

Mathematics at Alto

Middle Years Program / IB Diploma Program

Introduction

Mathematics at Alto is taught in an integrated approach so that students build solid foundations and have regular exposure to the four main areas of mathematics which are number, algebra, shape, and data. The regular revisiting of topics permits students to be sure in their understanding as they push the boundaries of other standard curricula.

Middle Years Program

Grade 6

| Major Unit | Statement of Inquiry | Topics / Content |
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| Number sense and systems | Mathematics can be represented in different forms as influenced by time and place | <ul style="list-style-type: none"> Understanding base 10 system and place value Using different forms of rounding and decimal approximation Simplification of numerical expressions in the number systems and forms of number Use of number lines to represent data Forms of numbers: naturals, integers, rationals, place value and zero Ordering numbers Recognizing and classifying numbers in different number systems |
| Introduction to algebra (patterns) | A logical process is needed to see patterns in the natural world around us | <ul style="list-style-type: none"> Predicting the next term in a linear number sequence Finding a general rule for simple sequences |
| Fractions, decimals, and percentages | Different forms can make quantities easier to understand and use in everyday life | <ul style="list-style-type: none"> Conversion between different forms of numbers—fractions, decimals, and percentages Using the four number operations (addition, subtraction, multiplication and division) with fractions and decimals Transformation between different forms of numbers Representing a number as the product of its prime factors—find the greatest common divisor and least common multiple Percentage increase and decrease of simple percentages |
| Geometry (perimeter, area) | Change is the result of the decisions of humankind and therefore its responsibility | <ul style="list-style-type: none"> Geometrical elements and their classification Review of quadrilateral properties Finding the perimeter (circumference), and area of two-dimensional (2D) shapes Using appropriate forms of rounding to estimate results Converting between different units of measurement |
| Data management | Different representations make it easier to understand and analyse relationships within communities | <ul style="list-style-type: none"> Data collection Constructing and interpreting graphs |

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| Properties and construction of angles | Creativity is enhanced through an understanding of form and unique use of space | <ul style="list-style-type: none"> • Construction and measuring of angles • Naming and classifying different geometrical elements • Solving problems using the properties of angles in different figures or positions • Solving problems involving acute, right and obtuse angles in triangles |
| Probability | Using a set mathematical process can help us make decisions and choices based on our personal values | <ul style="list-style-type: none"> • Calculating probabilities of simple events • Solving simple problems using tree diagrams |

Grade 7

| Major Unit | Statement of Inquiry | Topics / Content |
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| Ratios, rates, and proportions | A logical process helps us simplify quantities and make informed decisions regarding the opportunities of a connected world | <ul style="list-style-type: none"> • Dividing a quantity in a given ratio • Converting between different units of measurement and between different currencies • Finding a constant of proportionality and setting up equations |
| Geometry | Using finite resources responsibly must be taken into consideration when designing structures | <ul style="list-style-type: none"> • Finding the perimeter and area of complex 2D shapes • Finding the volume of cylinders and basic prisms |
| Integers | Quantities are represented in different ways to help us understand changes in our natural environment | <ul style="list-style-type: none"> • Operations with integers • Representing integers on a number line • Identifying the different components of the Cartesian plane: axes, origin, coordinates (x, y) and points |
| Algebraic expressions and equations | Cultures express themselves through pattern design | <ul style="list-style-type: none"> • Expanding and simplifying algebraic expressions • Changing the subject of the formula • Using substitution to evaluate expressions • Solving equations using algebraic fractions • Finding and justifying a general rule for simple sequences |
| Geometry — parallel lines and transversals | Logic can be used to justify what we discover through measurement | <ul style="list-style-type: none"> • Solving problems using the properties of angles in intersecting and parallel lines • Naming and classifying different geometrical elements • Developing basic proofs |
| Statistics | Different representations make it easier to understand and analyse global relationships and explore responsibilities within them | <ul style="list-style-type: none"> • Constructing and interpreting graphs • Calculating the mean, median and mode • Choosing the best measure of central tendency |
| Transformations | Creativity is enhanced through an understanding of form and shape | <ul style="list-style-type: none"> • Transforming a figure by rotation, reflection, translation and enlarging • Solving the properties of regular polygons |

Grade 8

| Major Unit | Statement of Inquiry | Topics / Content |
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| Algebra | Modelling using a logical process helps us understand the world around us | <ul style="list-style-type: none"> • Solving basic equations involving algebraic fractions • Factorization of linear and quadratic expressions • Finding and justifying general rules/formulae for sequences |

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| Triangle geometry | The mathematical discoveries of yesterday continue to help us solve problems today | <ul style="list-style-type: none"> Solving problems involving triangles by using Pythagoras' theorem and its converse |
| Exponents | Simplification requires an understanding and logical application of rules within a system | <ul style="list-style-type: none"> Evaluating numbers with integer exponents Deriving and using the laws of exponents |
| Geometry— Compound volume and surface area | An understanding of form and space can benefit our communities | <ul style="list-style-type: none"> Finding the volume and surface area of regular and compound shapes |
| Linear relationships | Relationships in our natural world can be represented using models which allow us to better understand changes within it | <ul style="list-style-type: none"> Understanding and using the Cartesian plane The components of the linear function $y = mx + c$ Solving linear equations algebraically and graphically Graphing linear functions and understanding their characteristics |
| Scatter plots | Models can help us understand the impact of humankind on our world and allow us to explore our rights and responsibilities when sharing finite resources with others | <ul style="list-style-type: none"> Graphical analysis and representation of data in scatter plots Constructing and interpreting scatter plots Drawing a line of best fit |

Grade 9

| Major Unit | Statement of Inquiry | Topics / Content |
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| Quadratic relationships | Modelling helps understand relationships between variables and can inform behaviour | <ul style="list-style-type: none"> Factorization of quadratic expressions Solving quadratic equations algebraically and graphically Analysing and using well- defined procedures for solving complex problems |
| Linear functions | Patterns in the natural world can be represented as relationships and thus help in making predictions | <ul style="list-style-type: none"> The linear function $f(x) = mx + c$, its graph, gradient and y-intercept Parallel and perpendicular lines and the relationships between their gradients Solving equations algebraically and graphically Solving simultaneous equations |
| Coordinate geometry | Systems of representation have their limitations | <ul style="list-style-type: none"> Understanding and using the Cartesian plane and plotting points. Finding distances between points and finding the midpoint |
| Similarity and Right-angle trigonometry | Using knowledge it is possible to calculate what we cannot measure | <ul style="list-style-type: none"> Properties of similar triangles Trigonometric ratios in right-angled triangles Relating angles and sides of right-angled triangles using sine, cosine and tangent Solving problems involving similarity Solving problems in right- angled triangles using trigonometric ratios |
| 3D and complex shapes | Appropriate calculations can save natural resources | <ul style="list-style-type: none"> Finding the perimeter (circumference), area and volume of regular and irregular two-dimensional (2D) and three- dimensional (3D) shapes Compound shapes |
| Central tendency and range for continuous data | Logic can help us justify our choices | <ul style="list-style-type: none"> Calculating the mean, median and mode, and choosing the best measure of central tendency |

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| | | <ul style="list-style-type: none"> • Box-and-whisker plots • Representation using box and whisker diagram |
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Grade 10

| Major Unit | Statement of Inquiry | Topics / Content |
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| Quadratic functions | Using a model to represent a relationship can improve decision making | <ul style="list-style-type: none"> • Graphing quadratic function and understanding its characteristics • Determining composite functions and their graphs. • Addition and subtraction of functions • Describing and analysing transformed quadratic functions • Determining the range, given the domain • Translating, reflecting and dilating functions |
| Linear programming | Representing a system of relationships can help us understand how to make better use of resources | <ul style="list-style-type: none"> • Solving and graphing linear inequalities • Linear programming |
| Sinusoidal functions | Changing parameters of a shape can lead to desired outcomes | <ul style="list-style-type: none"> • Transformation of sine and cosine functions • Graphing sine and cosine functions and understanding their characteristics • Using the sine and cosine rules to solve problems • Trigonometric identities • The unit circle |
| Exponentials and logarithms | Discovering relationships can lead to understanding how systems evolve | <ul style="list-style-type: none"> • Finding and justifying a general rule for a sequence • Arithmetic and geometric series • Developing, and justifying or proving, general rules/formulae for sequences • Finding the sum of the series, including infinite series • Using the laws of logarithms • Determining inverse functions and their graphs |
| Circle geometry | Logic can be used to justify what we discover through measurement | <ul style="list-style-type: none"> • Using circle theorems to find lengths of chords and measures of angles • Converting angles between degrees and radians • Solving problems using radians |
| Vectors | Using different forms of representation can help to make more successful journeys | <ul style="list-style-type: none"> • Addition, subtraction and scalar multiplication of vectors, both algebraically and graphically • Dot product |
| Probability | Decisions reached through logic may not reflect beliefs and values | <ul style="list-style-type: none"> • Calculating probabilities of independent events, mutually exclusive events, and combined events • Solving problems using tree diagrams and Venn diagrams • Calculating conditional probability |

IB Diploma Program

Students select either higher level (HL) or standard level (SL) mathematics at Alto. Students entering the course must choose between analysis and approaches or applications and interpretations. [Read more.](#)

Grade 11 - Standard Level

| Major Unit | Topics / Content |
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| From patterns to generalisations | <ul style="list-style-type: none">• Number patterns and sigma notation• Arithmetic and geometric sequences• Binomial theorem• Proof |
| Representing relationships | <ul style="list-style-type: none">• Function notation• Drawing functions• Domain and range of functions• Composite and inverse functions |
| Modelling relationships | <ul style="list-style-type: none">• Gradient of a linear function• Transformation of functions• Graphing quadratic functions• Solving quadratic functions• The quadratic formula and the discriminant• Applications of quadratics |
| Equivalent representations | <ul style="list-style-type: none">• The reciprocal function• Transforming reciprocal functions• Rational functions |
| Measuring change | <ul style="list-style-type: none">• Limits and convergence• The derivative functions• Differentiation rules• Graphical representation of first and second derivatives• Applications of differential calculus: optimisation and kinematics |
| Representing data | <ul style="list-style-type: none">• Sampling• Presentation of data• Measures of central tendency• Measures of dispersion |
| Modelling relationships between data sets | <ul style="list-style-type: none">• Scatter diagrams• Measuring correlation• The line of best fit• Least squares regression |

Grade 11 - High Level

| Major Unit | Topics / Content |
|----------------------------------|---|
| From patterns to generalisations | <ul style="list-style-type: none">• Sequences and series• Arithmetic and geometric sequences• Proof• Counting principles and the binomial theorem |
| Representing relationships | <ul style="list-style-type: none">• Functions and their graphs• Classification of functions• Operations with Functions• Graphical functional transformations |
| Expanding the number system | <ul style="list-style-type: none">• Quadratic equations and inequalities• Complex numbers• Polynomial equations and inequalities• Fundamental theorem of algebra |

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| | <ul style="list-style-type: none"> • Solving equations and inequalities • Solving systems of linear equations |
| Measuring change | <ul style="list-style-type: none"> • Limits, continuity and convergence • The derivative of a function • Differentiation rules • Graphical representations of derivatives • Applications of differential calculus • Implicit differentiation |
| Analysing data and quantifying randomness | <ul style="list-style-type: none"> • Sampling • Descriptive statistics • Justification of statistical techniques • Correlation, causation and linear regression |

Grade 12 - Standard Level

| Major Unit | Topics / Content |
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| Quantifying randomness | <ul style="list-style-type: none"> • Theoretical and experimental probability • Venn diagrams and sample spaces • Independent and dependent events • Probability tree diagrams |
| Representing equivalent quantities | <ul style="list-style-type: none"> • Exponents • Logarithms • Derivatives of exponential and logarithmic functions |
| Approximation to generalisation | <ul style="list-style-type: none"> • Antiderivatives • Indefinite integrals • Area and definite integrals • Area between two curves |
| Relationships in space | <ul style="list-style-type: none"> • Geometry of 3D shapes • Right angled trigonometry • Non-right angled trigonometry • Applications of trigonometry |
| Periodic relationships | <ul style="list-style-type: none"> • Radians, arcs, sectors and segments • Trigonometric ratios and the unit circle • Trigonometric identities and equations • Trigonometric functions |
| Modelling change | <ul style="list-style-type: none"> • Derivatives of sine and cosine • Applications of derivatives • Integration with sine, cosine and substitution • Kinematics and accumulating change |
| Valid comparisons and informed decisions | <ul style="list-style-type: none"> • Random variables • Binomial distribution • Normal distribution |

Grade 12 - High Level

| Major Unit | Topics / Content |
|----------------------------|--|
| Relationships in space | <ul style="list-style-type: none"> • Properties of 3D space • Angles of measure • Ratios and identities • Trigonometric functions • Trigonometric equations |
| Generalising relationships | <ul style="list-style-type: none"> • Integration as antidifferentiation • Exponents and logarithms • Derivatives of exponential and logarithmic functions |

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| | <ul style="list-style-type: none"> • Integration Techniques |
| Modelling change | <ul style="list-style-type: none"> • Areas and Volumes • Kinematics • Ordinary differential equations |
| Modelling 3D space | <ul style="list-style-type: none"> • Geometrical representation of vectors • Vector algebra and scalar products • Vector equations • Vector products and their properties • Vector equation of a plane • Application of vector |
| Equivalent systems of representation | <ul style="list-style-type: none"> • Forms of complex number • Operations with complex numbers in polar form • Powers and roots of complex numbers in polar form |

Detailed scope and sequences for each grade might vary. Also teachers are encouraged to incorporate current events into the curriculum and adapt their statement of inquiry based on classroom discussions.