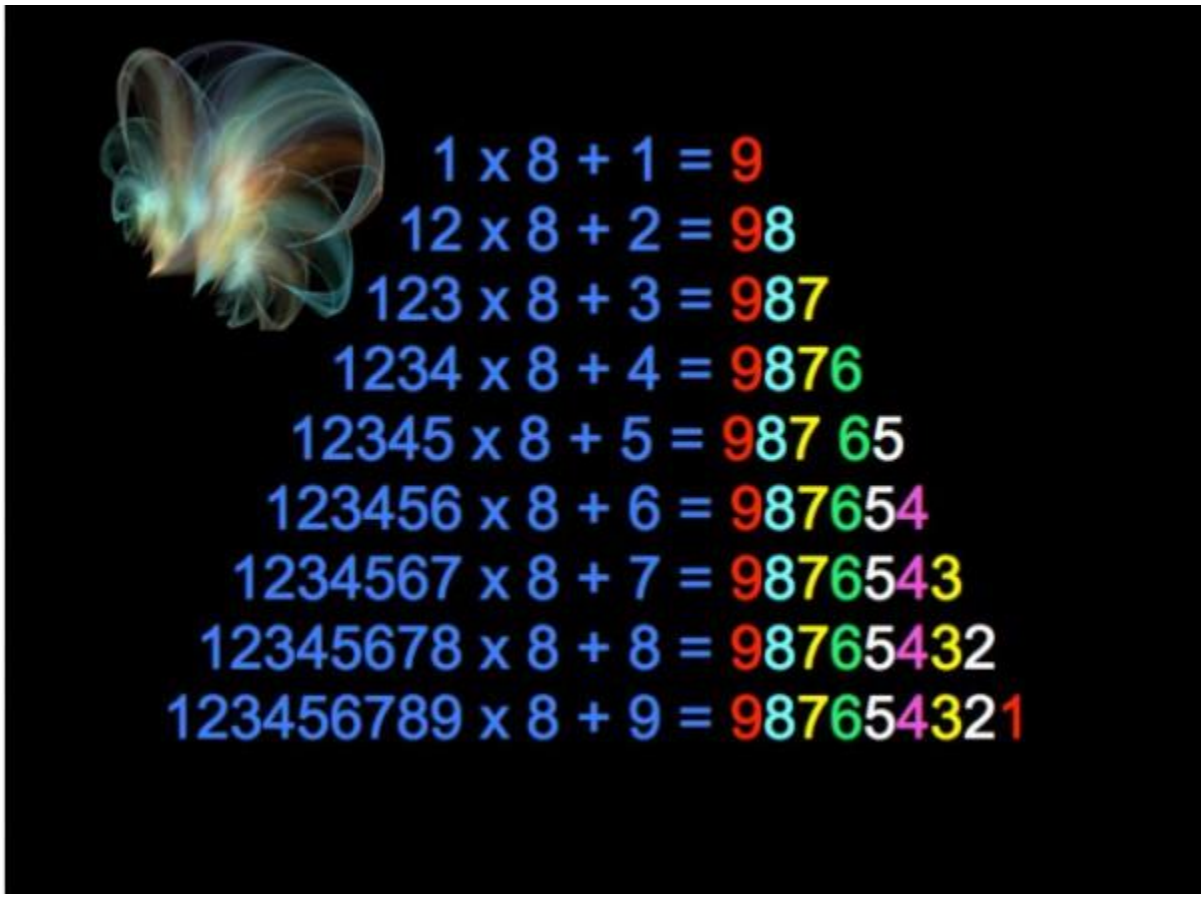
SANGAM SCHOOL OF EXCELLENCE

COURSE OUTLINE OF MATHEMATICAL STUDIES SL

BATCH 2014-16



MR. SHIV KHATOR

IBDP MATHEMATICS EDUCATOR

Course description:

In two to three paragraphs, describe the course in terms of focus, purpose, aims and objectives, the inclusion of internationalism, the proposed process, and expected assessment. This should be a summary.

The course syllabus focuses on important mathematical topics that are interconnected. The syllabus is
organized and structured with the following tenets in mind: placing more emphasis on student understanding of fundamental concepts than on symbolic manipulation and complex manipulative skills; giving greater emphasis to developing students' mathematical reasoning rather than performing routine operations; solving mathematical problems embedded in a wide range of contexts; using the calculator effectively. The course includes project work, a feature unique to mathematical studies SL within group 5. Each student completes a project, based on their own research; this is guided and supervised by the teacher. The project provides an opportunity for students to carry out a mathematical study of their choice using their own experience, knowledge and skills acquired during the course. This process allows students to take sole responsibility for a part of their studies in mathematics.
The students most likely to select this course are those whose main interests lie outside the field of mathematics, and for many students this course will be their final experience of being taught formal mathematics. All parts of the syllabus have therefore been carefully selected to ensure that an approach starting from first principles can be used. As a consequence, students can use their own inherent, logical thinking skills and do not need to rely on standard algorithms and remembered formulae. Students likely to need mathematics for the achievement of further qualifications should be advised to consider an alternative mathematics course. Owing to the nature of mathematical studies SL, teachers may find that traditional methods of teaching are inappropriate and that less formal, shared learning techniques can be more stimulating and rewarding for students. Lessons that use an inquiry-based approach, starting with practical investigations where possible, followed by analysis of results, leading to the understanding of a mathematical principle and its formulation into mathematical language, are often most successful in engaging the interest of students. Furthermore, this type of approach is likely to assist students in their understanding of mathematics by providing a meaningful context and by leading them to understand more fully how to structure their work for the project.

PURPOSE

It is designed for students with varied mathematical backgrounds and abilities. It offers students opportunities to learn important concepts and techniques and to gain an understanding of a wide variety of mathematical topics. It prepares students to be able to solve problems in a variety of settings, to develop more sophisticated mathematical reasoning and to enhance their critical thinking. The individual project is an extended piece of work based on personal research involving the collection, analysis and evaluation of data. Students taking this course are well prepared for a career in social sciences, humanities, languages or arts. These students may need to utilize the statistics and logical reasoning that they have learned as part of the mathematical studies SL course in their future studies..

AIMS

The aims of Math Studies SL course is to enable students to:

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

OBJECTIVES

Students are able to:

1. Recall, select and use their knowledge of mathematical facts, concepts and techniques in a variety of familiar and unfamiliar contexts.
2. Use their knowledge of mathematical skills, results and models in both real and abstract contexts to solve problems.
3. 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.
4. Use technology, accurately, appropriately and efficiently both to explore new ideas and to solve problems.
5. Construct mathematical arguments through use of precise statements, logical deduction and inference, and by the manipulation of mathematical expressions.
6. Investigate unfamiliar situations involving organizing and analyzing information or measurements, drawing conclusions, testing their validity, and considering their scope and limitations.

Command terms with definitions

Students should be familiar with the following key terms and phrases used in examination questions, which are to be understood as described below. Although these terms will be used frequently in examination questions, other terms may be used to direct students to present an argument in a specific way.

Calculate -Obtain a numerical answer showing the relevant stages in the working.

Comment -Give a judgment based on a given statement or result of a calculation.

Compare -Give an account of the similarities between two (or more) items or situations, referring to both (all) of them throughout.
Construct- Display information in a diagrammatic or logical form.
Deduce- Reach a conclusion from the information given.
Describe- Give a detailed account.
Determine- Obtain the only possible answer.
Differentiate- Obtain the derivative of a function.
Draw -Represent by means of a labelled, accurate diagram or graph, using a pencil. A ruler straight edge) should be used for straight lines. Diagrams should be drawn to scale. Graphs should have points correctly plotted (if appropriate) and joined in a straight line or smooth curve.
Estimate -Obtain an approximate value.
Find -Obtain an answer showing relevant stages in the working.
Hence- Use the preceding work to obtain the required result.
Hence or otherwise- It is suggested that the preceding work is used, but other methods could also receive credit.
Interpret- Use knowledge and understanding to recognize trends and draw conclusions from given information.
Justify -Give valid reasons or evidence to support an answer or conclusion.
Label -Add labels to a diagram.
List -Give a sequence of brief answers with no explanation.
Plot -Mark the position of points on a diagram.
Show- Give the steps in a calculation or derivation.
Show that -Obtain the required result (possibly using information given) without the formality of proof. "Show that" questions do not generally require the use of a calculator.
Sketch- Represent by means of a diagram or graph (labelled as appropriate). The sketch should give a general idea of the required shape or relationship, and should include relevant features.
Solve- Obtain the answer(s) using algebraic and/or numerical and/or graphical methods.
State -Give a specific name, value or other brief answer without explanation or calculation.
Verify -Provide evidence that validates the result.
Write down- Obtain the answer(s), usually by extracting information. Little or no calculation is required. Working does not need to be shown.

Topics:

In narrative or outline form, list what you will cover in your course to meet the IB syllabus requirements. In addition, if IB courses are going to be combined with Advanced Placement or other curriculums, outlines should address additional non-IB topics to be covered.

Topic	**Teaching Hours**
Topic 1- Number and Algebra	**20**

1.1 Natural numbers, integers, rational numbers, and real numbers.	1.5
1.2 Approximation: decimal places, significant figures. Percentage errors. Estimation.	2
1.3 Expressing numbers in the form $a \times 10^k$, where $1 \leq a < 10$ and k is an integer.	1.5
1.4 SI (*Système International*) and other basic units of measurement: for example, kilogram (kg), metre (m), second (s), litre (l), metre per second (m s–1), Celsius scale.	1.5
1.5 Currency conversions	1.5
1.6 Use of a GDC to solve pairs of linear equations in two variables and quadratic equations.	2
1.7 Arithmetic sequences and series, and their applications. Use of the formulae for the *n*th term and the sum of the first *n* terms of the sequence	3
1.8 Geometric sequences and series. Use of the formulae for the *n*th term and the sum of the first *n* terms of the sequence.	3
1.9 Financial applications of geometric sequences and series: • compound interest • annual depreciation.	4
Topic 2- Descriptive Statistics	**12**
2.1 Classification of data as discrete or continuous.	2
2.2 Simple discrete data: frequency tables.	2
2.3 Grouped discrete or continuous data: frequency tables; mid-interval values; upper and lower boundaries. Frequency histograms.	2
2.4 Cumulative frequency tables for grouped discrete data and for grouped continuous data; cumulative frequency curves, median and quartiles. Box-and-whisker diagram.	2
2.5 Measures of central tendency. For simple discrete data: mean; median; mode. For grouped discrete and continuous data: estimate of a mean; modal class.	2
2.6 Measures of dispersion: range, interquartile range, standard deviation.	2
Topic 3- Logic, Sets and Probability	**20**
3.1 Basic concepts of symbolic logic: definition of a proposition; symbolic notation of propositions.	2

3.2 Compound statements: implication, $\Rightarrow$;equivalence, $\Leftrightarrow$; negation, $\neg$; conjunction,$\wedge$; disjunction, $\vee$; exclusive disjunction, $\vee$ .Translation between verbal statements andsymbolic form.	2
3.3 Truth tables: concepts of logical contradiction and tautology.	3
3.4 Converse, inverse, contrapositive. Logical equivalence. Testing the validity of simple arguments through the use of truth tables.	2
3.5 Basic concepts of set theory: elements $x \in A$, subsets $A \subset B$; intersection $A \cap B$; union $A \cup B$; complement A' . Venn diagrams and simple applications.	3
3.6 Sample space; event A; complementary event, A Probability of an event. Probability of a complementary event. Expected value.	3
3.7 Probability of combined events, mutually exclusive events, independent events. Use of tree diagrams, Venn diagrams, sample space diagrams and tables of outcomes. Probability using "with replacement" and "without replacement". Conditional probability.	5
Topic 4- Statistical Application	**17**
4.1 The normal distribution. The concept of a random variable; of the parameters μ and σ ; of the bell shape; the symmetry about $x = \mu$. Diagrammatic representation. Normal probability calculations. Expected value. Inverse normal calculations.	3
4.2 Bivariate data: the concept of correlation. Scatter diagrams; line of best fit, by eye, passing through the mean point. Pearson's product–moment correlation coefficient, r. Interpretation of positive, zero and negative, strong or weak correlations.	4
4.3 The regression line for y on x. Use of the regression line for prediction purposes.	4
4.4 The χ 2 test for independence: formulation of null and alternative hypotheses; significance levels; contingency tables; expected frequencies; degrees of freedom; p-values..	6
Topic 5 – Geometry and Trigonometry	**18**
5.1 Equation of a line in two dimensions: the forms $y = mx + c$ and $ax + by + d = 0$. Gradient; intercepts. Points of intersection of lines. Lines with gradients, m_1 and m_2 .Parallel lines $m_1 = m_2$. Perpendicular lines, $m_1 \times m_2 = -1$.	4
5.2 Use of sine, cosine and tangent ratios to find the sides and angles of right-angled triangles. Angles of elevation and depression.	5
5.3 Use of sine rule, cosine rule and area of triangle and area of triangle.	4
5.4 Geometry of three-dimensional solids: cuboid; right prism; right pyramid; right cone; cylinder; sphere; hemisphere; and combinations of these solids. The distance between two points; eg between two vertices or vertices with midpoints or midpoints with midpoints. The size of an angle between two lines or between a line and a plane.	5

Topic 6- Mathematical Models	**20**
6.1 Concept of a function, domain, range and graph. Function notation. Concept of a function as a mathematical model.	3
6.2 Linear models. Linear functions and their graphs,	2
6.3 Quadratic models. Quadratic functions and their graphs. Properties of a parabola: symmetry; vertex; intercepts on the x-axis and y-axis. Equation of the axis of symmetry,	3
6.4 Exponential models. Exponential functions and their graphs. Concept and equation of a horizontal asymptote.	4
6.5 Models using functions of the form $f(x) = ax^m + bx^n + \ldots$; $m,n \in \mathrm{z}$. Functions of this type and their graphs. The y-axis as a vertical asymptote.	3
6.6 Drawing accurate graphs. Creating a sketch from information given. Transferring a graph from GDC to paper. Reading, interpreting and making predictions using graphs. Included all the functions above and additions and subtractions.	3
6.7 Use of a GDC to solve equations involving combinations of the functions above.	2
Topic-7 Introduction to differential Calculus	**18**
7.1 Concept of the derivative as a rate of change. Tangent to a curve. formal treatment of limits	2
7.2 The principle that $f(x) = ax^n \Rightarrow f'(x) = a^n$ The derivative of functions of the form $f(x) = ax^n + bx^{n-1} + \ldots$, where all exponents are integers.	2
7.3 Gradients of curves for given values of x. Values of x where $f'(x)$ is given. Equation of the tangent at a given point. Equation of the line perpendicular to the tangent at a given point (normal).	3
7.4 Increasing and decreasing functions.	4
7.5 Values of x where the gradient of a curve is zero. Solution of $f'(x) = 0$. Stationary points. Local maximum and minimum points.	4
7.6 Optimization problems.	3
Total Teaching Hours	125 hrs
Internal Assessment-Project	25hrs
Grand Total	150hrs

Connection to IM

The students enrolled in IB Math Studies SL will explore mathematics in a global context. They will look at the historical and cultural contributions to the field of mathematics. This will be accomplished by looking at:

- The history of mathematicians as well as time-line facts.
- The invention and use of the various tools and instruments of mathematics.
- The various number systems of the world.
- Mathematical linguistics.
- The universal approach to mathematical symbolism.

Connections to TOK

Proof: Axioms, rules of inference; mathematical deduction (and induction); is there more to math. than manipulation of symbols according to given rules; if not, then why is math. interesting? What is intelligence? Can a machine think? Alan Turing's test. Godel
Logic: Limitations of logic; Russell's set paradox and ancient Greek paradoxes; mention of Godel.
Truth: universal truths; is math discovered or invented; could God make 2+2=5?
Nature of infinity: irrational numbers and Euclid's proof; one-one mappings and counting; Cantor's diagonal arguments.
Beauty and creativity: What makes a proof beautiful? Is the result or the proof more interesting? Ways of proving Pythagoras' Theorem.
Computers: Can we use computers to see things which were not otherwise possible eg fractals? Influences of computers and calculating devices on the development of math.
History: The story of mathematics; important turning points and significant mathematicians.

Map of mathematics: Who is doing math today? Where are the main centres? What are the main research areas? Who funds mathematics? Cryptography.

IB Learner Profile Attributes in Mathematics

The aim of all IB programmes is to develop internationally minded people who, recognizing their common humanity and shared guardianship of the planet, help to create a better and more peaceful world.

LP Attributes	**IB Learner Profile**	**IB learner profile attributes connected to Mathematics with examples**
Inquirer	They develop their natural curiosity. They acquire the skills necessary to conduct inquiry and research and show independence in learning. They actively enjoy learning and this love of learning will be sustained throughout their lives	Inquirers look for patterns. Inquirers write proofs to illuminate the patterns they have discovered. Inquirers discover mathematical patterns and relationships to deepen their understanding and ownership of the ideas and concepts being studied.
Knowledgeable	They explore concepts, ideas and issues that have local and global significance. In so doing, they acquire in-depth knowledge and develop	Math is the global and multi-disciplinary language. For example, science expresses itself through math. Our understanding of math continues

	understanding across a broad and balanced range of disciplines	to evolve and deepen as our ability to explore ideas of greater complexity continues to develop
Thinkers	They exercise initiative in applying thinking skills critically and creatively to recognize and approach complex problems, and make reasoned, ethical decisions.	Studies SL mathematics is dedicated to complex multi-step problems. Students are required to think in order to evaluate their solutions and problem solving approaches
Communicators	They understand and express ideas and information confidently and creatively in more than one language and in a variety of modes of communication. They work effectively and willingly in collaboration with others	Students must use appropriate math language because math has its own language. Communicating in this language requires an understanding of it set of rules, symbols, notation, syntax etc. Math has multiple modes of communication (graphical, algebraic and examples) that need to be mutually reinforcing and consistent
Principled	They act with integrity and honesty, with a strong sense of fairness, justice and respect for the dignity of the individual, groups and communities. They take responsibility for their own actions and the consequences that accompany them.	Students are expected to take responsibility for their own work and problem solving. Math is very unforgiving – if a student tries to pretend to work at or understand the subject, their lack of knowledge will be found out by the independent assessments
Open-minded	They understand and appreciate their own cultures and personal histories, and are open to the perspectives, values and traditions of other individuals and communities. They are accustomed to seeking and evaluating a range of points of view, and are willing to grow from the experience	Students explore and discover multiple methods of solving problems. Students understand that there are different perspectives that can be equally effective in visualizing, setting up, or solving problems.
Caring	They show empathy, compassion and respect towards the needs and feelings of others. They have a personal commitment to service, and act to make a positive difference to the lives of others and to the environment	Better students learn better by teaching peers and owning their peers' progress. Attaching real world emotions and morals to math problems by relating the mathematical concept to problems that have real human impact increases a student's appreciation for the role that math can play in improving the world in which they live

Risk Takers	They approach unfamiliar situations and uncertainty with courage and forethought, and have the independence of spirit to explore new roles, ideas and strategies. They are brave and articulate in defending their beliefs	Risk takers speak in class despite the possibility of being incorrect. Risk takers attack unfamiliar problems because they know they are good at math when they can solve them
Balanced	They understand the importance of intellectual, physical and emotional balance to achieve personal well-being for themselves and others	Balanced students manage their time in and out of the class. One way of maintaining balance is through finding the quick, simple ways to solve problems. A good understanding of math and its elegance can streamline problem solving and make students more effective and efficient
Reflective	They give thoughtful consideration to their own learning and experience. They are able to assess and understand their strengths and limitations in order to support their learning and personal development	Reflecting involves considering where assumptions are made that can lead to truth or error. Being able to reflect on your own work and how you are approaching a problem and how to correct an inferior method can lead to penetrating insights

Assessment:

Knowledge of IBO-required assessments and descriptors should be evident. All parts of IB assessment should be addressed, both internal and external. In addition, examples of non-IB monitoring should be given, if they are part of the course.

Assessment

Paper	**Detail**	**Duration**	**Weightage**
	External Assessment -Two written examination papers externally assessed	**3 hrs**	**80%**
1	This paper consists of 15 compulsory short-response questions.(90 marks). Each question is worth 6 marks. GDC is allowed	**1 ½ hrs**	**40%**
2	This paper consists of 6 compulsory extended-response questions.(90 marks) .Questions in this section will vary in terms of length and level of difficulty. GDC is allowed	**1 ½ hrs**	**40%**
Internal Assessment-Project	The project is an individual piece of work involving the collection of information or the generation of measurements, and the analysis and evaluation of the information or measurements. (20 marks).		**20%**

INTERNAL ASSESSMENT CRITERION FOR MATHEMATICAL STUDIES STANDARD LEVEL							
PT	A.Introduction	B. Information /measurement	C. Mathematical processes	D. Interpretation of results	E. Validity	F. Structure & Communication	G. Notation and
0	The project does not contain a clear statement of the task	The project does not contain any relevant information collected or relevant measurements	The project does not contain any mathematical processes.	The project does not contain any interpretations or conclusions	There is no awareness shown that validity plays a part in the	No attempt has been made to structure the project.	does not contain correct mathematical notation or
1	The project contains a clear statement of the task.	The project contains relevant information collected or relevant generated measurements.	At least two simple mathematical processes have been carried out	The project contains at least one interpretation or conclusion	There is an indication, with reasons, if and where validity plays	Some attempt has been made to structure the project.	The project contains some correct mathematical notation **or** terminology.
2	The project contains a title, a clear statement of the task and a description of the plan.	The relevant information collected, or set of measurements generated, is organized in a form appropriate for analysis	At least two simple mathematical processes have been carried out correctly.	The project contains interpretations and/or conclusions that are consistent with the		The project has been structured in a logical manner so that it is easily followed	The project contains correct mathematical notation **and** terminology throughout
3	The project contains a title, a clear statement of the task and a detailed plan that is followed.	The relevant information collected, or set of measurements generated, is organized in a form appropriate for analysis **and** is	At least two simple mathematical processes have been carried out correctly. All processes used are relevant	The project contains a meaningful discussion of interpretations and conclusions that		The project has been well structured in accordance with the stated plan **and** is	
4			The simple relevant mathematical processes have been carried out correctly. In addition, at				
5			The simple relevant mathematical processes have been carried out correctly. In addition, at least one relevant further process has been carried out. All processes, both				

SANGAM SCHOOL OF EXCELLENCE

Subject:- MATHEMATICAL STUDIES STANDARD LEVEL

Syllabus Break up (IB DP 1st year)

S#	Month	Contents	Teaching Hrs
1	July ,14	Number Properties and Measurement	12.75
2	August,14	Laws of Algebra	9
3	September,14	Equations and formulae, sequence and series	9
4	October,14	Descriptive Statistics	5
5	November,14	Descriptive Statistics	7
6	December,14	Sets and venn diagram,	11.25
7	January,15	probability	8.25
8	February,15	Probability	4.5
9	March,15	The normal distribution	11.25
10	April,15	Two variable statistics	10
11	June,15	Two variable statistics	6
		TOTAL	94

May remains the month of Final Examinations and remains a summer break for Students of 1st year.

The school splits for a Summer break for teachers by 25th May and reopens on 16th June.

Syllabus Break up (IB DP 2nd year)

S#	Month	Contents	Teaching Hrs
1	July ,15	Pythagoras Theorem, Coordinate Geometry and Perimeter, Area and Volume(Introductions)	14
2	August,15	Perimeter, Area and Volume, Trigonometry	12
3	September,15	Functions, Quadratic Equations	10
4	October,15	Exponential Functions, Revision of syllabus for Term Exams	9
5	November,15	Unfamiliar Functions	6
6	December,15	Differential Calculus	12
7	January,16	Applications of differential calculus	10
8	February,16	Miscellaneous Exercise of the course	6
9	March,16	Revision	10
10	April,16	Revision	12
		TOTAL	101

Resources:

List the books and other resource materials and software that will be used in the course. Information should include what is currently available as well as what is being ordered.

Books Required:

Name	Publisher	Description	Author
Mathematics for the International Student Mathematical Studies SL	Haese and Harris Publications	IB Diploma Mathematical Studies SL	Mal Coad Glen Whiffen Sandra Haese Michael Haese Mark Humphries
Mathematical Studies SL	IBID Press	IB Diploma Mathematical Studies SL	Fabio Cirrito
Mathematics for the International Student Mathematical Studies SL Exam Preparation and Practice Guide	Haese and Harris Publications	IB Diploma Mathematical Studies SL	Mal Coad Glen Whiffen Sandra Haese Michael Haese Mark Humphries

Other resources: i. Casio CG-20 or Casio fx 9860 G II ii. Graph software

IA DEADLINES

Month	Date	Description
Jan 15	21st jan	Math studies SL –IA
June 2015	18th June	Introduction of project for Math studies SL
Aug 2015	17th Aug	First draft submission of project Math studied SL
Sep 2015	30th Sep	Second draft submission of project Math studied SL
Nov 2015	24th Nov	Final draft submission of project Math studied SL

For group 5 subjects:

- Does the course provide adequate training in analytical and critical thought?
- Have courses been sequenced to provide appropriate preparation for the various mathematics options and computer science?
- How will the international perspective of your students be enhanced by the methodology and resources used in the teaching of mathematics/computer science?
- Does the classroom and/or library contain a variety of modern mathematics textbooks, technical reference materials and other supplementary instructional materials to support the course(s) in IB mathematics?
- Does the classroom and/or library contain sufficient materials to support the computer science course?

Yes because students read the problem carefully then they think that how to solve the problem using different methods. Sometimes they solve their problems by healthy discussion.

Yes courses have been sequenced to develop intercultural and international mindedness in the students. This course provides appropriate preparation for the various mathematics options for all over development of the students. The

They will solve their problems using all the resources provided by IB online and other sites to develop international mindedness.

Yes the classroom and/or library contain a variety of modern mathematics textbooks, technical reference materials and other supplementary instructional materials to support the course(s) in IB mathematics. There are some study guides from IBDP Press and some from Cambridge University.