IB Math AA 12 HL
Course Outline

2021 ~ 22
Mr. Lee
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1. Course: IB Mathematics Analysis and Approaches 12

Prerequisite: IB Mathematics Analysis and Approaches 11

This course recognizes the need for analytical expertise in a world where innovation is increasingly dependent on a deep understanding of mathematics. This course includes topics that are both traditionally part of a pre-university mathematics course (for example, functions, trigonometry, calculus) as well as topics that are amenable to investigation, conjecture and proof, for instance the study of sequences and series at both SL and HL, and proof by induction at HL.

The course allows the use of technology, as fluency in relevant mathematical software and hand-held technology is important regardless of choice of course. However, Mathematics: analysis and approaches has a strong emphasis on the ability to construct, communicate and justify correct mathematical arguments.

Students who choose Mathematics: analysis and approaches at SL or HL should be comfortable in the manipulation of algebraic expressions and enjoy the recognition of patterns and understand the mathematical generalization of these patterns. Students who wish to take Mathematics: analysis and approaches at higher level will have strong algebraic skills and the ability to understand simple proof. They will be students who enjoy spending time with problems and get pleasure and satisfaction from solving challenging problems.

It is expected that most students embarking on a DP mathematics course will have studied mathematics for at least 10 years. There will be a great variety of topics studied, and differing approaches to teaching and learning. Thus, students will have a wide variety of skills and knowledge when they start their mathematics course. Most will have some background in arithmetic, algebra, geometry, trigonometry, probability and statistics. Some will be familiar with an inquiry approach, and may have had an opportunity to complete an extended piece of work in mathematics.

- Course duration: Term 1 and 2, 2021 ~ 2022
- Teacher Name: Mr. Lee
- Email: lee_jun@surreyschools.ca
- Classroom/Office: Room 112
- Phone: 604-536-2131 (Ext: 2114)
- Tutorial sessions: By appointment
- Parent interview: By appointment
- Textbook: Both soft (on Teams) and hard copies are available for students
    - Cambridge – Mathematics Higher Level for the IB Diploma (Old)
    - Hodder Education – Mathematics Analysis and Approaches HL (New)

2. Aim

The aims of all DP mathematics courses 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.

3. Syllabus

All topics are compulsory. Students must study all the sub-topics in each of the topics in the syllabus as listed in this guide. Students are also required to be familiar with the topics listed as prior learning.

Syllabus component	Suggested teaching hours	
	SL	HL
Topic 1—Number and algebra	19	39
Topic 2—Functions	21	32
Topic 3— Geometry and trigonometry	25	51
Topic 4—Statistics and probability	27	33
Topic 5 —Calculus	28	55
The toolkit and the 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.	30	30
Total teaching hours	**150**	**240**

4. Assessment

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.

Assessment objectives	Paper 1 %	Paper 2 %	Paper 3 % HL only	Exploration %
Knowledge and understanding	20-30	15-25	10-20	5-15
Problem solving	20-30	15-25	20-30	5-20
Communication and interpretation	20-30	15-25	15-25	15-25
Technology	0	25-35	10-30	10-20
Reasoning	5-15	5-10	10-20	5-25
Inquiry approaches	10-20	5-10	15-30	25-35

External Assessment: Papers 1, 2 and 3

These papers are externally set and externally marked. Together, they contribute 80% of the final mark for the course. These papers are designed to allow students to demonstrate what they know and what they can do. Papers 1 and 2 will contain some questions, or parts of questions, which are common with SL.

Internal Assessment: Mathematical Exploration (Due date: Feb. 7, 2022)

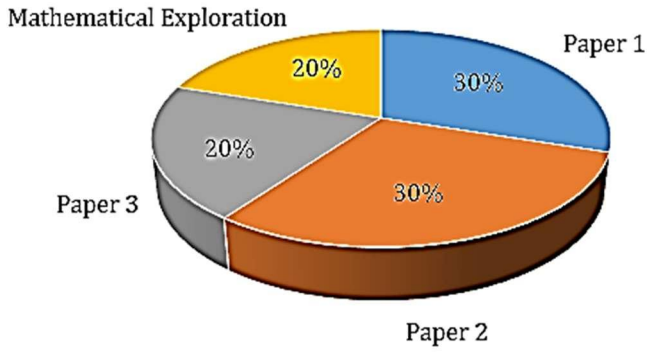
Internal assessment is an integral part of the course and is compulsory for both SL and HL students. It enables students to demonstrate the application of their skills and knowledge and to pursue their personal interests without the time limitations and other constraints that are associated with written examinations. The internal assessment should, as far as possible, be woven into normal classroom teaching and not be a separate activity conducted after a course has been taught. The internal assessment requirements at SL and at HL is an individual

exploration. This is a piece of written work that involves investigating an area of mathematics. It is marked according to five assessment criteria.

More detailed guidelines will be provided in the class.

Overview of the IB Math Assessment

First assessment 2021	
Assessment component	**Weighting**
External assessment (5 hours) **Paper 1 (120 minutes)** No technology allowed. (110 marks) *Section A* Compulsory short-response questions based on the syllabus. *Section B* Compulsory extended-response questions based on the syllabus.	**80%** **30%**
Paper 2 (120 minutes) Technology required. (110 marks) *Section A* Compulsory short-response questions based on the syllabus. *Section B* Compulsory extended-response questions based on the syllabus. **Paper 3 (60 minutes)** Technology required. (55 marks) Two compulsory extended response problem-solving questions.	**30%** **20%**
Internal assessment This component is internally assessed by the teacher and externally moderated by the IB at the end of the course. **Mathematical exploration** Internal assessment in mathematics is an individual exploration. This is a piece of written work that involves investigating an area of mathematics. (20 marks)	**20%**



Predicted Grades

"Everything Counts but Nothing is Counted (no crunching numbers)"

Students' final IB grades will be predicted ***qualitatively*** throughout everything they do in the course based on the following grade descriptors.

Grade Descriptors

Grade 7 - Demonstrates a thorough knowledge and comprehensive understanding of the syllabus; successfully constructs and applies mathematical arguments at a sophisticated level in a wide variety of contexts; successfully uses problem-solving techniques in challenging situations; recognizes patterns and structures, makes generalizations and justifies conclusions; understands and explains the significance and validity of results, and draws full and relevant conclusions; communicates mathematics in a clear, effective and concise manner, using correct techniques, notation and terminology; demonstrates the ability to integrate knowledge, understanding and skills from different areas of the course; uses technology correctly in challenging situations—makes efficient use of calculator's functionality when required.

Grade 6 - Demonstrates a broad knowledge and comprehensive understanding of the syllabus; successfully constructs and applies mathematical arguments in a variety of contexts; uses problem-solving techniques in challenging situations; recognizes patterns and structures, and makes some generalizations; understands and explains the significance and validity of results, and draws relevant conclusions; communicates mathematics in a clear and effective manner, using correct techniques, notation and terminology; demonstrates some ability to integrate knowledge, understanding and skills from different areas of the course; uses technology correctly in routine situations—makes efficient use of calculator's functionality when required.

Grade 5 - Demonstrates a broad knowledge and good understanding of the syllabus; applies mathematical arguments in performing routine tasks; successfully uses problem solving techniques in routine situations; successfully carries out mathematical processes in a variety of contexts, and recognizes patterns and structures; understands the significance of results and draws some conclusions; communicates mathematics effectively, using appropriate techniques, notation and terminology; demonstrates an awareness of the links between different areas of the course; makes use of calculator's functionality when required—may occasionally be inefficient.

Grade 4 - Demonstrates a satisfactory knowledge of the syllabus; applies mathematical arguments in performing some routine tasks; uses problem-solving techniques in routine situations; successfully carries out mathematical processes in straightforward contexts; shows some ability to recognize patterns and structures; has limited understanding of the significance of results and attempts to draw some conclusions; communicates mathematics adequately, using some appropriate techniques, notation and terminology; makes some use of calculator's functionality, but perhaps not always when required—may be inefficient at times.

Grade 3 - Demonstrates partial knowledge of the syllabus and limited understanding of mathematical arguments in performing some routine tasks; attempts to carry out mathematical processes in straightforward contexts; makes an attempt to use problem-solving techniques in routine situations; communicates some mathematics, using some appropriate techniques, notation or terminology; occasionally uses calculator's functionality, but often inefficiently; does not always use it when required and may use an inefficient analytic approach.

Grade 2 - Demonstrates limited knowledge of the syllabus; attempts to carry out mathematical processes at a basic level; communicates some mathematics, but often uses inappropriate techniques, notation or terminology; unable to use calculator correctly when required—questions exclusively requiring the use of the GDC are generally not attempted.

Grade 1 - Demonstrates minimal knowledge of the syllabus; demonstrates little or no ability to use mathematical processes, even when attempting routine tasks; communicates only minimal mathematics and consistently uses inappropriate techniques, notation or terminology; is unable to make effective use of technology.

Report Card Marks (Percentage)

BC Ministry Assessment Requirements: In line with the philosophy of the IB Diploma Programme, students will be assessed against the course objectives at their current level of achievement on the 7-point scale throughout the course. As required by the Ministry of Education, students will also be given a percentage converted from the IB level that reflects their achievement in relation to the corresponding BC Curriculum course.

Also, for partial IB students, IB course may be combined with an approved high school credential for the purpose of admission to many universities. For instance, UBC uses the following conversions.

International Baccalaureate Certificate Students

International Baccalaureate certificate courses may be combined with an approved high school credential for the purpose of admission.

For students who present International Baccalaureate certificate courses, the admission average will be calculated on the higher of either the official IB final score or the final school grade. In those cases where an IB score is not available at the time of admission selection, the course grade will be used.

The grade conversion scale that will be used to determine admission based on official IB results is as follows. Note that the equivalences are based upon whether the IB course is presented at the Standard Level (SL) or the Higher Level (HL). Also, special notation is made to recognize students who take IB Math Higher Level.

IB SL Grade	IB HL Grade	IB HL Math Grade	% Equivalent
--	--	7	100
--	7	6	98
7	6	5	96
6	5	4	90
5	4	3	86
4	3	--	76
3	--	--	70

Furthermore, based on the table of equivalences from UBC for DP Courses students, the BCAIBWS (British Columbia Association of International Baccalaureate World Schools) recommends that member schools use this table to guide their teachers in reporting purposes for parents and the BC Ministry of Education.

One of the shared goals for all IB schools in BC is to ensure that students are not disadvantaged for taking on the challenges of a rigorous and demanding academic program. As well, having received feedback from university partners that they recognize the significantly better preparation that Higher Level courses offer students in achieving success in their studies, we recognize that this difference should be accounted for in reporting as this will positively impact student admissibility outside of BC and for other purposes such as scholarships.

Anticipated Grade SL Course	% Range for Reporting
7	96-100
6	90-95
5	86-89
4	76-85
3	70-75
2	50-69
1	0-49

Anticipated Grade HL Course	% Range for Reporting
7	98-100
6	96-97
5	90-95
4	86-89
3	76-85
2	70-75
1	0-49 (0-69%?)

5. Approaches to Teaching and Learning

Approaches to teaching and learning across the Diploma Programme refers to deliberate strategies, skills and attitudes which permeate the teaching and learning environment. These approaches and tools, intrinsically linked with the learner profile attributes, enhance student learning and assist student preparation for the Diploma Programme assessment and beyond. The aims of approaches to teaching and learning in the Diploma Programme are to:

- empower teachers as teachers of learners as well as teachers of content
- empower teachers to create clearer strategies for facilitating learning experiences in which students are more meaningfully engaged in structured inquiry and greater critical and creative thinking
- promote both the aims of individual subjects (making them more than course aspirations) and linking previously isolated knowledge (concurrency of learning)
- encourage students to develop an explicit variety of skills that will equip them to continue to be actively engaged in learning after they leave school, and to help them not only obtain university admission through better grades but also prepare for success during tertiary education and beyond
- enhance further the coherence and relevance of the students' Diploma Programme experience
- allow schools to identify the distinctive nature of an IB Diploma Programme education, with its blend of idealism and practicality

The five approaches to learning (developing thinking skills, social skills, communication skills, self management skills and research skills) along with the six approaches to teaching (teaching that is inquiry based, conceptually-focused, contextualized, collaborative, differentiated and informed by assessment) encompass the key values and principles that underpin IB pedagogy

6. Academic Honesty

Academic honesty in the Diploma Programme is a set of values and behaviours informed by the attributes of the learner profile. In teaching, learning and assessment, academic honesty serves to promote personal integrity, engender respect for the integrity of others and their work, and ensure that all students have an equal opportunity to demonstrate the knowledge and skills they acquire during their studies.

All coursework – including work submitted for assessment—is to be authentic, based on the student's individual and original ideas with the ideas and work of others fully acknowledged. Assessment tasks that require teachers to provide guidance to students or that require students to work collaboratively must be completed in full compliance with the detailed guidelines provided by the IB for the relevant subjects.

7. Class Policies

- Online classes on MS Teams
  - Work at your desk with all the materials
  - Connect on your computer, not on your phone, for all functionalities
- Missed quizzes/tests
  - Students must consult with the teacher prior to their known/planned absences
  - Students will get zero automatically if they do not show up on the day of the test – treat every test like a real IB exam
- Late assignments
  - Assignments are usually collected electronically on MS Teams
  - No late homework assignment is accepted
- Plagiarism
  - Simply mark zero assigned to all students involved
  - Detailed examples of plagiarism and intellectual dishonesty are listed in your school agenda and disciplinary procedures will be strictly reinforced as set by the school policies – a diploma candidate student may lose his/her diploma
- Help sessions
  - If you are struggling in math, then consider setting up appointments with the teacher (or someone who can help) as soon as possible, rather than delaying until the new concepts are introduced
  - I am usually available at lunch, after school or by appointments to provide extra help
  - Peer tutors are also an option, and if you wish, you can pick up a list from the office
- Materials
  - A graphing calculator (TI-84 plus CE recommended)
  - A scientific calculator
  - Other stationary items
- Food & Drink in the Classroom
  - Only water is allowed in the classroom – no exceptions