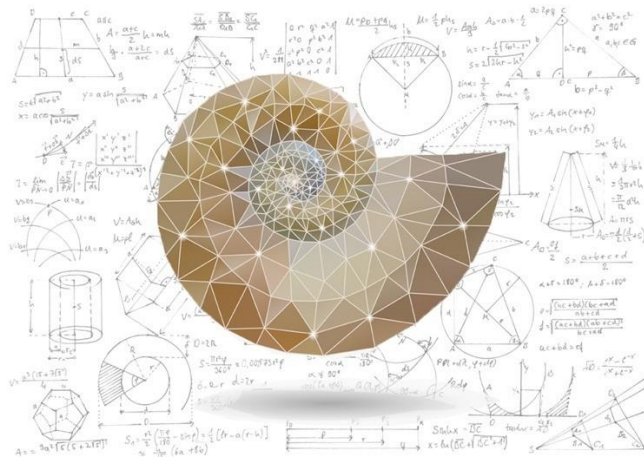


IB MATHEMATICS HL

COURSE DESCRIPTION



From <https://www.quora.com/Why-do-you-love-maths-intensely>

“Pure mathematics is, in its way, the poetry of logical ideas” , Albert Einstein

What is the course about?

Mathematics is a compulsory subject for all IB diploma students. Learning it is an excellent way to develop logical thinking and also patience and persistence in problem solving. For many of us it is a tool to solve problems from every-day life and for some it extends into their chosen profession. However, because of different needs, abilities and interests of students BISC offers three different courses to choose:

Mathematics HL

Mathematics SL

Mathematical Studies SL.

Mathematical HL is a course designed for students with strong mathematical background who want to study mathematics in depth because of their interest in the subject itself or in areas related to it such as physics, engineering or technology. Students will have opportunity to encounter advanced concepts and solve challenging problems where they will be able to use and extend their analytical and technical skills.

The syllabus consist of six core topics:

- Algebra (including complex numbers)
- Functions and Equations (polynomial, rational, exponential, logarithmic)
- Circular Functions and Trigonometry (including graphs, equations, trig identities)
- Vectors (including vector geometry in 3 dimensions)
- Statistics and Probability (with focus on discrete and continuous probability distributions)
- Calculus (differential and integral calculus)

Additionally an Option topic of Calculus will be studied, covering for example limits of sequences, testing convergence of series, Taylor and Maclaurin series expansions, the Fundamental Theorem of Calculus, solving differential equations. All the topics, core and option, are compulsory for all the students.

All students will have a chance to further explore the area of mathematics of their own interest as well, as they will be required to write their Exploration Paper as a part of the IB assessment (Internal Assessment).

How is the course structured?

Topics will be sequenced in an order which provides the best preparation for students, not necessarily in the order in which they appear in the syllabus. During the first term of the first year similar topics in all three levels (Mathematical Studies, Mathematics SL, Mathematics HL) will be covered to give students a chance for a smooth transfer in case they want to change a level of mathematics. Due to the vast range of topics to be studied in Mathematics HL course, revision might be possible during study leave time before final exams in May. Students will start their research for the Internal Assessment during the first year (in IB1) with the final version to be submitted around December/January of the second year of the IB Diploma Programme.

What distinguishes this course from other mathematical courses?

Great care should be taken to select a mathematical course that is most appropriate for an individual student. The choice depends on their own abilities in mathematics, their own interest in mathematics and those particular areas of the subject that may hold the most interest, their academic plans, in particular the subjects they wish to study in future, their other choices of subjects within the framework of the Diploma Programme.

Comparison between mathematical courses available in BISC

Mathematical Studies SL	Mathematics SL	Mathematics HL
For students with varied mathematical background and abilities.	For students who already possess knowledge of basic mathematical concepts, and who are equipped with the skills needed to apply simple mathematical techniques correctly.	For students with a very good background in mathematics who are competent in a range of analytical and technical skills.
For students who prepare for future studies in social sciences, humanities, languages or arts.	For students who prepare for future studies in subjects such as chemistry, economics, psychology and business administration.	For students who prepare for future studies in mathematics, physics, engineering or technology.
Not recommended for students taking Physics HL or Chemistry HL.	Suitable for students taking Physics HL or Chemistry HL.	Suitable for students taking Physics HL or Chemistry HL
An inquiry-based approach of learning is mostly used.	A development of mathematical techniques and skills however without a mathematical rigour.	Developing important mathematical concepts in a comprehensible, coherent and rigorous way.
For both examination papers, students must have access to a Graphic Display Calculator at all times.	Students are not permitted access to any calculator for one of written exam papers.	Students are not permitted access to any calculator for one of written exam papers.

How is the course assessed?

Regular homework, written tests after every chapter and short quizzes are parts of the formative assessment of a student's progress and encourage them to work systematically. Test and quiz results will be given as a percentage of total marks and as a grade from 1 to 7.

The End of Year Exam at the end of the first year of the course will be structured in a way similar to a real exam and marked using the same criteria to give students an opportunity to know their level and decide about them being promoted to IB2. Students will be given Paper 1 and Paper 2 containing topics of core syllabus studied in the first year.

Final written exam consists of three written papers based on all topics from the syllabus. Paper 1 (no calculator) and Paper 2 (Graphic Display Calculator required) consist of Section A with short questions and Section B with compound questions, each Paper worth 30% of the final mark. Paper 3 (Graphic Display Calculator required) consists of 5 or 6 questions from the Option syllabus and is worth 20% of the final mark. In addition each student has to write Internal Assessment paper: Mathematical Exploration – a component assessed at school and moderated by an external examiner, worth 20% of the final mark. It is a written report of up to 12 pages on a topic explored by a student in the area of their mathematical interest. The focus is on correct and rigorous mathematics comparable to the level of the course, coherent and concise communication, correct mathematical terminology and thorough reflection. A set of criteria and example papers will be provided and analyzed before students write their own paper.

Are there any requirements?

In order to qualify for the course a student needs to fulfil one of the conditions below:

- Receive grade A* in IGCSE Mathematics 0580 or equivalent
- Pass the Entrance Test for IB Maths HL with the score of over 85%

Students participating in the Induction Week receive a packet with the following documents:

- Background Knowledge booklets as pdf files
- Prior learning documents: lists of topics of the required background knowledge
- Topics that are included in the Entrance Test

In case of not participating in the Induction Week students should request the relevant information from the IB coordinator or the maths teacher at a.tokarz@bisc.krakow.pl

The equipment required for the Entrance Test: pen, pencil, ruler, scientific calculator. The exam will last 1hour 30 minutes. It is possible to retake the exam once.

What materials will I need?

Students will be provided with textbooks and A4 format notebooks. Textbooks will have to be returned to the school library at the end of the 2-years' course. Students should buy their own folders and binders in order to keep all the additional materials well-organized for study and revision.

It is very important that **each student buys their own Graphic Display Calculator, model Texas Instruments TI-84 Plus (Silver Edition/CE)**. It will be possible that the school places the order for the calculator as well.



Do not buy any different model of a calculator without consultation with your teacher!. They are expensive and not all graphical calculators are allowed for IB diploma courses. It is important for all the students in the class to have one of above Texas Instruments calculators.

What will I learn?

In Mathematics HL course students will develop an understanding of principles and nature of mathematics through in-depth study of new concepts from various branches of mathematics, from algebra, through geometry and statistics to calculus. When applying concepts in solving problems, students will develop their logical, critical and creative thinking along with patience and persistence. The newly acquired skills will be applied in unfamiliar situations with help of abstraction and generalization techniques. Students will learn how to communicate their ideas in a clear and concise way and appreciate ideas different from their own. The work will be supported by appropriate use of technology, graphic display calculator or computer software. We hope that this whole “journey” will be enjoyable and will give students a chance to experience the power and elegance of mathematics.

In what ways does the Mathematics syllabus promote the attributes of the IB learner profile?

In the course of study students will be developing the attributes of the IB learner profile.

<p>Open-minded Working in and international environment students will confront, compare and learn to appreciate different cultures, perspectives and points of view in a wide range of situations, from understanding and accepting various ways of mathematical presentation up to other cultures and personalities.</p>	<p>Knowledgeable Students will study many advanced mathematical concepts and practice skills which can be applied in a range of scientific disciplines. They will recall and select appropriate knowledge of facts, concepts and techniques and use them in various familiar and unfamiliar contexts.</p>	
<p>Thinkers Students will exercise their critical, analytical, reasoning and creative thinking skills when solving complex mathematical problems. They will construct mathematical arguments paying attention to precision and following rules of logic.</p>	<p>Balanced In view of heavy workload students will practice making right choices in order to keep their intellectual, physical and emotional balance.</p>	<p>Reflective Students will reflect on their learning strategies in order to understand their strengths and limitations. That awareness will support their learning and personal development.</p>

<p>Principled Students will practice academic integrity and honesty in the process of writing Exploration paper, where they will credit to authors of sources used in the research. In the process of learning they will take responsibility for their actions and the consequences to follow.</p>	<p>Inquirers Internal Assessment component is where students will develop their curiosity while exploring mathematical concepts and applications and show independence in their learning when writing a report paper. In the process of research as well as during lessons they will investigate unfamiliar situations in abstract and real-life situations, organize and analyze information, make conjectures, draw conclusions and test their validity.</p>	
<p>Communicators Students will collaborate on daily basis when sharing and discussing their ideas in a clear and organized way due to complexity of discussed topics. When writing their Exploration paper they will develop a skill of concise and coherent communication.</p>	<p>Risk-takers By taking the course of Mathematics HL students will have plenty of opportunity to approach unfamiliar and challenging situations with courage and independence.</p>	<p>Caring When collaborating with others, students will work on developing empathy and respect towards the needs and feeling of others.</p>

How can Mathematics be an inspiration for an extended essay question?

Writing extended essay in mathematics provides students with opportunity to demonstrate appreciation to some aspects of mathematics. For example,

- The applicability of mathematics to solve abstract or real life problems
- The beauty of mathematics e.g. in geometry
- The elegance of mathematics in proving theorems
- The links between different branches of mathematics
- The origin and development of a branch of mathematics

Can an interest in Mathematics lead to a CAS project?

Yes, it can. Here are examples of possible CAS projects involving Mathematics:

- assisting a sports club or team with pre- and post-fitness assessment statistical analysis
- hosting a series of mathematics events for parents and the community to build an appreciation for mathematics
- creating a video series of “mathematics adventures” for younger children
- designing and painting a mural celebrating mathematics through the ages
- planning and running a “mathematics scavenger hunt” for younger students.

What is the relationship between Theory of Knowledge (TOK) and Mathematics HL?

In TOK classes students will be looking for answers to questions like:

- What does it mean to know something?
- Where does the knowledge come from?
- How much can the knowledge be trusted?
- Why are logic and reasoning important?

Mathematics will be one of the areas of knowledge that student will look into, when considering possible answers. How can Mathematics HL lessons be helpful? Here are a few examples:

- deductive reasoning – use of definitions, axioms and theorems to prove relations between mathematical objects (Questions starting with: “Show that...”);
- inductive reasoning – proof by mathematical induction (PMI) ;
- making conjectures and either proving them or providing counterexamples.

Where can I find more information about the course?

You can download the Mathematics HL subject guide for more information. Please also feel free to email the Mathematics HL teacher, Anna Tokarz, at a.tokarz@bisc.krakow.pl.

Bibliography

Mathematics HL guide. First examinations 2014. Published June 2012.

Website: www.ibo.org