

Diploma Programme subject outline—Group 5: mathematics

School name	The International School in Genoa	School code	001380
Name of the DP subject	Mathematics: Analysis and Approaches (in English)		
Level	Higher <input checked="" type="checkbox"/>	Standard completed in two years <input checked="" type="checkbox"/>	Standard completed in one year * <input type="checkbox"/>
Name of the teacher(s) who updated this outline	Dalia CHALLITA		
Date when outline was last updated	September 2022		

* All Diploma Programme courses are designed as two-year learning experiences. However, up to two standard level subjects, excluding languages ab initio and pilot subjects, can be completed in one year, according to conditions established in the *Handbook of procedures for the Diploma Programme*.

1. Course outline

This is an outline showing how the topics are distributed over time to ensure that students are prepared to comply with the requirements of the course.

	Topic/unit (as identified in the IB subject guide) <i>Topics/units are listed in the order taught.</i>	Contents	Allocated time		Assessment instruments used	Resources <i>Main resources used, including information technology if applicable.</i>
			One class is <input type="text" value="60"/> minutes.	In one week there are <input type="text" value="4"/> classes.		
Year 1	Number, Algebra and Functions Basics HL, SL	Composite, inverse, range, domain	3 weeks (12 hours)		Formative: Classroom observation, Kognity assignments and self-quizzes, textbook and	TI-nspire classroom activities, Desmos classroom activities, Kognity, past IB questions
	Functions HL, SL	Quadratic, rational, factor and remainder theorems	4 weeks (16 hours)			

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		One class is 60 minutes. In one week there are 4 classes.			
Sequences and Series HL, SL	Infinite sums, Sigma notation, binomial theorem	4 weeks (16 hours)	exam-style questions (self-assessed against answer key), open-book past IB questions. Summative: end-of-unit tests based on past IB papers.	from IB question bank.	
Exponential and Logarithmic Functions HL, SL	Sketching graphs, relevance in the real world, meaning of e	3 weeks (12 hours)			
Trigonometric Functions and Equations HL, SL	Radians, unit circle, graphs, inverse, identities	4 weeks (16 hours)			
Geometry and Trigonometry HL, SL	3D space, trigonometric rules, volume, surface area	2 weeks (8 hours)			
Complex Numbers (HL only)	Cartesian plane, conjugates, polar form, roots	3 weeks (12 hours)			
Vectors, Lines and Planes (HL only)	Scalar and cross product, understanding in 3D space	4 weeks (16 hours)			
Year 2	Statistics 1 and Probability HL, SL	Descriptive statistics, measures of location and spread, linear regression, simple and compound events, conditional probability, density functions	4 weeks (16 hours)	Formative: Classroom observation, Kognity assignments and self-quizzes, textbook and exam-style questions (self-assessed against answer key), open-book past IB questions. Summative: end-of-unit tests based on past IB papers.	TI-nspire classroom activities, Desmos classroom activities, Kognity, past IB questions from IB question bank.
	Additional topics in probability (HL only)	Counting principle, Bayes' theorem	2 weeks (8 hours)		
	Differential Calculus HL, SL	Limits, Gradient, algebra of derivatives, maxima and minima, tangents and normals, chain, product and quotient rule, optimization, related rates, l'Hopital's rule	10 weeks (40 hours)		
	Differential Equations (HL)	Separable, homogenous and linear	2 weeks (8 hours)		

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		One class is 60 minutes. In one week there are 4 classes.		
only)	differential equations, numerical methods, Maclaurin and Taylor expansions			
Integral Calculus HL, SL	Antidifferentiation, Riemann integrals, methods of integration, areas, volumes of revolution, kinematics	4 weeks (16 hours)		
Proofs (HL only)	Logical proofs, proof by mathematical induction	1 week (4 hours)		
Statistics 2 HL, SL	Discrete and continuous random variables, binomial and normal distribution, algebra of expected values	4 weeks (16 hours)		

2. IB internal assessment requirement to be completed during the course

How and when IB internal and external assessment requirements are worked on, including a timeline of when the requirements are first introduced, when they are due, and how students are prepared to complete them.

IA is first introduced towards the end of DP Year 1. Students are encouraged to complete some work over the summer.
Some class time is dedicated at the beginning of DP Year 2.
First Draft is due October - DP2
Final is due December - DP2.

3. Links to TOK

A sample topic from this course outline that allows students to make links with TOK, with a description of the lesson plan.

Topic	Link with TOK (including description of lesson plan)
A Peak into the History on Non-Euclidean Geometry (lesson plan borrowed from Peter McCombe)	<p>Description: Students watch each of the following videos and answer the questions below (there are 5 videos in total in the lesson plan, and some wrap-up questions). Here are examples:</p> <p>Video 1: https://www.youtube.com/watch?v=nkvVR-sKJT8</p> <p>What did Pythagoras do in Magna Grecia? What does the word postulate mean? (Research not in video) What is the fifth postulate?</p> <p>Video 2: https://www.youtube.com/watch?v=vUWKMo5scKY</p> <p>How long did people try to prove postulate 5? What did Omar Khayyan add to number theory and why was it important? How would the quadratic be different if the equation was $x^2 + 10x = 56$? Who brought the elements back to Europe?</p>

4. Approaches to learning

A sample topic from this course outline that allows students to specifically develop one or more of the approaches to learning skill categories (thinking, communication, social, self-management or research).

Topic	Contribution to the development of students' approaches to learning skills (including one or more skill category)
Optimization	<p>Research</p> <p>After learning that the cube is the optimal geometric shape in terms of (for example) saving cardboard in packaging, students research how packaging is actually done, and whether the optimal shape price-wise is always the chosen one.</p>

Topic	Contribution to the development of students' approaches to learning skills (including one or more skill category)
	In fact, they discover it is very often not the chosen one, in which case they research why this particular modal is then chosen, and how marketing plays a role.

5. International mindedness

A sample topic from this course outline that allows students to analyse international-mindedness from different cultural perspectives, including the reasons for this choice and resources that are used to achieve this goal.

Topic	Contribution to the development of international mindedness (including resources used)
Exponential Functions	In a graphing activity students are given different sets of population data for different countries, without knowing the name of the country. They need to guess what country each set of data belongs to based on trends they notice in the data and historical events that may have caused these trends.

6. Development of the IB learner profile

A sample topic from this course outline with an explanation of how the contents and related skills pursue the development of the identified attribute(s) of the IB learner profile.

Topic	Contribution to the development of the attribute(s) of the IB learner profile
All topics	<p>Communicators</p> <p>A "Polygraph" activity on Desmos Classroom Activities is a partnered guessing game, designed to teach students the power of using correct mathematical definitions and terminology, and develop informal language into formal vocabulary. Each round, players are matched into pairs. There is one picker (of an object that needs to be guessed, using correct mathematical terminology) and one guesser.</p> <p>More generally, these activities teach the power of communicating with precise ideas and expressions, so that the words we use cannot be interpreted in an ambiguous way.</p>

7. Resources

A description of the instructional materials and other resources used to support the aims and methods of this course.

Resources listed throughout the syllabus:

- TI Nspire CX graphing display calculator (each student responsible for having his/her own)
- TI nspire classroom activities (website)
- Pearson SL Mathematics Approaches and Analysis for the IB Diploma
- Kognity online textbook
- Desmos classroom activities and graphing calculator
- Khan Academy
- Video resources from Revision Village IB Mathematics
- IB Questions Bank