

Mathematics Course Outline

Overview*

Maths classes in VIS take a holistic approach to teaching by incorporating real life applications into learning. Students will learn the importance of mathematics and its applications in the local and global communities as well as how to understand and communicate this knowledge.

Students study mathematics in the form of units of work. These will include concepts and principals commonly identified as belonging to the four strands of: Number, Algebra, Geometry & Trigonometry and Statistics & Probability.

In both the PYP (primary school) and the MYP (middle school), it is important that learners acquire mathematical understanding by constructing their own meaning through increasing levels of abstraction, starting with an exploration of their own personal experiences, understandings and knowledge. Additionally, it is fundamental to the philosophy of both programmes that, since it is to be used in real-life situations, mathematics needs to be taught in relevant, realistic contexts, rather than by attempting to impart a fixed body of knowledge. In both programmes, mathematics is valued not only for its beauty but also for its usefulness in helping us to understand how the world works and for providing us with a unique way to communicate. Mathematics is an essential tool for transdisciplinary and interdisciplinary inquiry. Teaching and learning experiences in both the PYP and MYP challenge students to be curious, ask questions and explore and interact with the environment physically, socially and intellectually. Through engaging in this process, students are able to construct meaning about mathematics concepts, transfer this meaning to symbols and apply mathematical understanding in familiar and unfamiliar situations.

Students will participate in many different mathematical investigations and work in different group formations to seek answers to a variety of different mathematical problems, questions and situations.

The *Approaches To Learning* are key to each unit as the final assessment task will focus on one or a set of related skills such as research for a presentation, or making observations & measurements for a lab report. Using one of the *Global Contexts* to focus each unit allows students to place learning in context and help students to develop attitudes and values based on knowledge and skills.

Aims of the Mathematics Course*

The aims of the teaching and study of MYP mathematics are to encourage and enable students to:

1. enjoy mathematics, develop curiosity and begin to appreciate its elegance and power
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
5. develop confidence, perseverance, and independence in mathematical thinking and problem-solving
6. develop powers of generalization and abstraction
7. apply and transfer skills to a wide range of real-life situations, other areas of knowledge and future developments
8. appreciate how developments in technology and mathematics have influenced each other
9. appreciate the moral, social and ethical implications arising from the work of mathematicians and the applications of mathematics
10. appreciate the international dimension in mathematics through an awareness of the universality of mathematics and its multicultural and historical perspectives
11. appreciate the contribution of mathematics to other areas of knowledge
12. develop the knowledge, skills and attitudes necessary to pursue further studies in mathematics
13. develop the ability to reflect critically upon their own work and the work of others

The content and illustrative material used for the 'Units of Work' are taken from the Lithuanian National Curriculum materials and are matched to the MYP objectives appropriate to the age level and complexity of the material concerned;

MYP Objectives & Interim Objectives*

A: Knowing and Understanding

Grade 6	Grade 8	Grade 10
<i>At the end of the first year, students should be able to:</i>	<i>At the end of the third year, students should be able to:</i>	<i>At the end of the fifth year, students should be able to:</i>
i. select appropriate mathematics when solving problems in both familiar and unfamiliar situations	i. select appropriate mathematics when solving problems in both familiar and unfamiliar situations	i. select appropriate mathematics when solving problems in both familiar and unfamiliar situations
ii. apply the selected mathematics successfully when solving problems	ii. apply the selected mathematics successfully when solving problems	ii. apply the selected mathematics successfully when solving problems
iii. solve problems correctly in a variety of contexts	iii. solve problems correctly in a variety of contexts	iii. solve problems correctly in a variety of contexts

B: Investigating Patterns

Grade 6	Grade 8	Grade 10
<i>At the end of the first year, students should be able to:</i>	<i>At the end of the third year, students should be able to:</i>	<i>At the end of the fifth year, students should be able to:</i>
i. apply mathematical problem-solving techniques to recognize patterns	i. select and apply mathematical problem solving techniques to discover complex patterns	i. select and apply mathematical problem solving techniques to discover complex patterns
ii. describe patterns as relationships or general rules consistent with correct findings	ii. describe patterns as relationships and/or general rules consistent with findings	ii. describe patterns as general rules consistent with findings
iii. verify whether the pattern works for other examples	iii. verify and justify relationships and/or general rules	iii. prove , or verify and justify , general rules

C: Communicating

Grade 6	Grade 8	Grade 10
<i>At the end of the first year, students should be able to:</i>	<i>At the end of the third year, students should be able to:</i>	<i>At the end of the fifth year, students should be able to:</i>
i. use appropriate mathematical language (notation, symbols and terminology) in both oral and written statements	i. use appropriate mathematical language (notation, symbols and terminology) in both oral and written explanations	i. use appropriate mathematical language (notation, symbols and terminology) in both oral and written explanations
ii. use different forms of mathematical representation to present information	ii. use appropriate forms of mathematical representation to present information	ii. use appropriate forms of mathematical representation to present information
iii. communicate coherent mathematical lines of reasoning	iii. move between different forms of mathematical representation	iii. move between different forms of mathematical representation
iv. organize information using a logical structure	iv. communicate complete and coherent mathematical lines of reasoning	iv. communicate complete, coherent and concise mathematical lines of reasoning
	v. organize information using a logical structure	v. organize information using a logical structure

D: Applying Mathematics in Real-Life Contexts

Grade 6	Grade 8	Grade 10
<i>At the end of the first year, students should be able to:</i>	<i>At the end of the third year, students should be able to:</i>	<i>At the end of the fifth year, students should be able to:</i>
i. identify relevant elements of authentic real-life situations	i. identify relevant elements of authentic real-life situations	i. identify relevant elements of authentic real-life situations
ii. select appropriate mathematical strategies when solving authentic real-life situations	ii. select appropriate mathematical strategies when solving authentic real-life situations	ii. select appropriate mathematical strategies when solving authentic real-life situations
iii. apply the selected mathematical strategies successfully to reach a solution	iii. apply the selected mathematical strategies successfully to reach a solution	iii. apply the selected mathematical strategies successfully to reach a solution
iv. explain the degree of accuracy of a solution	iv. explain the degree of accuracy of a solution	iv. justify the degree of accuracy of a solution
v. describe whether a solution makes sense in the context of the authentic real-life situation	v. explain whether a solution makes sense in the context of the authentic real-life situation	v. justify whether a solution makes sense in the context of the authentic real-life situation

Grade 6 mathematics units include:

- ◆ Simple word problems with integers, simple equations with integer solutions and introduction to inequalities
- ◆ Coordinate plane, point plotting, scales and axes, concept of correlated values, describe and name the shapes/vertices/points of shapes drawn on coordinate plane
- ◆ Recognition and Identification of solids, angle classification, drawing and labelling, mathematical drawing skills and accurate drawing of geometric shapes using appropriate mathematical tools
- ◆ Unit conversion and measurement and accurate use of measuring tools, concepts of perimeter, area and volume, fractions and the four main arithmetic operations with them, conversions between fractions, decimals and percentages
- ◆ Statistics: gathering and organizing data into tables
- ◆ Sorting expressions, equations and inequalities to develop understanding of concept, simple modelling with emphasis on vocabulary and applicable situations

Grade 7 mathematics units include:

- ◆ Word problems solutions: how to, simplifying variable expressions, simple equations and rearrangement, order of operations, simple inequalities
- ◆ Number: Proportions, ratios and percentages and calculations, negative numbers, rounding, estimating, modulus, visual representations
- ◆ Sum of angles in polygons: triangles, parallelograms and circles, perimeter and volume
- ◆ Geometry: angle, shape and triangle classification and properties, simple areas and perimeter calculations and representation, area of triangles investigation, 1D/2D and 3D concepts and vocabulary, introduction to volume and surface area,
- ◆ Speed-time and distance relationship and formulae, calculations, direct proportion concept and graphical analysis
- ◆ Probability & statistics: surveys and data handling, graph creation and interpretation

Grade 8 mathematics units include:

- ◆ Exponents and scientific notation: rules, operations & application (not including fractional exponents)
- ◆ Linear equations & inequalities, introduction to zero law and simple quadratics, Identifying and justifying which points belong to which equations, relationships between equations of parallel and perpendicular lines, graphical solutions to equations and inequalities, gradients and slopes, general form of a line
- ◆ Pythagorean theorem and radicals, square and cube roots, trapezium and parallelogram and their properties, 30-60-90 triangle properties, distance between two points
- ◆ Areas of composite shapes, surface area concept and calculation algorithm
- ◆ Geometry: surface areas and volumes, properties of parallel lines and angles, congruent triangles and the triangle inequality, basic solids and their properties
- ◆ Statistics and data processing, selecting appropriate charts and methods of data organization, mode-median-mean-range, introduction to permutations and combinations

Grade 9 mathematics units include:

- ◆ Sets groups and Venn diagrams
- ◆ Systems of linear equations & inequalities: Real numbers and operations, graphical solutions to equations and inequalities
- ◆ Triangles: congruence and similarity, similarity coefficient application in perimeter and area calculations quadrilaterals, trapezium, proving statements in mathematical language, complete solutions to right triangle problems, midpoints, distance from point to a line
- ◆ Quadratics: Real numbers and operations, modeling with linear and quadratic equations, graphical solutions to equations and inequalities, general form of a parabola, factorizing linear and quadratic equations
- ◆ Statistics and probability: collecting, organizing and interpreting data, representation of data and making conclusions, probability trees, interquartile range
- ◆ Review: exponents and radicals, simplification of expressions
- ◆ **Extension topics for grade 9:** general form of ellipse and hyperbola, linear programming & logistics

Grade 10 mathematics units include:

- ◆ Geometric transformations: translation, rotations, reflections and dilations by equation and visual representation
- ◆ Non-linear systems of equations
- ◆ Trigonometry: triangles and circles, properties of medians, perpendicular height (altitude) and bisectors, equation and sector of a circle, tangents and properties, central and inscribed angles, arcs and chords and their properties
- ◆ Functions: pattern recognition through functions, domain, range, max./min., proper application and analysis with functions
- ◆ Transformations of functions
- ◆ Advanced statistics and probability: dependent and independent, multivariate analysis, conditional probability, standard deviation, combinatorics
- ◆ **Extension topics for grade 10:** 3D Cartesian plane, vectors, sine and cosine rules, simple trigonometric identities in the unit circle, degrees and radians, sequences and series, Fibonacci, fractional exponents, logarithms and number bases

Assessment*

A variety of assessment methodologies are used within MYP Mathematics. Included in the list of age-appropriate strategies, employed in age-appropriate ways, depending upon the topics being studied, are the following:

Assessment tasks in MYP mathematics

Generally, criteria A, B and D are assessed with different kinds of tasks. Criterion C is often used to assess constructed responses and reports in combination with criterion B or D.

Criterion	Typical assessment tasks	Notes
Criterion A: Knowing and understanding	Classroom tests Examinations Assignments that include both familiar and unfamiliar situations	Tasks which use criterion A with criterion B will clearly define which aspects of the task will be assessed with each criterion, ensuring that the task is rigorous enough to allow students to achieve the highest levels of both criteria.
Criterion B: Investigating patterns	Mathematical investigations of some complexity that allow students: - to choose their own mathematical techniques - to reason from the specific to the general	Assessment tasks could have a variety of solutions and should enhance independent mathematical thinking.
Criterion C: Communicating	Investigations and real-life problems Reports that: - require logical structure - allow multiple forms of representation to present information	Criterion C is often used when students present a report, for example, that requires a logical structure in order to be followed and that would allow for several forms of representation to be used to present information.
Criterion D: Applying mathematics in real-life contexts	Opportunities to use mathematical concepts to solve real-life problems	For example: modelling or curve-fitting tasks based in authentic contexts. Mathematics can be used to model many situations (for example, painting a room, analysing mobile telephone tariff plans, triangulation, diet plans).

Students achieve a level from 1-8 in each criterion (A-D) and these are added together (max. 32 points) to calculate the Final Achievement Level using the following table.

MYP Final achievement Level	1	2	3	4	5	6	7
Total mark/32	1-5	6-9	10-14	15-18	19-23	24-27	28-32

In order for parents and students to appreciate MYP grades in other, perhaps more familiar, contexts please see the conversion tables below.

MYP Final achievement Level	1	2	3	4	5	6	7
Lithuanian system grades	1-2	3	4-5	6	7-8	9	10
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MYP Final achievement Level	1	2	3	4	5	6	7
Letter grades	F	E	D-D+	C-C+	B-B+	A	A+

* All information is taken from the IB MYP mathematics Guide for 2014