

IB Diploma Programme course outlines: Mathematics SL

Course description

This course caters for students who already possess knowledge of basic mathematical concepts and who are equipped with the skills needed to apply simple mathematical techniques correctly. The course is designed for the non-specialist who, nevertheless, needs a sound background in mathematics for the purpose of his further study at university or career options in science, economics or business. The course is challenging and requires a high level of mathematical ability as well as sustained effort and commitment. Students should normally have obtained at least a grade 4 in mathematics in their MYP5 year and demonstrated a consistent grade 4 level in class during their last two years in the middle school.

Mathematics provides an opportunity for students to think logically and creatively by applying abstract principles to particular situations. In recognising patterns, in forming and proving a general result or in constructing and interpreting a model of a real situation the student will be following in a long tradition of mathematics worldwide. The students will learn a new language, notation and terminology, leading them to a deeper understanding of the elegance, power and potential of mathematics and to a greater confidence in their powers of communication. Integral to the course will be the application of appropriate technology as a tool to help solve genuine problems. We have chosen text books which emphasise the international nature of mathematics.

The internally assessed component, the portfolio, allows students to develop their ideas independently and then to reflect on their results, without the time constraints of an examination. It offers them the opportunity to think critically and imaginatively by deploying the techniques of mathematics which they have learned and appropriate technology to solve a mathematical problem of some depth. At each stage students will be encouraged to explore alternative approaches.

Topics

The course content is based on the IB Mathematics SL guide. We have also taken into account the natural breaks in the year whilst planning this course. Important features of how the topics are arranged during the two years of the course are:

- Statistics and Calculus are largely covered during the first year in order to develop early familiarity with them and allow students the potential of using elements for their portfolio work, if need be.
- The portfolio work will mainly be completed during the first term of the second year whilst the students study Matrices and Vectors, two fairly straight forward topics.

There will be a non-IB assessment in the form of a mock exam in the style of the IB exam in January of Year 2.

See the two year plan below for full details of the sequencing of topics and the timing of external and internal assessment. Each line represents a week.

There are no plans to teach towards APs or other curriculums.

Connections to TOK

Proof: Axioms, rules of inference; mathematical deduction (and induction); is there more to maths than manipulation of symbols according to given rules; if not, then why is maths 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 maths 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 maths.

History: The story of mathematics; important turning points and significant mathematicians.

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

Course Outline

Mathematics SL weekly topic guide		
Start of year 1 of 33 weeks		
Topic 1.1 Algebra	Sequences and series, APs & GPs	
Topic 1.2 Algebra	Exponents and logarithms Laws of indices and logs	
Topic 1.3 Algebra	Binomial expansion, Pascal's triangle, GDC	
Topic 2.5 Functions	Quadratic graph; axis, turning pt, intercepts	
Topic 2.6 Functions	Solving quadratics	
Topics 3.1 and 3.2 Circular functions	Radian measure/ length of an arc, area of a sector Definition of sine, cosine and tan functions and their graphs/ $\sin^2 + \cos^2 = 1$	GDC
Topic 3.3 Circular functions	The double angle formulae	
Topic 3.4 Circular functions	Periodicity and applications	
Topic 3.5 Circular functions	Solving trig equations	
Topic 3.6 Circular functions	Sine and cosine rules and area of a triangle	Triangle problems, GDC, Appreciation of Pythagoras' theorem as a special case of the cosine rule, the ambiguous case of the sine rule

Topic 7.1 Calculus	Convergence and definition of f'	
Topic 7.1 Calculus	Gradients, tangents and normals;	
Topic 7.1 Calculus	increasing and decreasing functions	
Topic 7.2 Calculus	Differentiation of products and quotients	
Topic 7.2 Calculus	Differentiation of composites	
Topic 7.2 Calculus	Second derivative; notation	
Topic 7.3 Calculus	Max/min/optimisation	
Topic 7.3 Calculus	Max/min/optimisation	
Topic 2.1 Functions	Domain and range	
Topic 2.2 Functions	Graphing functions	Apply to the functions met earlier, emphasis on and exploring the use of the GDC
Topic 2.3 Functions	Transformations Translations and stretches in both directions, reflections in both axes	GDC
Topic 2.4 Functions	Inverse functions Reflection in $y=x$	GDC
Topics 2.7 and 2.8	Exponential and log functions, Growth and decay	Definition of e
Topics 6.1 and 6.2 Statistics and probability	Concepts of population, sample, random sample and frequency distribution of discrete and continuous data. Presentation of data: frequency tables and diagrams, box and whisker plots. Grouped data: mid-interval values, interval width, upper and lower interval boundaries, frequency histograms.	Treatment of both continuous and discrete data. GDC
Topic 6.3 Statistics and probability	Basics: Mean, median, mode; quartiles, percentiles. Range; interquartile range; variance; standard deviation.	Awareness that the population mean, μ , is generally unknown, and that the sample mean, \bar{x} , serves as an estimate of this quantity. GDC
Topic 6.4 Statistics and probability	Cumulative frequency; cumulative frequency graphs; use to find median, quartiles, percentiles.	
Topic 6.5 Statistics and probability Topic 6.8 Venn and tree diagrams to feature all the way	Basic concepts of probability Concepts of trial, outcome, equally likely outcomes, sample space (U) and event.	GDC

through.	The probability of an event A $P(A)=n(A)/n(U)$ The complementary events A and $A' = (\text{not } A)$; $P(A)+P(A')=1$.	
Topic 6.6 Statistics and probability	Combined events, the formula: $P(A \cup B)=P(A)+P(B)-P(A \cap B)$ $P(A \cap B)=0$ for mutually exclusive events.	Appreciation of the non-exclusivity of “or”.
Topic 6.7 Statistics and probability	Conditional probability and independent events	
Topic 5.1 General concepts of vectors	Position, displacement, column and unit vectors $\vec{AB}=\vec{b}-\vec{a}$	
Topic 5.2 Properties of the scalar product	The scalar product of two vectors The angle between two vectors Perpendicular and parallel vectors	
Portfolio week	To explain the portfolio requirements and complete version 1 of type 1	Portfolio Type 1 version 1 3.75 class hours plus 2 homework hours
Topic 5.3 Vectors	Vector equation of a straight line; angle between line	
End of year 1		

Mathematics SL weekly topic guide		
Start of year 2 of 26 weeks		
Topic 5.4 Vectors	Coincident and parallel lines; point of intersection (if there is one)	
Topic 5 Vectors	Review	Portfolio Type 2 version 1 2.25 class hours plus 2 hours homework
Mock IB exams	Mock IB exams	Mock IB exams
Review of exams	Review of exams	Review of exams
Topics 4.1 and 4.2 Matrices	For storing data, algebra	
Topic 4.3 Matrices	Determinants 2×2 3×3 and inverse of 2×2	
Topic 4.4 Matrices	Solving simultaneous equations	Portfolio Type 1 version 2
Review of Topics 4 & 5	Matrices, Vectors,	
Topic 7.4 Calculus	Indefinite integration of standard functions and composites	
Topic 7.5 Calculus	Definite integration, determine the constant term	Portfolio Type 2 version 2
Topic 7.5 Calculus	Definite integration, area	
Topic 7.5 Calculus	Definite integration, volume	

Topic 7.7 Calculus	Asymptotes, points of inflexion, concave up and concave down	
Review of Topics 1 to 3		
Review of Topics 4 to 6		
Topics 7.7 Calculus	Asymptotes, points of inflexion, concave up and concave down	
Topic 7.6 Calculus	Kinematic problems involving displacement, s	
Topic 6.9 Statistics and probability	Concept of discrete random variables and their probability distributions	
Topic 6.10 Statistics and probability	The Binomial distribution; mean of	
Topic 6.11 Statistics and probability	The Normal distribution; properties and normal probabilities	
Topic 6.11 Statistics and probability	The Normal distribution; properties and normal probabilities	
Topic 6 Review	Statistics	
Topic 7 Review	Calculus	
Study leave		
Study leave		
Study leave		
IB exams		
IB exams		
IB exams		
IB exams		