own right or as a major component of a related subject. The course is designed specifically to allow students to learn about a variety of branches of mathematics in depth and also to appreciate practical applications. It is expected that students taking this course will also be taking mathematics HL.

The nature of the subject is such that it focuses on different branches of mathematics to encourage students to appreciate the diversity of the subject. Students should be equipped at this stage in their mathematical progress to begin to form an overview of the characteristics that are common to all mathematical thinking, independent of topic or branch.

The aims of all mathematics courses in group 5 are to enable students to:

- enjoy mathematics, and develop an appreciation of the elegance and power of mathematics
- develop an understanding of the principles and nature of mathematics
- communicate clearly and confidently in a variety of contexts
- develop logical, critical and creative thinking, and patience and persistence in problem-solving
- employ and refine their powers of abstraction and generalization
- apply and transfer skills to alternative situations, to other areas of knowledge and to future developments
- appreciate how developments in technology and mathematics have influenced each other
- appreciate the moral, social and ethical implications arising from the work of mathematicians and the applications of mathematics
- appreciate the international dimension in mathematics through an awareness of the universality of mathematics and its multicultural and historical perspectives
- appreciate the contribution of mathematics to other disciplines, and as a particular "area of knowledge" in the TOK course.

II. Curriculum model overview

Component	Recommended teaching hours
Topic 1 Linear algebra	48
Topic 2 Geometry	48
Topic 3 Statistics and probability	48
Topic 4 Sets, relations and groups	48

Topic 5 Calculus	48
Topic 6 Discrete mathematics	48

Note: One of topics 3–6 will be assumed to have been taught as part of the mathematics HL course and therefore the total teaching hours will be 240 not 288.

III. Assessment model

Having followed the further mathematics HL course, students will be expected to demonstrate the following.

- Knowledge and understanding: recall, select and use their knowledge of mathematical facts, concepts and techniques in a variety of familiar and unfamiliar contexts.
- Problem-solving: recall, select and use their knowledge of mathematical skills, results and models in both real and abstract contexts to solve problems.
- 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.
- Technology: use technology, accurately, appropriately and efficiently both to explore new ideas and to solve problems.
- Reasoning: construct mathematical arguments through use of precise statements, logical deduction and inference, and by the manipulation of mathematical expressions.
- Inquiry approaches: investigate unfamiliar situations, both abstract and real-world, involving organizing and analysing information, making conjectures, drawing conclusions and testing their validity.

Assessment at a glance

Type of assessment	Format of assessment	Time (hours)	Weighting of final grade (%)
External		5	
Paper 1 (graphical display calculator required)	Compulsory short- to medium-response questions based on the whole syllabus.	2.5.	50
Paper 2 (graphical display calculator required)	Compulsory medium- to extended-response questions based on the whole syllabus.	2.5	50

IV. Sample questions

- The group {G,+} is defined by the operation of addition on the set G={2n|nεZ}.
  The group {H, +} is defined by the operation of addition on the set H = {4n|nεZ}.
  Prove that {G, +} and {H, +} are isomorphic.

- The positive integer N is represented by 4064 in base b and 2612 in base b +1.
  Determine the value of b.
  Find the representation of N
  i. in base 10;
  ii. in base 12.