Curriculum Intent

A level Mathematics is often thought of as a subject of complicated calculations dealing with highly abstract topics. However, studying it also gives us the power to discover and identify essential practical information used in our day-to-day lives as mathematics underpins virtually all the practical developments in science, IT and economics which have formed our modern world. Mathematics is a versatile qualification, well-respected by employers and is a "facilitating" subject for entry to higher education; for most science, technology, engineering and mathematics (STEM) degree courses A level Mathematics is a requirement. It is also of great benefit to students studying geography, psychology, economics and business studies.

AQA A level 7357 specification in mathematics encourages students to:

• understand mathematics and mathematical processes in a way that promotes confidence, fosters enjoyment and provides a strong foundation for progress to further study
extend their range of mathematical skills and techniques
• understand coherence and progression in mathematics and how different areas of mathematics are connected
• apply mathematics in other fields of study and be aware of the relevance of mathematics to the world of work and to situations in society in general
• use their mathematical knowledge to make logical and reasoned decisions in solving problems both within pure mathematics and in a variety of contexts, and communicate the mathematical rationale for these decisions clearly
• reason logically and recognise incorrect reasoning
• generalise mathematically
• construct mathematical proofs
• use their mathematical skills and techniques to solve challenging problems which require them to decide on the solution strategy
• recognise when mathematics can be used to analyse and solve a problem in context
• represent situations mathematically and understand the relationship between problems in context and mathematical models that may be applied to solve them
• draw diagrams and sketch graphs to help explore mathematical situations and interpret solutions
• make deductions and inferences and draw conclusions by using mathematical reasoning
• interpret solutions and communicate their interpretation effectively in the context of the problem
• read and comprehend mathematical arguments, including justifications of methods and formulae, and communicate their understanding
• read and comprehend articles concerning applications of mathematics and communicate their understanding
• use technology such as calculators and computers effectively and recognise when such use may be inappropriate
• take increasing responsibility for their own learning and the evaluation of their own mathematical development

Curriculum Implementation:

A level Mathematics at Ecclesbourne is taught by two teachers concurrently. One teacher delivers Pure and Mechanics and the other Pure and Statistics.

ear	Term		Content	
12	Autumn	1	PURE TOPIC 2: Straight Lines & Circles Prior Learning GCSE Equation of a straight line, equation of a circle centre (0,0), parallel and perpendicular lines and circle theorems. Understand and use the equation of a straight line, including the forms y=mx+c and ax+by+c=0. Gradient conditions for two straight lines to be parallel or perpendicular. Be able to use straight line models in a variety of real life contexts eg gas bill: standing charge and price per unit. Understand and use the coordinate geometry of the circle including using the equation of a circle; completing the square to find the centre and radius of a circle; use of the following properties: the angle in a semicircle is a right angle, the perpendicular from the centre to a chord bisects the chord, the radius of a circle at a given point on its circumference is perpendicular to the tangent to the circle at that point. PURE TOPIC 3: Differentiation Prior Learning GCSE Laws of indices including rational exponents, rates of change and gradients. Differentiate x^n , for rational values of n , and related constant multiples, sums and differences. Understand and use the derivative of f(x) as the gradient of the tangent to the graph of y=f(x) at a general point (x, y). Differentiation from first principles for small positive integer powers of x and hence the gradient of the tangent is a limit. Interpretation of differentiation as a rate of change; Understand and use the second derivative as the rate of change of gradient. Sketching the gradient function for a given curve. Apply differentiation to find gradients, tangents and normals, maxima and	PURE TOPIC 1: Algebraic Manipulation, Quadratic Equations and Simultaneous Equations Prior learning GCSE Simplifying and manipulating algebraic expressions, laws of indices, quadratic equations and graphs and simultaneous equations. Understand and use the laws of indices for all rational exponents. Use and manipulate surds, including rationalising the denominator. Work with quadratic functions and their graphs; the discriminant of a quadratic function, including the conditions for real and repeated roots; completing the square; solution of quadratic equations including solving disguised quadratic equations. Solve simultaneous equations in two variables by elimination and by substitution, including one linear and one quadratic equation. Manipulate polynomials algebraically, including expanding brackets and collecting like terms, factorisation and simple algebraic division; use of the factor theorem. Simplifying rational expressions will be covered in year 13 PURE TOPIC 4: Graphs, Linear & Quadratic Inequalities Prior Learning GCSE Linear graphs, quadratic graphs, simple cubic graphs, reciprocal graphs and transformations of given functions. Solve linear and quadratic inequalities in a single variable and interpret such inequalities graphically, including inequalities with brackets and fractions. Represent linear and quadratic inequalities graphically. Express solutions through correct use of ‘and’ and ‘or’, or through set notation. Understand and use graphs of functions; sketch curves defined by simple equations. Interpret algebraic solution of equations graphically; use intersection points of graphs to solve

			minima and stationary points. Identify where functions are increasing or decreasing. *The connection of the second derivative to convex and concave sections of curves and points of inflection will be covered in year 13, as will derivatives of trigonometric functions, exponentials and logs*	equations. Understand and use proportional relationships and their graphs. Understand the effect of simple transformations on the graph of y=f(x) including sketching associated graphs: y=af(x), y=f(x)+a, y=f(x+a), y=f(ax), y=-f(x), y=f(-x) *Combinations of transformations and the modulus function will be covered in year 13*
	Autumn	2	PURE TOPIC 5: Integration Prior Learning GCSE Laws of indices including rational exponents and area under a curve. Know and use the Fundamental Theorem of Calculus which is that integration is the reverse of differentiation. Integrate x^n (excluding n=-1), and related sums, differences and constant multiples. Find y = f(x) given the derivative (gradient function) and a point on the graph. Evaluate definite integrals; use a definite integral to find the area under a curve. *The integrals of e^{kx}, $\frac{1}{x}$, sin kx and cos kx and the area bounded by two curves will be covered in year 13* PURE TOPIC 7: Binomial Expansions Prior Learning GCSE Laws of indices and multiplying brackets. Understand and use the binomial expansion of $(a+bx)^n$ for positive integer n. Evaluate ^nC_r using $^nC_r = \frac{n!}{r!(n-r)!}$ algebraically and simplify. *The binomial expansion for any rational n will be covered in year 13* STATISTICS TOPIC 1: Statistical Sampling Prior Learning GCSE Basic statistics to describe a population Understand and use the terms 'population', 'sample', 'parameter' and 'statistic'. Use samples to make informal inferences about the population. Understand and use sampling techniques, including simple random, systematic, opportunity, stratified, quota and cluster sampling. Select or critique sampling techniques (including stratification) in the context of solving a statistical problem,	PURE TOPIC 6: Trigonometry Prior Learning GCSE Trigonometric ratios in right angled triangles, Sine and Cosine rules and quadratic equations. Understand and use the definitions of sine, cosine and tangent for angles of any size. The sine and cosine rules; the area of a triangle in the form $\frac{1}{2}\ ab\ \sin C$. Be aware of the ambiguous case that can arise from the use of the sine rule. Understand and use the sine, cosine and tangent functions; their graphs, symmetries, asymptotes and periodicity and simple transformations of them. Understand and use $\tan\theta = \frac{\sin\theta}{\cos\theta}$ and $\sin^2\theta + \cos^2\theta = 1$. Solve simple trigonometric equations in a given interval, including quadratic equations in sin, cos and tan and equations involving multiples of the unknown angle. *The use of radians, the exact values of sine, cosine and tangent for common values and the identities involving secant, cosecant and cotangent will be covered in year 13*

			including understanding that different samples can lead to different conclusions about the population and could overcome practical problems when sampling. Become familiar with the Large Data Set.	
	Spring	3	STATISTICS TOPIC 2: Data Presentation & Interpretation Prior Learning GCSE Scatter graphs and correlation, mean, median, quartiles and inter-quartile range Interpret diagrams for single-variable data, including understanding that area in a histogram represents frequency. Connect to probability distributions using relative frequencies. Interpret scatter diagrams and regression lines for bivariate data, including recognition of scatter diagrams which include distinct sections of the population (calculations involving regression lines are excluded). Become familiar with the Large Data Set. Interpret measures of central tendency and variation, extending to standard deviation. Be able to calculate standard deviation, including from summary statistics. Recognise and interpret possible outliers in data sets and statistical diagrams. Select or critique data presentation techniques in the context of a statistical problem. Be able to clean data, including dealing with missing data, errors and outliers. STATISTICS TOPIC 3: Probability & Statistical Distributions Prior Learning GCSE Basic probability calculations, sample spaces and tree diagrams Understand and use mutually exclusive and independent events when calculating probabilities. Link to discrete and continuous distributions. Understand and use simple, discrete probability distributions (calculation of mean and variance of discrete random variables is excluded). Including the binomial distribution, as a model; calculate probabilities using the binomial distribution.	PURE TOPIC 8: Exponentials & Logarithms Prior Learning GCSE Laws of indices and growth and decay. Know and use the functions a^x and e^x and their graphs, where a is positive. Know that the gradient of e^{kx} is equal to ke^{kx} and hence understand why the exponential model is suitable in many applications. Know and use the definition of $\log_a x$ as the inverse of a^x, where a is positive and x≥0. Know and use the function lnx and its graph, and know lnx as the inverse function of e^x. Understand and use the laws of logarithms. Solve equations of the form $a^x=b$. Use a combination of simple transformations of the exponential and logarithm functions. Use logarithmic graphs to estimate parameters in relationships of the form $y=ax^n$ and $y=kb^x$, given data for x and y. Understand and use exponential growth and decay; use in modelling (examples may include the use of e in continuous compound interest, radioactive decay, drug concentration decay, exponential growth as a model for population growth); consideration of limitations and refinements of exponential models. PURE MATHS TOPIC 9: Vectors Prior Learning GCSE Vectors in 2D as column vectors and vector arithmetic Use vectors in two dimensions defined by column vector, in i and j notation and given by magnitude and direction. Calculate the magnitude and direction of a vector and convert between component form and magnitude/direction form. Add vectors diagrammatically and perform the algebraic operations of vector addition and multiplication by scalars, and understand their geometrical interpretations. Understand and use position vectors; calculate the distance between two points represented by position vectors. Use vectors to solve problems in pure mathematics and in context, including forces.

				Vectors in three dimensions and the use of vectors in kinematics problems will be covered in year 13
	Spring	4	STATISTICS TOPIC 3 - continued STATISTICS TOPIC 4: Statistical Hypothesis Testing Prior Learning A Level year 12 The Binomial distribution Understand and apply the language of statistical hypothesis testing, developed through a binomial model: null hypothesis, alternative hypothesis, significance level, test statistic, 1-tail test, 2-tail test, critical value, critical region, acceptance region, p-value (probability of test statistic or more extreme result occurring). Conduct a statistical hypothesis test for the proportion in the binomial distribution and interpret the results in context. Understand that a sample is being used to make an inference about the population and appreciate that the significance level is the approximate probability of incorrectly rejecting the null hypothesis. *The use of correlation coefficients in hypothesis testing will be covered in year 13*	MECHANICS TOPIC 1: Kinematics in One Dimension Prior Learning GCSE Compound units, travel graphs, gradients and area under a graph. Prior Learning A Level year 12 Differentiation and integration. Units in the S.I. system: length, time, mass, velocity, acceleration, force, weight. Understand and use the language of kinematics: position; displacement; distance travelled; velocity; speed; acceleration. Understand, use and interpret graphs in kinematics for motion in a straight line: displacement against time and interpretation of gradient; velocity against time and interpretation of gradient and area under the graph. Understand, use and derive the formulae for constant acceleration for motion in a straight line. Use calculus in kinematics for motion in a straight line. *Moments, the extension to two dimensions for motion in a straight line and the extension to use calculus techniques for motion in two dimensions using vectors will be covered in year 13* MECHANICS TOPIC 2: Forces & Newton's Laws Prior Learning GCSE Compound units, vectors, speed, distance and time calculations Understand the concept of a force; understand and use Newton's first law ie an object moves with constant velocity or remains at rest unless acted on by a force. Understand and use Newton's second law for motion F = ma, in a straight line (restricted to forces in two perpendicular directions or simple cases of forces given as 2-D vectors). Understand and use weight and motion in a straight line under gravity; gravitational acceleration, g , and its value in S.I. units to varying degrees of accuracy] and ensure answers given to an appropriate level of accuracy (the inverse square law for gravitation is not required and g may be assumed to be constant, but students should be aware that g is not a universal constant but depends on

				location). Understand and use Newton's third law (equal and opposite); equilibrium of forces on a particle and motion in a straight line (restricted to forces in two perpendicular directions or simple cases of forces given as 2-D vectors); application to problems involving smooth pulleys and connected particles. *The extension to situations where forces need to be resolved in two dimensions, resolving forces in two dimensions and the equilibrium of a particle under coplanar forces will be covered in year 13* PURE MATHS TOPIC 10: Proof Prior Learning GCSE Irrational, rational and prime numbers and algebraic manipulation Understand and use the structure of mathematical proof, proceeding from given assumptions through a series of logical steps to a conclusion; use methods of proof: including proof by deduction, proof by exhaustion, Proof by contradiction (including proof of the irrationality of √2 and the infinity of primes, and application to unfamiliar proofs), Disproof by counter example.
	Summer	5	Revision and consolidation	Revision and consolidation
	Summer	6	PURE TOPIC 11 Further Differentiation Prior Learning A Level year 12 Basic differentiation and its applications to tangents, normal and stationary points Differentiate x^n , for rational values of n , and related constant multiples, sums and differences. Understand and use the derivative of f(x) as the gradient of the tangent to the graph of y=f(x) at a general point (x, y). Differentiation from first principles for small positive integer powers of x and hence the gradient of the tangent is a limit. Interpretation of differentiation as a rate of change; Understand and use the second derivative as the rate of change of gradient. Sketching the gradient function for a given curve. Apply differentiation to find gradients, tangents and normals, maxima and minima and stationary points. Identify where functions are increasing or decreasing. Understand and use the derivative of sin x and cos x. Differentiate e^{kx} and a^{kx}, $sin\ kx$, $cos\ kx$, $tan\ kx$ and	PURE MATHS TOPIC 12: Trigonometry & Circular Measure Prior Learning A Level year 12 Trigonometry including solving equations and using identities Work with radian measure, including use for arc length and area of sector. Understand and use the standard small angle approximations of sine, cosine and tangent. Sin θ ≈ θ , cos $\theta \approx 1 - \frac{\theta^2}{2}$, tan θ ≈θ where θ is in radians. Know and use exact values of sin θ and cos θ for 0 , π/6 , π/4 , π/3 , π/2 , π and multiples thereof, and exact values of tan θ for 0 , π/6 , π/4 , π/3 , π and multiples thereof. Understand and use the definitions of sec θ, cosec θ and cot θ and of $\sin^{-1}\theta$, $\cos^{-1}\theta$ and $\tan^{-1}\theta$; their relationships to sine, cosine and tangent; understanding of their graphs; their ranges and domains Understand and use $sec^2\theta \equiv 1 + tan^2\theta$ and $cosec^2\theta \equiv 1 + cot^2\theta$

			related sums, differences and constant multiples. Understand and use the derivative of ln x. Differentiate using the product rule, the quotient rule and the chain rule.	
13	Autumn	1	**PURE TOPIC 11: Further Differentiation** Prior Learning A Level year 12 Basic differentiation and its applications to tangents, normal and stationary points. Product, quotient and chain rules and differentiation of trigonometric, exponential and natural log functions. **Apply differentiation to find points of inflection and understand the second derivative and its connection to graph shape. Differentiate using the product rule, the quotient rule and the chain rule, including problems involving connected rates of change and finding $\frac{dy}{dx}$ by differentiating x=f(y) w.r.t. y. Include differentiating inverse trig.** **PURE TOPIC 14: Functions and transformations** **Numerical methods** **Prior Learning A Level year 12** **Algebraic Manipulation, Quadratic Equations & Simultaneous Equations, Graphs, Linear & Quadratic Inequalities.** **Simplify rational expressions including by factorising and cancelling, and algebraic division (by linear expressions only). The modulus of a linear function. Domain and range of a function. Understand and use composite functions; inverse functions and their graphs (including inverse trig). Combinations of transformations (reflection, translations and stretches).** **PURE TOPIC 15: Binomial Theorem, sequences and series** Prior Learning A Level year 12	**PURE MATHS TOPIC 12: Trigonometry & Circular Measure** Prior Learning A Level year 12 Trigonometry including solving equations and using identities, working with radians including arc length and sector area, and reciprocal trig functions Revision and consolidation **PURE MATHS TOPIC 13: Trigonometry** Prior Learning A Level year 12 Basic trigonometric identities and working with radians **Understand and use double angle formulae; use of formulae for $sin\,(A \pm B)$, $cos\,(A \pm B)$ and $tan\,(A \pm B)$; understand geometrical proofs of these formulae. Understand and use expressions for $a\,cos\,\theta + b\sin\theta$ in the equivalent forms of $r\cos(\theta \pm \alpha)$ or $r\sin(\theta \pm \alpha)$. Proofs involving trigonometric functions and identities.**

			Binomial Expansions for positive integer exponents **Extend the binomial theorem to any rational n , including its use for approximation; be aware that the expansion is valid for $\left\|\frac{bx}{a}\right\| < 1$. (proof not required). Work with sequences including those given by a formula for the nth term and those generated by a simple relation of the form $x_{n+1} = f(x_n)$; increasing sequences; decreasing sequences; periodic sequences; oscillating sequences. Understand and use sigma notation for sums of series. Understand and work with arithmetic sequences and series, including the formulae for nth term and the sum to n terms. Understand and work with geometric sequences and series including the formulae for the nth term and the sum of a finite geometric series; the sum to infinity of a convergent geometric series, including the use of $\|r\| < 1$; modulus notation. Use sequences and series in modelling eg compound interest, exponential growth and decay.**	
	Autumn	2	**PURE TOPIC 16: Further Integration** Prior Learning A Level year 12 Integration of x^n (excluding $n = -1$) and related sums, differences and constant multiples. Using a definite integral to find the area under a curve. **Integrate e^{kx} , $\frac{1}{x}$, $sin\ kx$, $cos\ kx$ and related sums, differences and constant multiples. Use a definite integral to find the area between two curves. Understand and use integration with limits of infinity. Carry out simple cases of integration by substitution and integration by parts;**	**PURE TOPIC 17: Numerical Methods** Prior Learning GCSE Solving equations by trial and improvement and using iterations **Locate roots of $f(x) = 0$ by considering changes of sign of $f(x)$ in an interval of x on which $f(x)$ is sufficiently well-behaved (i.e. continuous in the region). Understand how change of sign methods can fail. Solve equations approximately using simple iterative methods; be able to draw associated cobweb and staircase diagrams. Solve equations using the Newton-Raphson method and other recurrence relations of the form $x_{n+1} = g(x_n)$. Understand how**

			understand these methods as the inverse processes of the chain and product rules respectively (Integration by substitution includes finding a suitable substitution and is limited to cases where one substitution will lead to a function which can be integrated; integration by parts includes more than one application of the method but excludes reduction formulae). **PURE TOPIC 18: Partial fractions and integration** Prior Learning A Level year 13 Simplify rational expressions including by factorising and cancelling, and algebraic division and integration methods **Decompose rational functions into partial fractions (denominators could include up to 3 linear factors and repeated linear factor; numerators constant or linear). Integrate using partial fractions.** **PURE TOPIC 19: Parametric equations** Prior Learning A Level year 13 Differentiation methods including chain, product and quotient rules and all integration methods. **Understand and use the parametric equations of curves and conversion between Cartesian and parametric forms. Use parametric equations in modelling in a variety of contexts. Differentiate simple functions and relations defined parametrically, for first derivative only. Differentiate simple functions and relations defined implicitly, for first derivative only. Integrate Parametric Equations.**	**such methods can fail. Understand and use numerical integration of functions, including the use of the trapezium rule and estimating the approximate area under a curve and limits that it must lie between. Use numerical methods to solve problems in context.** **MECHANICS TOPIC 3: Kinematics in Two Dimensions** Prior Learning A Level year 12 Vectors including magnitude and direction and position vectors. Kinematics in one dimension including graphs, gradients and areas. ➢ **Use vectors in three dimensions** ➢ **Use vectors to solve problems in kinematics** ➢ **Use trigonometric functions to solve problems in context, including problems involving vectors, kinematics and forces** ➢ **Understand, use and derive the formulae for constant acceleration for motion in 2 dimensions using vectors** ➢ **Use calculus in kinematics for motion in 2 dimensions using vectors** ➢ **Model motion under gravity in a vertical plane using vectors; projectiles**
	Spring	3	**PURE TOPIC 20: Differential equations** Prior Learning A Level year 12 kinematics in one dimension.	**MECHANICS TOPIC 4: Equilibrium & Resolving** Prior Learning A Level year 12 Forces and Newton's Laws.

			Prior Learning A Level year 13 Differentiation methods including chain, product and quotient rules and all integration methods. **Use of functions in modelling, including consideration of limitations and refinements of the models. Differentiate simple functions and relations defined implicitly, for first derivative only. Construct simple differential equations in pure mathematics and in context, (contexts may include kinematics, population growth and modelling the relationship between price and demand). Evaluate the solution of simple first order differential equations with separable variables, including finding particular solutions. Interpret the solution of a differential equation in the context of solving a problem, including identifying limitations of the solution; includes links to kinematics.** **STATS Topic 5: Further probability** Prior Learning A Level year 12 Understand and use mutually exclusive and independent events when calculating probabilities **Understand and use conditional probability, including the use of tree diagrams, Venn diagrams, two-way tables. Understand and use the conditional probability formula** $\mathbf{P}(A\|B) = \frac{\mathbf{P}(A \cap B)}{\mathbf{P}(B)}$ **Modelling with probability, including critiquing assumptions made and the likely effect of more realistic assumptions.** **STATS Topic 6: Statistical distributions** Prior Learning A Level year 12 Discrete and continuous distributions including the binomial distribution.	**Understand and use Newton's second law (F=ma) for motion in situations where forces need to be resolved (restricted to 2 dimensions). Resolving forces in 2 dimensions; equilibrium of a particle under coplanar forces.** **MECHANICS TOPIC 5: Statics & Dynamics** Prior Learning A Level year 12 Forces and Newton's Laws. **Understand and use addition of forces; resultant forces; dynamics for motion in a plane. Understand and use the** $\mathbf{F} \leq \mu\mathbf{R}$ **model for friction; coefficient of friction; motion of a body on a rough surface; limiting friction and statics.**

			Understand and use the Normal distribution as a model; find probabilities using the Normal distribution. Link to histograms, mean, standard deviation, points of inflection and the Binomial distribution. Select an appropriate probability distribution for a context, with appropriate reasoning, including recognising when the Binomial or Normal model may not be appropriate.	
	Spring	4	**STATS Topic 7: Statistical hypothesis testing** Prior Learning A Level year 12 Statistical hypothesis testing using a binomial model. **Understand and apply correlation coefficients as measures of how close data points lie to a straight line. Interpret a given correlation coefficient using a given p-value or critical value (calculation of correlation coefficients is excluded). Conduct a statistical hypothesis test for the mean of a Normal distribution with known, given or assumed variance and interpret the results in context.** **STATS Topic 8: Statistical distributions and large data set** Prior Learning A Level year 12 Discrete and continuous distributions including the binomial distribution. **Understand and use the Normal distribution as a model; find probabilities using the Normal distribution. Link to histograms, mean, standard deviation, points of inflection and the binomial distribution. Select an appropriate probability distribution for a context, with appropriate reasoning, including recognising when the binomial or Normal model may not be appropriate.**	**MECHANICS TOPIC 6: Moments** Prior Learning A Level year 12 Kinematics in One Dimension. ➢ **Understand and use derived quantities and units: moment** **Understand and use moments in simple static contexts**

	Summer	5	Revision Programme	
	Summer	6	Study Leave	

How you are assessed

Students will complete regular Graded Assessments as homeworks throughout the course and also Graded examinations under formal conditions. These will inform expected outcomes but the A level result is based solely on performance in the final external assessment papers.

A Level Exams	Paper 1	Paper 2	Paper 3
Calculator Allowed (Graphical)	Yes	Yes	Yes
What's assessed	Any content from: • A: Proof • B: Algebra and functions • C: Coordinate geometry • D: Sequences and series • E: Trigonometry • F: Exponentials and logarithms • G: Differentiation • H: Integration • I: Numerical methods	Any content from Paper 1 and content from: • J: Vectors • P: Quantities and units in mechanics • Q: Kinematics • R: Forces and Newton's laws • S: Moments	Any content from Paper 1 and content from: • K: Statistical sampling • L: Data presentation and interpretation • M: Probability • N: Statistical distributions • O: Statistical hypothesis testing
• written exam: 2 hours • 100 marks 33⅓% of the A level	• written exam: 2 hours • 100 marks • 33⅓% of the A level	• written exam: 2 hours • 100 marks • 33⅓% of the A level	• written exam: 2 hours • 100 marks • 33⅓% of the A level
Style of questions	A mix of question styles, from short, single-mark questions to multi-step problems.	A mix of question styles, from short, single-mark questions to multi-step problems.	A mix of question styles, from short, single-mark questions to multi-step problems.

Extra-curricular opportunities

Integral website - https://integralmaths.org/
All students are given individual login details to access the resources on integral. There are a lot of very useful worksheets and notes all targeting the AQA syllabus. This is an excellent resource and it will be used as part of the curriculum but there is plenty that can be done independently as well.

Advanced Maths Support Network https://amsp.org.uk/

The Advanced Mathematics Support Programme is a government-funded initiative. It is led and delivered by MEI, with Tribal as a key partner. It aims to increase participation in Core Maths, AS/A level Mathematics and Further Mathematics, The programme provides national support students in state-funded schools and colleges in England.

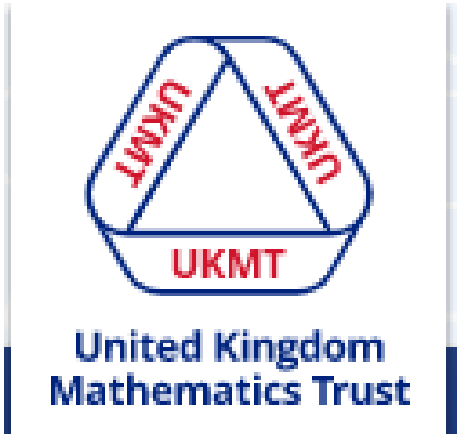
UKMT Individual Maths Challenge

Promoting a love of problem solving

The Senior Mathematical Challenge is a 60-minute, multiple-choice competition aimed at students across the UK.

It encourages mathematical reasoning, precision of thought, and fluency in using basic mathematical techniques to solve interesting problems.

The problems on the Intermediate Mathematical Challenge are designed to make students think. Most are accessible, yet still challenge those with more experience.



Once a year students take part in the individual maths challenge. Students are awarded Bronze, Silver or Gold certificates and if they score highly enough they qualify for the Senior Kangaroo challenge for the top 8000 in the country or the Senior Mathematical Olympiad for the top 1200 in the country.

UKMT Senior Team Challenge

Promoting teamwork and problem solving

The Team Maths Challenge is a competition giving students the opportunity to tackle a variety of engaging mathematical activities while developing teamwork and communication skills.

Teams of four students from schools around the UK take part in dozens of Regional Finals and high-scoring teams are invited to compete in the National Final.

Teams compete against each other in four rounds.

Group Round

Teams work to solve ten questions of varying type and difficulty in the time allowed. Each team must decide their own strategy: whether to work in pairs, individually or as a team.

Crossnumber

Similar to a crossword but with numerical answers. Teams work in pairs; one pair has the across clues and the other pair has the down clues. The pairs work independently to complete the grid using logic and deduction.

Shuttle

Teams compete against the clock to correctly answer a series of four questions. Each team is divided into Pair A (given Questions 1 and 3) and Pair B (given Questions 2 and 4). Question 1 can be solved independently of the others, but the answer to each subsequent question is dependent on the answer to the previous one.

Relay

Teams split off into pairs, with pairs taking it in turns to solve problems. This round involves lots of movement as well as mathematics: a race against the clock with lots of lively activity and excitement.

Each year 2 year 11 and 2 year 12 students are selected to represent the school at the UKMT Senior Team Challenge.

In 2021 we are trialling a Maths Problem solving Club, working weekly. We will look at a variety of problem solving, logic puzzles and interesting historical Maths.

We are blessed in Maths with the number of online resources that are available to support Maths outside the classroom. This list is by no means exhaustive but is a good place to start.

Curriculum support

https://www.mymaths.co.uk/ Revision help and practice questions – students have individual accounts for this website. MyMaths offers a wealth of resources that help develop confidence and fluency in maths.

Curriculum enrichment

https://www.numberphile.com/ The best collection of interesting Maths videos, James Grime is particularly good but all of them well worth watching

https://nrich.maths.org/ Engaging and accessible maths problems and puzzles

https://twitter.com/edsouthall Regular tweets of interesting Maths problems

https://www.bbc.co.uk/programmes/p063yhf0 Puzzle for the day

https://www.transum.org/Software/SW/Starter_of_the_day/ a problem for every day of the year

https://www.bbc.co.uk/programmes/b006qshd BBC radio 4 more or less

https://www.bbc.co.uk/programmes/b00snr0w BBC RADIO 4 INFINITE MONKEY CAGE

There are also some very accessible Maths books that have been published, allowing students to access Mathematical ideas that are not on the curriculum. This is a list of my current favourites.

The Music of the Primes Marcus du Sautoy (Harper-Collins, 2003)

See also his horizon documentary with Alan Davies either on iplayer or youTube

The Simpsons and Their Mathematical Secrets

Fermat's Last Theorem

Both by Simon Singh , both excellent, well written, easy to read but interesting and clever

A Mathematician's Apology G.H. Hardy

Almost the go to book for anyone going to study Maths, don't put it on your personal statement if you want to stand out!

Mathematical beauty Dan Pearcy

Mainly because I used to tech him A level Maths

Uncle Petros and Goldbach's Conjecture Apostolos Doxiadis

Quite a different book, not too heavy and more of a story.

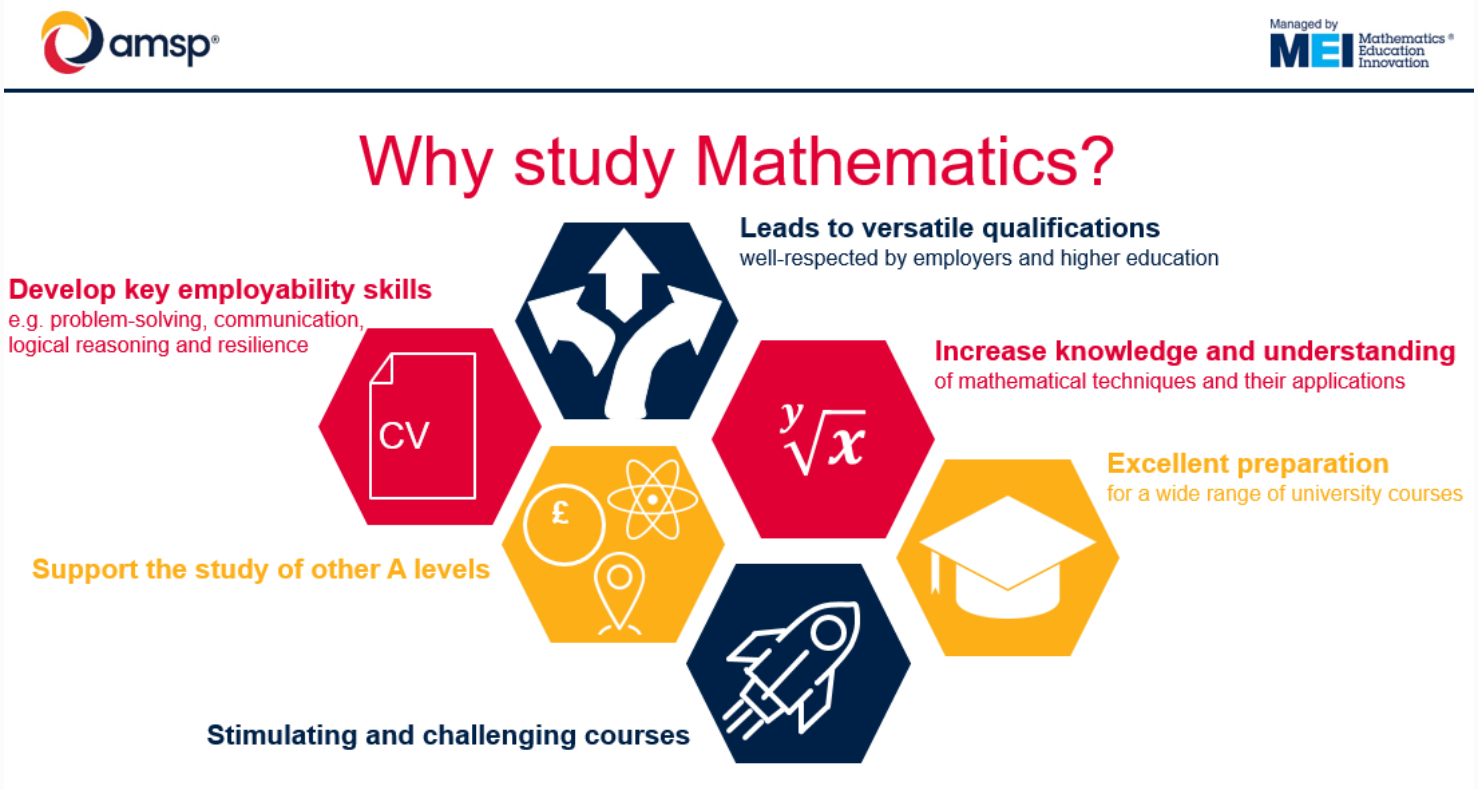
The MαTH βOOK Clifford A Pickover (Sterling, 2009)

Pretty pictures but good maths, easy to dip in and out of.

Impact

It's not surprising that maths is a very popular A-level choice. A spokesperson for the Institute of Mathematics and its Applications says: "A-level maths is tremendously important. It provides a firm foundation for all scientific, technical, engineering and mathematical careers and a flying start for many other types of career, such as those in finance, medicine, agriculture … etc. The list is endless!" On average, those with a maths A-level earn 11% more over their lifetime than those without.

The reason why so many employers highly value mathematics qualifications is that mathematics students become better at thinking logically and analytically. Through solving problems students develop resilience and are able to think creatively and strategically. The writing of structured solutions, proof and justification of results help to formulate reasoned arguments. And importantly the development of excellent numeracy skills enhances the ability to process and interpret data. Some exciting careers that could be open to students that have studied A level mathematics are: architecture, strong mathematical skills are required when it comes to the planning and creation of any building, from homes to skyscrapers; medicine or scientific research, just as maths pairs well with sciences at A-Level, it also facilitates any job in medicine or scientific research; and, games development, maths can even give access to a career in the gaming world, more specifically in the creation and development of new games as maths skills are needed to develop further abilities in programming. An A level Mathematics course gives students the opportunity to study 'pure' topics such as geometry, calculus and trigonometry and to use these ideas within the 'applied' topics such as mechanics and statistics. Students need an enthusiasm for problem-solving, and the course suits those with the tenacity to keep going in the hunt for possible solutions to awkward problems. Although mathematics is highly logical, it also requires imagination and determination to work well on your own: working on problems is the surest way to develop the knowledge and intuition required to do well and to develop the discipline needed to clearly communicate the solution. The 'applied' disciplines of mechanics and statistics require mathematical modelling to make sense of real-life problems. Students will learn how to model real-life situations in mathematical terms, how models are refined and how to identify limitations within this process. Students will be expected to use technology where appropriate; for example, the use of spreadsheets and graphical calculators to support statistical analysis. An A-level in mathematics really will equip a young person with a variety of skills for the rapidly changing modern technological world in which we live in today.



What skills will I get if I study maths?

Maths is one of the best subjects to develop your analytical, research and problem-solving skills. Not only will studying maths help give you the knowledge to tackle scientific, mechanical, coding and abstract problems, it will also help you develop logic to tackle everyday issues like planning projects, managing budgets and even debating effectively.

What careers is maths good for?

Maths degrees

People with maths degrees and other qualifications can go into: accounting, medicine, engineering, forensic pathology, finance, business, consultancy, teaching, IT, games development, scientific research, programming, the civil service, design, construction and astrophysics to name a few. Specific job roles include actuary, business analyst, software engineer, technology analyst, information engineer, speech technology researcher, and maths teacher.

Jobs in the mathematical sciences - that is, careers that studying maths at university prepares you for directly - tend to be very well paid. The combination of a skills shortage and a growing need for maths skills means more and more employers are on the look out for maths graduates.

'Why study maths?' presentation resources | AMSP