ÉCOLE Jeannine Manuel
International understanding through a bilingual education

MATHEMATICS: ANALYSIS & APPROACHES B SL

	Topic/unit	Contents	Allocated time Each class is 95 minutes. In one week there are 2 classes.	Assessment instruments to be used	Resources
Year 1	Topic 1 – Number and Algebra	All contents of topic 1, from 1.1 to 1.9	From September to the Autumn break (6 weeks or 19 hours)	Online quizzes via www.socrative.com to assess basic concepts of topics via short answer and multiple choice for formative assessment Mock exams twice a year (formal school-wide examinations) Peer and self-assessment using Google forms and the topic guide for students to assess their strengths and weaknesses End of topic tests for summative assessment. Open-ended questioning	Extracts of "Mathematical Discovery on Understanding, Learning and Teaching Problem Solving" by G. Polya Repository of Jupyter interactive notebooks accessible via mybinder.org Use of GeoGebra for geometry, R for statistics, Excel for functions and modelling, Matlab for optimisation Oxford University Press Analysis and approaches textbook IB materials accessible at www.kognity.com Past papers from IB, WJEC, AQA and Cambridge
	Topic 2 - Functions	All contents of topic 2 from 2.1 to 2.11	From after the Autumn break to (6 the third week of January (8 weeks or 25 hours))		
	Topic 5 – Calculus	All contents of topic 5 from 5.1 to 5.11	From end ofJanuary to end of May (12 weeks or 38 hours)		

	June till the end of year 1 will be review, consolidation of topics 1,2,5 and preparation for the internal assessment.				
Year 2	Review	Review of year 1 and assessment	First two weeks of September		
	IA work	Work on first draft	Mid September to End of September (2weeks)		
	Topic 4 Statistics and probability	All contents of topic 4 from 4.1 to 4.11	From October to Christmas break (9 weeks or 28.5 hours)		
	IA work	Work on final draft	First two weeks of January		
	Topic 3 – Geometry and trigonometry	All contents of topic 3 from 3.1 to 3.7	Mid January to mid March (8 weeks or 25 hours)		
	Revision	Revision for all topics	Mid March to examinations (3 weeks)		

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

The internal assessment will be presented to students in March of the first year. We will discuss the objective and purpose of the internal assessment, both as an assessment of skills but also as a chance to independently investigate something students are curious and enthusiastic about using mathematical methods. We will read through and discuss the criteria, their relative weight in the work to be produced as well as the general rules to adhere to. At this point we will also look at sample papers of diverse quality and mark them as group work, comparing scores assigned by each group and trying to find a consensus. Students will then have a month to come up with 3 ideas. These will be shared with everyone in the class via a Google sheet, and students will provide feedback to each other on the quality and feasibility of the topic.
By the end of the first year, all students will have a question that has been approved by the teacher. They will have the summer break to produce a detailed outline of their plan. The outline will be due beginning of September of the second year.
The first draft of this work will be due in November of the second year. Feedback and comments on this draft will be handed back to students in December before the Christmas break. The final draft of the work will be due mid-February.
Three double periods will be allocated for classwork on the first draft, and another three for the second draft. In addition to the two double periods in the first year, a total of 8 double periods (about 12.5 hours) of class time will be allocated to the internal assessment during class time.

2. Links to TOK

Topic	Link with TOK (including description of lesson plan)
Statistics – using mathematics to give a comprehensible summary of large datasets	The use of statistics and the tools it provides to give properties about large or unknown datasets, and more significantly the errors of interpretation that often arise can be generalised to most forms of knowledge and thinking. By this I mean that our interpretation of the data / knowledge can be biased or wrong due to a number of factors, be they emotional, intuitive, linguistic or from other ways of knowing. This is true of all our knowledge, and so the paralel is an interesting one to make. Lesson plan: 1) Discussing the possible cultural interpretations of statistics – do intuitive or acquired beliefs change our interpretation of statistical data? This allows students to appreciate the local vs global context of our belief systems. A worked example of this is the interpretation of infection test results by doctors. In countries with diseases with a high infection rate vs countries with a low infection rate, a positive infection test result does not carry the same signification (as can be proved by Bayesian conditional probabilities). 2) Activity around sampling. The British museum is a short walk from the school. I am not completely sure how to structure this activity yet, but my idea revolves around combining the idea of sampling and the collection of the British museum. It could be for instance trying to find out which decade is the most represented in the BMuseum's collection by number of articles from that period. If we had several teams competing against each other, they would have to think of the most efficient way to gather data that is representative. This would allow us to think about which errors could come in to their methods, and which biases they may have introduced, which biases the question itself may have introduced, how what we are trying to know should influence how we ask the question (would it always be right to count each object as equals for instance? How do we determine the relative importance of objects? Is all data equal? Etc etc) and think about how easy it is to be misled by mathematics. 3) Homework assignment : students are given four datasets that the teacher has primed for "manipulation". Students must make a "breaking news" video which uses this dataset correctly but for manipulative purposes of making a scandal. When this video is shown in class, other students must find the fallacies behind the reporting.

3. Approaches to learning

Topic	Contribution to the development of students' approaches to learning skills (including one or more skill category)
Topic 2 - Functions	For this topic, one use of functions will be to evaluate the age of the Universe by extracting data from astrophysical databases. To summarise, Hubble's Law tells us that the age of the universe can roughly be approximated by taking the inverse of the gradient of a graph of galactic recessional velocity (with respect to the Milky Way) vs distance. The skills that this particular activity will develop are: - Research. Students will have to validate the data they are using from an unfamiliar context. They will need to understand what it represents, which units and conventions are being used. The data will need to be formatted into a usable document in Excel that allows for graphing the data they wish to represent. Students will need to correctly interpret what the data is telling them and how to extract meaning given the mathematical relationship given by Hubble's law. - Thinking. Students often struggle to put mathematics in a real-world context if this is not something they are used to do. In this activity, thinking about the physical real-world meaning of the slope of the graph and the y-intercept helps ground their understanding and provides greater motivation for learning by applying to something. I find that finding the age of the universe from such an easy technique bewilders many and enhances their curiosity for mathematics and the world! By discussing the relationship between mathematics and real-world problems and solutions, the construction of mathematical concepts should be easier and in a broader context.

4. International mindedness

Topic	Contribution to the development of international mindedness (including resources you will use)
Topic 5 - Calculus	Developing the concept of "mathematical limits" and "infinitisemal calculus" in order to find concrete solutions to mathematical problems on which previous civilisations struggled was an incredible achievement. I think that learning about the progress made over centuries on this topic can be incredibly rich on a historical and cultural level.and allow students to discover how mathematical progress is made, whilst also investigating whether cultural norms can act as a hindrance to making further discoveries. This is also an opportunity to compare and contrast this to scientific progress, via an extract of "The structure of scientific revolutions", T. Kuhn), as well as judge how international collaboration can impact this progress. Resources to be used: - 5 minute video on the history of calculus https://www.youtube.com/watch?v=CHPEpVp5Q6c - Building a timeline of the development of calculus from Ancient Egyptian precursors / Ancient Greece / China (method of exhaustion) / Middle East and India and Modern European - Looking at different notations that emerged over time and how mathematicians came to an international consensus

5. Development of the IB learner profile

Topic	Contribution to the development of the attribute(s) of the IB learner profile
Topic 4 – Statistics and probability	In this topic, students learn about tools that are used to help us understand large sets of data. Students will be developing the following attributes of the learner profile: - Inquirers : this topic is very openended and will allow students to search for datasets that are relevant to their personal interests. They will be able to independently explore databases and try to find answers to questions they have relative to sport, politics, sociology, economics, finance, science, literature. This topic should show them that mathematics can be a powerful tool for learning. - Thinkers: The ability to correctly identify biases in sampling, or common misrepresentations of data from misusing statistics will be developed. This will enhance their broader critical thinking skills. - Communicators: This topic is perfect for students to do an in-depth analysis on a topic and present to the rest of the class. This can be done as group work also, in order to foster collaboration between students. - Knowledgeable: The broad range of possible areas of study, as well as listening and providing good feedback to other students on this project, will allow students to grow further and expand their knowledge-base.

6. Resources

Each student will have a textbook, and we will be using other online tools for learning such as www.mathsis fun.com (simple but great for a number of explanations) The Inthinking resources website (thinkib.com) The school has a number of computers available to use. Students will have access to www.kognity.com, a good learning and assesmment online resource. Students will have past questions from the IB to work with and train on I am currently working on a personal website that will be focused on providing help and ressources to students and expect this to be up by September 2019.

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MATHEMATICS: ANALYSIS & APPROACHES B HL

	Topic/unit	Contents	Allocated time Each class is 95 minutes. In one week there are 3 classes.	Assessment instruments to be used	Resources
Year 1	Topic 1 – Number and Algebra SL and AHL	All contents of topic 1, from 1.1 to 1.13	From September to the Autumn break (6 weeks or 29 hours at a rate of 3 double periods per week)	Online quizzes via www.socrative.com to assess basic concepts of topics via short answer and multiple choice for formative assessment Mock exams twice a year (formal school-wide examinations) Peer and self-assessment using Google forms and the topic guide for students to assess their strengths and weaknesses End of topic tests for summative assessment. Open-ended questioning	Extracts of "Mathematical Discovery on Understanding, Learning and Teaching Problem Solving" by G. Polya Repository of Jupyter interactive notebooks accessible via mybinder.org Use of GeoGebra for geometry, R for statistics, Excel for functions and modelling, Matlab for optimisation Oxford University Press Analysis and approaches textbook
	Topic 1 – Number and algebra AHL	1.14 to 1.16	From after the Autumn break to Christmas break (6 weeks or 10 hours) at a rate of 1 double period per week		
	Topic 2 – Functions SL and AHL	All contents of topic 2 from 2.1 to 2.14	From after the Autumn break to the third week of January (8 weeks or 26 hours) at a rate of 2 double periods per week		
	Topic 2 – Function AHL	2.15 to 2.16	From beginning of January to the third week of January (3 weeks or 5 hours) at a rate of 1 double period per week		
	Topic 5 – Calculus	All contents of topic 5 from 5.1 to 5.16	From end ofJanuary to mid May (10 weeks or 47.5 hours) at a rate of three double periods per week		

	Toolkit and Internal assessment		Mid May to end of June (6 weeks or 19 hours) 2 double periods /week		IB materials accessible at www.kognity.com Past papers from IB, WJEC, AQA and Cambridge
	Topic 5 Calculus AHL	5.17 to 5.19	Mid may to end of june (6 weeks or 10 hours at 1 double period / week)		
Year 2	Review	Review of year 1 and assessment	First two weeks of September		
	IA work	Work on first draft	Mid September to End of September (2 weeks or 6 hours)		
	Topic 4 Statistics and probability SL and AHL	All contents of topic 4 from 4.1 to 4.14	From October to end of November (7 weeks or 33 hours at 3 double periods per week)		
	IA work	Work on final draft	Last two weeks of December (2 weeks or 6 hours)		
	Topic 3 – Geometry and trigonometry	All contents of topic 3 from 3.1 to 3.18	Beginning of January third week March March (11 weeks or 52 hours) at 2 double periods / week		
	Revision	Revision for all topics	End of March to examinations (2 weeks)		

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By the end of the first year, all students will have a question that has been approved by the teacher. They will have the summer break to produce a detailed outline of their plan. The outline will be due beginning of September of the second year.

The first draft of this work will be due in November of the second year. Feedback and comments on this draft will be handed back to students in December before the Christmas break. The final draft of the work will be due mid-February.

Students will have 4 double periods either side of Christmas to work on their Internal assessment in class. These periods combined with 6 weeks in May / june of the first year will meet the recommended 30 hours teaching time.

2. Links to TOK

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I am currently working on a personal website that will be focused on providing help and ressources to students and expect this to be up by September 2019.