

Mathematics

The Mathematics Department of St Thomas More Catholic School aims to provide a foundation for all to: develop an understanding of the world; have the ability to reason mathematically; show an appreciation of the beauty and power of mathematics; and to have a sense of enjoyment and curiosity about the subject of Mathematics. It is essential to everyday life, critical to science, technology and engineering, and necessary for financial literacy and most forms of employment and therefore essential that we equip all students to reach their full potential.

Key Stage 3 and 4

The Mathematics Department curriculum has been developed to ensure that all students become fluent in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that students develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately. Students also develop their ability to reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language.

The curriculum is structured around the following Key Concepts:

The structure of the number system & working with number	Algebra	Probability & Statistics	Geometry & Measures
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The key concepts are covered across the following topics in Key Stage 3:

	Module 1	Module 2	Module 3
Year 7	<p>Number</p> <ul style="list-style-type: none"> ● Rounding (decimal places) ● Calculations ● BIDMAS ● Negative Numbers ● Powers and Roots ● Factors, Multiples, Primes ● Highest Common Factor, Lowest Common Multiple ● Fractions Basics ● Decimal Basics ● Equivalence of Fractions, Decimals and Percentages 	<p>Number</p> <ul style="list-style-type: none"> ● Fractions (Operations) ● Decimals (Operations) ● Percentages of Amounts ● Use of a Calculator <p>Ratio & Proportion</p> <ul style="list-style-type: none"> ● Proportion (eg recipes, currency conversions) <p>Algebra</p> <ul style="list-style-type: none"> ● Forming expressions ● Simplifying Expressions ● Substitution ● Multiply out single brackets <p>Geometry & Measures</p> <ul style="list-style-type: none"> ● Metric Units - types 	<p>Probability & Statistics</p> <ul style="list-style-type: none"> ● Averages (list) ● Probability Basics (simple probabilities, scales) ● Collecting Data and Simple Graphs <p>Geometry & Measures</p> <ul style="list-style-type: none"> ● Shapes - names and properties ● Area and Perimeter ● Volume and Surface Area of Cuboids <p>Algebra</p> <ul style="list-style-type: none"> ● Coordinates ● Function Machines ● Solving Linear Equations

		<ul style="list-style-type: none"> and converting • Time and Timetables • Angles - basic properties 	
Year 8	<p>Number</p> <ul style="list-style-type: none"> • Prime Factors • Rounding (significant figures) • Estimation • Percentage Change <p>Ratio & Proportion</p> <ul style="list-style-type: none"> • Forming and Simplifying Ratio • Splitting an Amount in Ratio <p>Algebra</p> <ul style="list-style-type: none"> • Factorising (single bracket) • Forming Linear Equations • Linear Inequalities 	<p>Geometry & Measures</p> <ul style="list-style-type: none"> • Area and Circumference of Circles • Volume and Surface Area of Prisms • Transformations • Angles and Parallel Lines • Angles in Polygons <p>Algebra</p> <ul style="list-style-type: none"> • Drawing Straight Line Graphs • Sequences and “nth” term 	<p>Probability & Statistics</p> <ul style="list-style-type: none"> • Listing Outcomes Systematically • Sample Space Diagrams • Relative Frequency • Averages from Tables • Frequency Trees • Two Way Tables • Pie Charts • Scatter Diagrams • Venn diagrams <p>Algebra</p> <ul style="list-style-type: none"> • Rearranging Simple Formulae • Drawing Straight Line Graphs <p>Geometry & Measures</p> <ul style="list-style-type: none"> • Plans & Elevations • Isometric Drawing of 3D Shapes
Year 9	<p>Number</p> <ul style="list-style-type: none"> • Negative Indices and Reciprocal • Standard Form • Reverse Percentages • Successive Percentage Changes • Error Intervals and Simple Bounds <p>Algebra</p> <ul style="list-style-type: none"> • Laws of Indices • Multiply Out Double Brackets • Factorising Quadratics 	<p>Probability & Statistics</p> <ul style="list-style-type: none"> • Venn Diagrams • Time Series • Probability Tree Diagrams <p>Geometry & Measures</p> <ul style="list-style-type: none"> • Pythagoras • Trigonometry of Right-Angled Triangles (SOHCAHTOA) • Arcs and Sectors • Volume and Surface Area of Cylinders 	<p>Algebra</p> <ul style="list-style-type: none"> • Equation of Straight Line Graphs • Quadratic Graphs • Simultaneous Equations <p>Ratio & Proportion</p> <ul style="list-style-type: none"> • Speed, Distance, Time • Density, Mass, Volume • Pressure • Similarity (lengths) <p>Probability & Statistics</p> <ul style="list-style-type: none"> • Combining Averages • Collecting Data <p>Geometry & Measures</p> <ul style="list-style-type: none"> • Bearings

At Key Stage 4 we continue to develop and build upon the skills acquired at Key Stage 3. We will aim to enable students to:

- develop fluent knowledge, skills and understanding of mathematical methods and concepts
- acquire, select and apply mathematical techniques to solve problems
- reason mathematically, make deductions and inferences, and draw conclusions
- comprehend, interpret and communicate mathematical information in a variety of forms appropriate to the information and context.

The table below shows the topics pupils will study throughout Key Stage 4:

Year 10 Foundation	<ul style="list-style-type: none"> ● Integers and place value ● Decimals and rounding ● Indices, powers, roots, and priority of operations ● Factors, multiples, and primes ● Basics of algebra ● Expressions and substitution 	<ul style="list-style-type: none"> ● Tables charts and graphs ● Handling data and pie charts ● Fractions, decimals, and percentages ● Equations and inequalities ● Ratio ● Percentages ● Sequences ● Shapes, parallel lines and angles 	<ul style="list-style-type: none"> ● Basics of graphs ● Transformations ● Sampling and averages ● Perimeter, area and volume
Year 10 Higher	<ul style="list-style-type: none"> ● Calculations, checking and rounding ● Indices, reciprocals and BIDMAS ● Factors, multiples, standard form, and surds ● Basic algebra ● Sequences ● Averages and range 	<ul style="list-style-type: none"> ● Representing data, scatter graphs ● Fractions and percentages ● Ratio and proportion ● Angle rules ● Pythagoras and trigonometry 	<ul style="list-style-type: none"> ● Graphs: the basics ● Linear graphs and coordinate geometry ● Quadratic, cubic and other graphs ● Perimeter, area and circles 3D shapes ● Accuracy and bounds
Year 11 Foundation	<ul style="list-style-type: none"> ● Changing the subject ● Plotting Straight line graphs ● Equations of straight line graphs ● Parallel lines ● Pythagoras ● Probability 	<ul style="list-style-type: none"> ● Profit and loss ● Speed, density and pressure ● Reverse percentages ● Drawing quadratic graphs ● Solving quadratic equations ● Fractions ● Right angled trigonometry ● Proportion ● Volume and surface area ● Sectors ● Simultaneous equations ● Angles in polygons 	<ul style="list-style-type: none"> ● Scatter graphs ● Similarity and congruence ● Algebra and graphs including reciprocals ● 3D shapes - plans and elevations ● Constructions ● Loci ● Vectors
Year 11 Higher	<ul style="list-style-type: none"> ● Transformations ● Cumulative frequency ● Histograms ● Probability 	<ul style="list-style-type: none"> ● Algebraic proportion including graphs ● Circle Theorems ● Similarity and 	<ul style="list-style-type: none"> ● Vectors ● Non linear graphs ● Circle geometry ● Advanced graphs

	<ul style="list-style-type: none"> • Quadratic and simultaneous equations • Linear inequalities • Multiplicative reasoning 	<ul style="list-style-type: none"> • Congruence • Algebraic fractions • Algebraic proof • Functions • Rationalising the denominator • Sine and Cosine rule • Area of a triangle (trigonometry) • Bearings • Constructions • Loci 	<ul style="list-style-type: none"> • including reciprocals and exponential functions • Transforming graphs • Area under a curve • Graph of trigonometric functions • Sampling methods <p>Exam Preparation</p>
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Key Stage 5 Mathematics & Further Mathematics

Key Stage 5 Mathematics builds from Key Stage 4 and introduces calculus and its applications.

Further Mathematics B (MEI) is both deeper and broader than A level mathematics. AS and A Level Further Mathematics build from GCSE Level and AS and A Level Mathematics. As well as building on algebra and calculus introduced in A Level Mathematics, the A Level Further Mathematics core content introduces complex numbers and matrices, fundamental mathematical ideas with wide applications in mathematics, engineering, physical sciences and computing. The non-core content includes different options that can enable students to specialise in areas of mathematics that are particularly relevant to their interests and future aspirations.

Both courses emphasise how mathematical ideas are interconnected and how mathematics can be applied to model situations using algebra and other representations, to help make sense of data, to understand the physical world and to solve problems in a variety of contexts, including social sciences and business. It prepares students for further study and employment in a wide range of disciplines involving the use of mathematics. These Key Concepts are applied, along with associated mathematical thinking and understanding, across the whole of the detailed content in this specification.

Key Concepts in Key Stage 5 Mathematics

Mathematical argument, language and proof	Mathematical problem solving	Mathematical modelling
<ul style="list-style-type: none"> • Construct and present mathematical arguments through appropriate use of diagrams; sketching graphs; logical deduction; precise statements involving correct use of symbols and connecting language, including: constant, coefficient, expression, equation, function, identity, index, term, variable • Understand and use mathematical language and syntax as set out in the content • Understand and use language and symbols associated with set theory, as set out in the 	<ul style="list-style-type: none"> • Recognise the underlying mathematical structure in a situation and simplify and abstract appropriately to enable problems to be solved • Construct extended arguments to solve problems presented in an unstructured form, including problems in context • Interpret and communicate solutions in the context of the original problem • Understand that many mathematical problems cannot be solved analytically, but numerical methods permit solution to a required level of accuracy • Evaluate, including by making reasoned estimates, the accuracy 	<ul style="list-style-type: none"> • Translate a situation in context into a mathematical model, making simplifying assumptions • Use a mathematical model with suitable inputs to engage with and explore situations (for a given model or a model constructed or selected by the student) • Interpret the outputs of a mathematical model in the context of the original situation (for a given model or a model constructed or selected by the student)

<p>content Apply to solutions of inequalities and probability</p> <ul style="list-style-type: none"> • Understand and use the definition of a function; domain and range of functions • Comprehend and critique mathematical arguments, proofs and justifications of methods and formulae, including those relating to applications of mathematics 	<p>or limitations of solutions, including those obtained using numerical methods</p> <ul style="list-style-type: none"> • Understand the concept of a mathematical problem solving cycle, including specifying the problem, collecting information, processing and representing information and interpreting results, which may identify the need to repeat the cycle • Understand, interpret and extract information from diagrams and construct mathematical diagrams to solve problems, including in mechanics 	<ul style="list-style-type: none"> • Understand that a mathematical model can be refined by considering its outputs and simplifying assumptions; evaluate whether the model is appropriate • Understand and use modelling assumptions
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The table below shows you the topics pupils will study throughout the A level Mathematics course during Key Stage 5:

	Module 1	Module 2	Module 3
Year 12	<p>Core</p> <ul style="list-style-type: none"> • Surds & Indices • Quadratic Functions • Equations & Inequalities • Coordinate Geometry • Polynomials • Graphs & Transformations <p>Statistics</p> <ul style="list-style-type: none"> • Processing & Representing Data <p>Mechanics</p> <ul style="list-style-type: none"> • Kinematics 	<p>Core</p> <ul style="list-style-type: none"> • Binomial Expansion • Proof • Trigonometry • Differentiation <p>Statistics</p> <ul style="list-style-type: none"> • Probability <p>Mechanics</p> <ul style="list-style-type: none"> • Forces 	<p>Core</p> <ul style="list-style-type: none"> • Integration • Vectors • Exponentials and Logarithms • Radians • Sequences & Series <p>Statistics</p> <ul style="list-style-type: none"> • Binomial Distribution • Hypothesis Testing • Collecting Data <p>Mechanics</p> <ul style="list-style-type: none"> • Variable Acceleration
Year 13	<p>Core</p> <ul style="list-style-type: none"> • Functions • Differentiation • Integration <p>Statistics</p> <ul style="list-style-type: none"> • Probability <p>Mechanics</p> <ul style="list-style-type: none"> • Kinematics (2D) • Force & Motion 	<p>Core</p> <ul style="list-style-type: none"> • Binomial Expansion • Partial Fractions • Trigonometric Functions and Identities • Parametric Equations • Vectors <p>Statistics</p> <ul style="list-style-type: none"> • Probability Distributions <p>Mechanics</p> <ul style="list-style-type: none"> • Moments • Projectiles 	<p>Core</p> <ul style="list-style-type: none"> • Differential Equations • Numerical Methods • Proof <p>Statistics</p> <ul style="list-style-type: none"> • Hypothesis Testing <p>Mechanics</p> <ul style="list-style-type: none"> • Friction

The table below shows you the topics pupils will study on the A level Further Mathematics course:

	Year 12	Year 13
Further Maths	<p>Core</p> <ul style="list-style-type: none"> • Matrices and Transformations • Introduction to complex numbers • Roots of Polynomials • Sequences and series • Complex numbers and geometry • Matrices and their inverses • Vectors and 3D space <p>Mechanics</p> <ul style="list-style-type: none"> • Kinematics • Forces and motion • A model for friction • Moments of forces • Work, energy and power • Impulse and momentum • Centre of mass 1 • Dimensional analysis <p>Statistics</p> <ul style="list-style-type: none"> • Statistical problem solving • Discrete random variables • Discrete probability distributions • Bivariate data (correlation coefficients) • Bivariate data (regression lines) • Chi-squared tests 	<p>Core</p> <ul style="list-style-type: none"> • Vectors 1 • Matrices • Series and induction • Further Calculus • Polar Coordinates • Maclaurin series • Hyperbolic functions • Applications of integration • First order differential equations • Complex numbers • Vectors 2 • Second order differential equations <p>Mechanics</p> <ul style="list-style-type: none"> • Motion under a variable source • Circular motion • Hooke's law • Modelling oscillations • Centre of mass 2 • Oblique impact <p>Statistics</p> <ul style="list-style-type: none"> • Conditional probability • Continuous random variables • Expectation algebra and the Normal distribution • Confidence intervals • Hypothesis testing • Simulation