



Eastbrook School

KS3 Curriculum Summary – Mathematics

The information below gives an overview of the topics that your child will be studying in Mathematics during years 7, 8 and 9. It also outlines how you can support your child to enrich and extend their learning outside of school.

Year 7		
Autumn term	Spring term	Summer term
Topics and themes	Topics and themes	Topics and themes
Unit 5: Fractions Unit 6: Probability Half-term test Unit 1: Analysing and displaying data Unit 2: Number skills End of term test	Unit 3: Expressions, functions and formulae Unit 8: Lines and angles Half-term test Unit 4: Decimals and measures Unit 7: Ratio and proportion End of term test	Unit 9: Sequences and graphs Half-term test Unit 10: Transformations End of term test End of year 1 test
Useful websites		
www.pearsonactivelearn.com www.mymaths.co.uk www.mathswatch.co.uk www.corbettsmaths.com (log in not required)		
Other ways to support learning		
Parents can support their child by ensuring that all homework is completed, check that their child has up-to-date log in details (these will be given by their maths teachers) for the websites suggested above.		

Year 7 Achievement Summary – By the end of Year 7 students will:

Year 7 Knowledge
<ul style="list-style-type: none"> describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete, continuous and grouped data; and appropriate measures of central tendency (mean, mode, median) and spread (range, consideration of outliers) understand and use place value for decimals, measures and integers of any size order positive and negative integers, decimals and fractions; use the number line as a model for ordering of the real numbers; use the symbols =, ≠, <, >, ≤, ≥ use the concepts and vocabulary of prime numbers, factors (or divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation property use the 4 operations, including formal written methods, applied to integers, decimals, proper and improper fractions, and mixed numbers, all both positive and negative substitute numerical values into formulae and expressions, including scientific formulae derive and apply formulae to calculate and solve problems involving: perimeter and area of triangles, parallelograms, trapezia, volume of cuboids (including cubes) and other prisms (including cylinders) use ratio notation, including reduction to simplest form record, describe and analyse the frequency of outcomes of simple probability experiments involving randomness, fairness, equally and unequally likely outcomes, using appropriate language and the 0-1 probability scale define percentage as 'number of parts per hundred', interpret percentages and percentage changes as a fraction or a decimal, interpret these multiplicatively, express 1 quantity as a

<ul style="list-style-type: none"> percentage of another, compare 2 quantities using percentages, and work with percentages greater than 100% interpret fractions and percentages as operators identify properties of, and describe the results of, translations, rotations and reflections applied to given figures use standard units of mass, length, time, money and other measures, including with decimal quantities use scale factors, scale diagrams and maps understand that the probabilities of all possible outcomes sum to 1
Year 7 Skills
<ul style="list-style-type: none"> begin to reason deductively in geometry, number and algebra, including using geometrical constructions use algebra to generalise the structure of arithmetic, including to formulate mathematical relationships select and use appropriate calculation strategies to solve increasingly complex problems draw and measure line segments and angles in geometric figures, including interpreting scale drawings change freely between related standard units [for example time, length, area, volume/capacity, mass]

The year 8 and 9 curriculum has been adapted to account for lost learning time due to Covid 19. The principles agreed with Curriculum leaders and applied to these adaptations are depth over breadth and maximising student engagement

Year 8		
Autumn term	Spring term	Summer term
Topics and themes	Topics and themes	Topics and themes
Unit 1: Number Unit 2: Area and volume Half-term test Unit 7: Ratio and proportion Unit 4: Expressions and equations End of term test	Unit 5: Real-life graphs Unit 9: Straight-line graphs Half-term test Unit 7: Lines and angles Unit 3: Statistics, graphs and charts End of term test	Unit 8: Calculating with fractions Unit 6: Decimals and ratio Half-term test Unit 10: Percentages, decimals and fractions End of term test End of year 2 test
Useful websites		
www.pearsonactivelearn.com www.mymaths.co.uk www.mathswatch.co.uk www.corbettsmaths.com (log in not required)		
Other ways to support learning		
Parents can support their child by ensuring that all homework is completed, check that their child has up-to-date log in details (these will be given by their maths teachers) for the websites suggested above.		

Year 8 Achievement Summary – By the end of Year 8 students will:

Year 8 Knowledge
<ul style="list-style-type: none"> construct and interpret appropriate tables, charts, and diagrams, including frequency tables, bar charts, pie charts, and pictograms for categorical data, and vertical line (or bar) charts for ungrouped and grouped numerical data use and interpret algebraic notation simplify and manipulate algebraic expressions to maintain equivalence by:

- collecting like terms
- multiplying a single term over a bracket
- taking out common factors
- expanding products of 2 or more binomials
- understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors
- use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals
- use integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5 and distinguish between exact representations of roots and their decimal approximations
- use algebraic methods to solve linear equations in 1 variable (including all forms that require rearrangement)
- understand and use the relationship between parallel lines and alternate and corresponding angles
- derive and use the sum of angles in a triangle and use it to deduce the angle sum in any polygon, and to derive properties of regular polygons
- express 1 quantity as a fraction of another, where the fraction is less than 1 and greater than 1
- divide a given quantity into 2 parts in a given part:part or part:whole ratio; express the division of a quantity into 2 parts as a ratio
- understand that a multiplicative relationship between 2 quantities can be expressed as a ratio or a fraction
- relate the language of ratios and the associated calculations to the arithmetic of fractions and to linear functions
- use compound units such as speed, unit pricing and density to solve problems
- use the properties of faces, surfaces, edges and vertices of cubes, cuboids, prisms, cylinders, pyramids, cones and spheres to solve problems in 3-D

Year 8 Skills

- begin to model situations mathematically and express the results using a range of formal mathematical representations
- interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning
- extend their understanding of the number system; make connections between number relationships, and their algebraic and graphical representations
- describe simple mathematical relationships between 2 variables (bivariate data) in observational and experimental contexts and illustrate using scatter graphs
- solve problems involving direct and inverse proportion, including graphical and algebraic representations
- apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles

Year 9

Autumn term	Spring term	Summer term
Topics and themes	Topics and themes	Topics and themes
Unit 1: Indices and standard form Unit 2: Expressions and formulae Half-term test Unit 3: Dealing with data Unit 4: Multiplicative reasoning End of term test	Unit 5: Constructions Unit 6: Equations, inequalities and proportionality Half-term test Unit 7: Circles, Pythagoras and prisms End of term test	Unit 8: Sequences and graphs Unit 9: Probability Half-term test Unit 10: Comparing shapes Unit 10: Transformations End of term test GCSE baseline test

Useful websites

www.pearsonactivelearn.com
www.mymaths.co.uk
www.mathswatch.co.uk
www.corbettsmaths.com (log in not required)

Other ways to support learning

Parents can support their child by ensuring that all homework is completed, check that their child has up-to-date log in details (these will be given by their maths teachers) for the websites suggested above.

Year 9 Achievement Summary – By the end of Year 9 students will:

Year 9 Knowledge

- calculate and solve problems involving: perimeters of 2-D shapes (including circles), areas of circles and composite shapes
- apply angle facts, triangle congruence, similarity and properties of quadrilaterals to derive results about angles and sides, including Pythagoras' Theorem, and use known results to obtain simple proofs
- generate terms of a sequence from either a term-to-term or a position-to-term rule
- recognise arithmetic sequences and find the n th term
- recognise geometric sequences and appreciate other sequences that arise
- generate theoretical sample spaces for single and combined events with equally likely, mutually exclusive outcomes and use these to calculate theoretical probabilities
- derive and use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle); recognise and use the perpendicular distance from a point to a line as the shortest distance to the line
- describe, sketch and draw using conventional terms and notations: points, lines, parallel lines, perpendicular lines, right angles, regular polygons, and other polygons that are reflectively and rotationally symmetric
- use the standard conventions for labelling the sides and angles of triangle ABC, and know and use the criteria for congruence of triangles
- work interchangeably with terminating decimals and their corresponding fractions
- round numbers and measures to an appropriate degree of accuracy [for example, to a number of decimal places or significant figures]
- use approximation through rounding to estimate answers and calculate possible resulting errors expressed using inequality notation $a < x \leq b$
- use a calculator and other technologies to calculate results accurately and then interpret them appropriately
- understand and use standard mathematical formulae; rearrange formulae to change the subject
- model situations or procedures by translating them into algebraic expressions or formulae and by using graphs
- work with coordinates in all 4 quadrants
- find approximate solutions to contextual problems from given graphs of a variety of functions, including piece-wise linear, exponential and reciprocal graphs
- recognise, sketch and produce graphs of linear and quadratic functions of 1 variable with appropriate scaling, using equations in x and y and the Cartesian plane
- enumerate sets and unions/intersections of sets systematically, using tables, grids and Venn diagrams
- reduce a given linear equation in 2 variables to the standard form $y = mx + c$; calculate and interpret gradients and intercepts of graphs of such linear equations numerically, graphically and algebraically
- use linear and quadratic graphs to estimate values of y for given values of x and vice versa and to find approximate solutions of simultaneous linear equations
- identify and construct congruent triangles, and construct similar shapes by enlargement, with and without coordinate grids

Year 9 Skills

- select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine

problems

- develop their use of formal mathematical knowledge to interpret and solve problems, including in financial mathematics
- explore what can and cannot be inferred in statistical and probabilistic settings, and begin to express their arguments formally
- make and test conjectures about patterns and relationships; look for proofs or counter-examples
- develop algebraic and graphical fluency, including understanding linear and simple quadratic functions
- substitute values in expressions, rearrange and simplify expressions, and solve equations
- use Pythagoras' Theorem and trigonometric ratios in similar triangles to solve problems involving right-angled triangles
- interpret and compare numbers in standard form $A \times 10^n$ $1 \leq A < 10$, where n is a positive or negative integer or 0
- solve problems involving percentage change, including: percentage increase, decrease and original value problems and simple interest in financial mathematics

Achieving or exceeding the above constitutes Key Stage 4 readiness



Eastbrook School

KS4 Curriculum Summary – Mathematics

The information below gives an overview of the topics that your child will be studying in Mathematics during years 10 and 11. It also outlines how you can support your child to enrich and extend their learning outside of school.

At the end of Year 11 the students will sit – [Edexcel Mathematics 1MA1](#)

The year 11 curriculum has been adapted to account for lost learning time due to Covid 19. These adaptations are a response to the amended syllabus

Year 10 Foundation		
Autumn term	Spring term	Summer term
Topics and themes	Topics and themes	Topics and themes
Unit 1: Number Unit 2: Algebra Unit 5: Equations, inequalities and sequences Unit 3: Graphs, tables and charts Unit 7: Averages and range Unit 4: Fractions and percentages End of term test	Unit 6: Angles Unit 12: Right-angled triangles Unit 8: Perimeter, area and volume 1 Unit 9: Graphs Unit 10: Transformations Unit 11: Ratio and proportion End of term test	Unit 13: Probability Unit 14: Multiplicative reasoning Unit 15: Constructions, loci and bearings Unit 17: Perimeter, area and volume 2 End of term test End of year 1 test
Year 10 Higher		
Autumn term	Spring term	Summer term
Topics and themes	Topics and themes	Topics and themes
Unit 4: Fractions, ratio and percentages Unit 5: Angles and trigonometry Unit 6: Graphs Unit 7: Area and volume Unit 8: Transformations and constructions End of term test	Unit 9: Equations and inequalities Unit 10: Probability Unit 11: Multiplicative reasoning Unit 12: Similarity and congruence Unit 13: More trigonometry End of term test	Unit 3: Interpreting and representing data Unit 14: Further statistics Unit 15: Equations and graphs Unit 16: Circle theorems Unit 2: Algebra Unit 17: More algebra End of term test End of year 1 test
Useful websites		
<ul style="list-style-type: none"> • Mathswatch.co.uk • Mymaths.co.uk • Mathsgenie.co.uk • Onmaths.co.uk • Mrbartonmaths.com 		
Other ways to support learning		
<ul style="list-style-type: none"> • Make sure you have the login for all the websites above. • Organise a timetable to revise Maths • Balance between online and offline time. • Use showmyhomework to interact with your teacher. • Do practice tests in exam conditions. • Fully equipped (protractor, compass, ruler, tracing paper and a calculator). • Set up a revision group using social media apps. 		

Year 10 Achievement Summary – By the end of Year 10 students will:

Year 10 (Foundation) Knowledge

- Apply systematic listing strategies, {including use of the product rule for counting}
- Estimate powers and roots of any given positive number, calculate with roots, and with integer {and fractional} indices
- Calculate exactly with fractions, identify and work with fractions in ratio problems.
- Simplify and manipulate algebraic expressions
- Know the difference between an equation and an identity
- Show algebraic expressions are equivalent
- Interpret simple expressions as functions with inputs and outputs
- plot and interpret graphs and graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematic problems
- Solve linear inequalities in one {or two} variable{s}; represent the solution set on a number line
- Simple arithmetic progressions, {and other sequences}
- Deduce expressions to calculate the nth term of linear sequences
- Compare lengths, areas and volumes using ratio notation and/or scale factors; make links to similarity
- Convert between related compound units
- Interpret and use fractional {and negative} scale factors for enlargements {describe the changes and invariance achieved by combinations of rotations, reflections and translations
- Identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference
- Construct and interpret plans and elevations of 3D shapes
- Interpret and use bearings
- Calculate arc lengths, angles and areas of sectors of circles
- Apply Pythagoras' Theorem and trigonometric ratios to find angles and lengths in right-angled triangles describe
- Apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one
- Use a probability model to predict the outcomes of future experiments; tend towards theoretical probability distributions, with increasing sample size
- Calculate the probability of independent and dependent combined events
- Calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables, and Venn diagrams
- Interpret and construct tables and line graphs {construct and interpret diagrams for grouped discrete data and continuous data.
- Use and interpret scatter graphs of bivariate data; recognise correlation and know that it does not indicate causation; draw estimated lines of best fit and make predictions

Year 10 (Foundation) Skills

- extend and formalise their knowledge of ratio and proportion, including trigonometric ratios, in working with measures and geometry, and in working with proportional relations
- Reason deductively in geometry, number and algebra, including using geometrical constructions
- Develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems
- Model situations mathematically and express the results using a range of formal mathematical representations
- Interpret their solution in the context of the given problem

Year 10 (Higher) Knowledge

- Calculate with roots, and with integer {and fractional} indices
- Calculate with numbers in standard form
- Change recurring decimals into their corresponding fractions and vice versa
- Identify and work with fractions in ratio problems
- Apply and interpret limits of accuracy when rounding or truncating, {including upper and lower

bounds}

- Simplify and manipulate algebraic expressions; factorising quadratic expressions, including the difference of two squares
- Simplifying expressions involving the laws of indices
- Argue mathematically, and use algebra to support and construct arguments {and proofs} where appropriate
- Interpret the reverse process as the 'inverse function'
- Interpret the succession of two functions as a 'composite function'
- Use the form $y = mx + c$ to identify parallel {and perpendicular} lines; find the equation of the line through two given points, or through one point with a given gradient
- Identify and interpret roots, intercepts and turning points of quadratic functions graphically; deduce roots algebraically {and turning points by completing the square}
- Find equation of a tangent to a circle at a given point
- Solve quadratic equations {including those that require rearrangement} algebraically by factorising, {by completing the square and by using the quadratic formula}
- Find approximate solutions using a graph; solve two simultaneous equations in two variables (linear/linear {or linear/quadratic}) algebraically; find approximate solutions using a graph {find approximate solutions to equations numerically using iteration}
- Translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution
- Solve linear inequalities in one {or two} variable{s}, {and quadratic inequalities in one variable}; represent the solution set on a number line, {using set notation and on a graph}
- recognise and use sequences of simple arithmetic progressions, Fibonacci type sequences, quadratic sequences, and simple geometric progressions {and other sequences}
- Deduce expressions to calculate the n th term of linear {and quadratic} sequences
- Compare lengths, areas and volumes using ratio notation and/or scale factors; make links to similarity (including trigonometric ratios)
- Convert between related compound units (speed, rates of pay, prices, density, pressure) in numerical and algebraic contexts
- Apply the concepts of instantaneous and average rate of change (gradients of tangents and chords) in numerical, algebraic and graphical contexts}
- Set up, solve and interpret the answers in growth and decay problems, including compound interest {and work with general iterative processes}.
- Interpret and use fractional {and negative} scale factors for enlargements {describe the changes and invariance achieved by combinations of rotations, reflections and translations}
- Identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and calculate arc lengths, angles and areas of sectors of circles
- Construct and interpret plans and elevations of 3D shapes
- Interpret and use bearings
- Calculate surface areas and volumes of spheres, pyramids, cones and composite solids
- Apply the concepts of congruence and similarity, including the relationships between lengths, {areas and volumes} in similar figures
- Apply Pythagoras' Theorem and trigonometric ratios to find angles and lengths in right-angled triangles {and, where possible, general triangles} in two {and three} dimensional figures
- Know the exact values of trigonometric identities for \sin \cos \tan .
- Know and apply the sine rule, , and cosine rule, to find unknown lengths and angles
- Know and apply to calculate the area, sides or angles of any triangle
- Understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size
- Calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions {calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables, tree diagrams and Venn diagrams}.
- Infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling interpret and construct tables and line graphs for time series data
- Construct and interpret diagrams for grouped discrete data and continuous data, i.e. histograms with equal and unequal class intervals and cumulative frequency graphs, and know their

- appropriate use
- Interpret, analyse and compare the distributions of data sets from univariate empirical distributions through: appropriate graphical representation involving discrete, continuous and grouped data, {including box plots} appropriate measures of central tendency (including modal class) and spread {including quartiles and inter-quartile range}
 - Apply statistics to describe a population
 - Use and interpret scatter graphs of bivariate data; recognise correlation and know that it does not indicate causation; draw estimated lines of best fit; make predictions; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing.

Year 10 (Higher) Skills

- Reason with proportional relations algebraically and graphically
- Algebraically and graphically make and test conjectures about the generalisations that underlie patterns and relationships
- Look for proofs or counter-examples; begin to use algebra to support and construct arguments {and proofs} reason deductively in geometry, number and algebra, including using geometrical constructions
- Explore what can and cannot be inferred in statistical and probabilistic settings, and express their arguments formally.
- Solving problems and evaluating the outcomes, including multi-step problems develop their use of formal mathematical knowledge to interpret and solve problems, including in financial contexts
- Make and use connections between different parts of mathematics to solve problems
- Model situations mathematically and express the results using a range of formal mathematical representations, reflecting on how their solutions may have been affected by any modelling assumptions
- Select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems; interpret their solution in the context of the given problem

Year 11 Foundation		
Autumn term	Spring term	Summer term
Topics and themes	Topics and themes	Topics and themes
Unit 5: Equations, inequalities and sequences Unit 3: Graphs, tables and charts Unit 13: Probability Unit 4: Fractions and percentages Unit 6: Angles Unit 7: Averages and range Unit 8: Perimeter, area and volume 1 Unit 17: Perimeter, area and volume 2	Unit 9: Graphs Unit 10: Transformations Unit 11: Ratio and proportion Unit 12: Right-angled triangles Unit 14: Multiplicative reasoning Unit 18: Fractions, indices and standard form Unit 15: Constructions, loci and bearings End of term test	Revision Exams
Year 11 Higher		
Autumn term	Spring term	Summer term
Topics and themes	Topics and themes	Topics and themes
Unit 5: Angles and trigonometry Unit 13: More trigonometry Unit 12: Similarity and congruence Unit 8: Transformations and constructions Unit 6: Graphs Unit 11: Multiplicative reasoning Unit 4: Fractions, ratio and percentages Unit 7: Area and volume End of term test	Unit 3: Interpreting and representing data Unit 14: Further statistics Unit 10: Probability Unit 2: Algebra Unit 9: Equations and inequalities Unit 15: Equations and graphs End of term test	Revision Exams
Useful websites		
<ul style="list-style-type: none"> • Mathswatch.co.uk • Mymaths.co.uk • Mathsgenie.co.uk • Onmaths.co.uk 		

- Mrbartonmaths.com

Other ways to support learning

- Make sure you have the login for all the websites above.
- Organise a timetable to revise Maths
- Balance between online and offline time.
- Use showmyhomework to interact with your teacher.
- Do practice tests in exam conditions.
- Fully equipped (protractor, compass, ruler, tracing paper and a calculator).
- Set up a revision group using social media apps.

Year 11

Year 11 (Foundation) Knowledge

- Calculate with numbers in standard form
- Plot and interpret graphs (including reciprocal graphs {and exponential graphs}) and graphs of non-standard functions in real contexts
- Construct quadratic and other non-linear graphs
- Find approximate solutions using a graph solve two simultaneous equations in two variables (linear/linear) algebraically
- Calculate surface areas and volumes areas and volumes of spheres, pyramids, cones and composite solids.
- Describe translations as 2D vectors; apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors

Year 11 (Foundation) Skills

- extend and formalise their knowledge of ratio and proportion, including trigonometric ratios, in working with measures and geometry, and in working with proportional relations
- Reason deductively in geometry, number and algebra, including using geometrical constructions
- Develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems
- Model situations mathematically and express the results using a range of formal mathematical representations
- Interpret their solution in the context of the given problem

Year 11 (Higher) Knowledge

- Calculate exactly with fractions, {surds} and multiples of π
- Simplify surd expressions involving squares and rationalise denominators
- Recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, the reciprocal function {the exponential function, and the trigonometric functions (with arguments in degrees) , and $y = \tan x$ for angles of any size}
- Sketch translations and reflections of the graph of a given function
- Plot and interpret graphs (including reciprocal graphs {and exponential graphs}) and graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration
- Calculate or estimate gradients of graphs and areas under graphs (including quadratic and other non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial contexts
- Recognise and use the equation of a circle with centre at the origin
- Understand that X is inversely proportional to Y is equivalent to X is proportional to $1/Y$; {construct and} interpret equations that describe direct and inverse proportion interpret the gradient of a straight line graph as a rate of change

- Apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results
- Describe translations as 2D vectors and apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors
- Use vectors to construct geometric arguments and proofs
- Use algebraic fractions, solve equations of algebraic fractions.

Year 11 (Higher) Skills

- Reason with proportional relations algebraically and graphically
- Algebraically and graphically make and test conjectures about the generalisations that underlie patterns and relationships
- Look for proofs or counter-examples; begin to use algebra to support and construct arguments {and proofs} reason deductively in geometry, number and algebra, including using geometrical constructions
- Explore what can and cannot be inferred in statistical and probabilistic settings, and express their arguments formally.
- Solving problems and evaluating the outcomes, including multi-step problems develop their use of formal mathematical knowledge to interpret and solve problems, including in financial contexts
- Make and use connections between different parts of mathematics to solve problems
- Model situations mathematically and express the results using a range of formal mathematical representations, reflecting on how their solutions may have been affected by any modelling assumptions
- Select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems; interpret their solution in the context of the given problem



KS5 Curriculum Summary – Mathematics

The information below gives an overview of the topics that your child will be studying in Mathematics during years 12 and 13. It also outlines how you can support your child to enrich and extend their learning outside of school.

Year 12		
Autumn term	Spring term	Summer term
Topics and themes	Topics and themes	Topics and themes
Unit 1: Algebra and functions Unit 1: Statistical sampling Unit 2a: Data presentation and interpretation Unit 6: Quantities and units in mechanics Unit 7a: Kinematics 1 (constant acceleration) Unit 2: Coordinate geometry in the (x, y) plane Unit 3: Further algebra Unit 2b: Data presentation and interpretation Unit 7b: Kinematics 1 (constant acceleration)	Unit 4: Trigonometry Unit 5: Vectors (2D) Unit 3: Probability Unit 4: Statistical distributions Unit 8a: Forces & Newton's laws Unit 6: Differentiation Unit 7: Integration Unit 5a: Statistical hypothesis testing Unit 8b: Forces & Newton's laws	Unit 8: Exponentials and logarithms Unit 5b: Statistical hypothesis testing Unit 9: Kinematics 2 (variable acceleration) Unit 1: Proof Unit 2: Algebraic and partial fractions
Useful websites		
Khan Academy. mathtv.com. HegartyMaths. MyMaths. Math Forum. Cut The Knot. SOS Maths.		
Other ways to support learning		
<p>A level maths courses start from the assumption that the GCSE skills are rock solid, so it may be worth practicing some of the higher end GCSE algebra questions with answers to self assess and learn from mistakes. In addition, the degree of problem solving needed is much greater - you need to be able to apply your memorised techniques flexibly and spot connections between concepts. Practice exam style questions alongside worked solutions.</p> <p>Have excellent work ethic - regularly doing more than the work set in lessons. Know what you need to learn, and seek help early on when you are unsure. Do not procrastinate - fill your time with meaningful activity that progresses. Form new work habits, this is not GCSE anymore.</p>		

Year 13		
Autumn term	Spring term	Summer term
Topics and themes	Topics and themes	Topics and themes
Unit 1: Statistical sampling Unit 2a: Data presentation and interpretation Unit 2b: Data presentation and interpretation Unit 3: Probability Unit 4: Statistical distributions Unit 5a: Statistical hypothesis testing Unit 5b: Statistical hypothesis testing Unit 2: Probability Unit 1: Regression and correlation	Unit 8: Differentiation Unit 9: Numerical methods - see Integration (part 2) for the trapezium rule Unit 4: Series and sequences Unit 6: Applications of kinematics Unit 5: The binomial theorem Unit 10: Integration (part 1) Unit 11: Integration (part 2) Unit 7: Applications of forces	Unit 12: Vectors (3D) Unit 8: Further kinematics Revision (A level) Formal examination (A level)

Unit 3a: The Normal distribution Unit 3b: The Normal distribution Unit 3c: The Normal distribution Unit 4: Moments Unit 3: Functions and modelling Unit 6: Trigonometry Unit 7: Parametric equations Unit 5: Forces at any angle		
Useful websites		
Khan Academy. mathtv.com. HegartyMaths. MyMaths. Math Forum. Cut The Knot. SOS Maths.		
Other ways to support learning		
<p>A level maths courses start from the assumption that the GCSE skills are rock solid, so it may be worth practicing some of the higher end GCSE algebra questions with answers to self assess and learn from mistakes. In addition, the degree of problem solving needed is much greater - you need to be able to apply your memorised techniques flexibly and spot connections between concepts. Practice exam style questions alongside worked solutions.</p> <p>Have excellent work ethic - regularly doing more than the work set in lessons. Know what you need to learn, and seek help early on when you are unsure. Do not procrastinate - fill your time with meaningful activity that progresses. Form new work habits, this is not GCSE anymore.</p>		

Year 12 & 13 Achievement Summary – By the end of Year 12 & 13 students will:

Year 12 & Yr13 Knowledge
<p><u>Mathematical argument, language and proof</u></p> <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 content [Apply to solutions of inequalities] and probability • 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><u>Mathematical problem solving</u></p> <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 or limitations of solutions], including those obtained using numerical methods
- 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

Mathematical modelling

- 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)
- 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

Proof

- 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] [Disproof by counter example] Proof by contradiction (including proof of the irrationality of $\sqrt{2}$ and the infinity of primes, and application to unfamiliar proofs)
- Algebra and functions
- 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 quadratic equations in a function of the unknown
- Solve simultaneous equations in two variables by elimination and by substitution, including one linear and one quadratic equation
- Solve linear and quadratic inequalities in a single variable and interpret such inequalities graphically, including inequalities with brackets and fractions] [Express solutions through correct use of 'and' and 'or', or through set notation] [Represent linear and quadratic inequalities graphically
- Manipulate polynomials algebraically, including expanding brackets and collecting like terms, factorisation and simple algebraic division; use of the factor theorem, Simplify rational expressions including by factorising and cancelling, and algebraic division (by linear expressions only)
- Understand and use graphs of functions; sketch curves defined by simple equations including polynomials, the modulus of a linear function, (including their vertical and horizontal asymptotes); interpret algebraic solution of equations graphically; use intersection points of graphs to solve equations] [Understand and use proportional relationships and their graphs]
- Understand and use composite functions; inverse functions and their graphs
- Understand the effect of simple transformations on the graph of $y = f(x)$ including sketching associated graphs and combinations of these transformations
- Decompose rational functions into partial fractions (denominators not more complicated than squared linear terms and with no more than 3 terms, numerators constant or linear)
- Use of functions in modelling, including consideration of limitations and refinements of the models

Coordinate geometry in the (x,y) plane

- Understand and use the equation of a straight line; gradient conditions for two straight lines to be parallel or perpendicular] [Be able to use straight line models in a variety of contexts]
- 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

- 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

Sequences and series

- Understand and use the binomial expansion for positive integer n index; the notations $n!$ and nCr ; link to binomial probabilities Extend to any rational n , including its use for approximation (proof not required)
- Work with sequences including those given by a formula for the n th term and those generated by a simple function relation ; increasing sequences; decreasing sequences; periodic sequences
- Understand and use sigma notation for sums of series
- Understand and work with arithmetic sequences and series, including the formulae for n th term and the sum to n terms
- Understand and work with geometric sequences and series including the formulae for the n th term and the sum of a finite geometric series; the sum to infinity of a convergent geometric series, including the use of modulus notation
- Use sequences and series in modelling

Trigonometry

- Understand and use the definitions of sine, cosine and tangent for all arguments; the sine and cosine rules; the area of a triangle, 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 where θ is in radians
- Understand and use the sine, cosine and tangent functions; their graphs, symmetries and periodicity, know and use exact values of \sin and \cos for π and multiples thereof
- Understand and use the definitions of secant, cosecant and cotangent and of \arcsin , \arccos and \arctan ; their relationships to sine, cosine and tangent; understanding of their graphs; their ranges and domains
- Understand and use double angle formulae; use of formulae for $\sin(2\theta)$, $\cos(2\theta)$, $\tan(2\theta)$; understand geometrical proofs of these formulae
- Understand and use expressions for $a \cos \theta \pm b \sin \theta$ in the equivalent forms of $r \cos(\theta - \alpha)$ or $r \sin(\theta + \alpha)$
- Solve simple trigonometric equations in a given interval, including quadratic equations in \sin , \cos and \tan and equations involving multiples of the unknown angle
- Construct proofs involving trigonometric functions and identities
- Use trigonometric functions to solve problems in context, including problems involving vectors, kinematics and forces

Exponentials and logarithms

- Know and use the function x^a and its graph, where a is positive] [Know and use the function e^x and its graph]
- Know that the gradient of e^{kx} is equal to ekx 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 x^a , where a is positive and $x \geq 0$] [Know and use the function $\ln x$ and its graph] [Know and use $\ln x$ as the inverse function of e^x
- Understand and use the laws of logarithms
- 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

Differentiation

- 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) ; the gradient of the tangent as a limit; interpretation as a rate of change; sketching the gradient function for a given curve; second derivatives; differentiation from first

principles for small positive integer powers of x) and for $\sin x$, $\cos x$ and $\ln x$ and [Understand and use the second derivative as the rate of change of gradient]; connection to convex and concave sections of curves and points of inflection

- Differentiate $a^n x$, for rational values of n , and related constant multiples, sums and differences] Differentiate e^{kx} and kx^a , $\sin kx$, $\cos kx$, $\tan kx$ and related sums, differences and constant multiples Understand and use the derivative of $\ln x$
- Apply differentiation to find gradients, tangents and normals, maxima and minima and stationary points], points of inflection [Identify where functions are increasing or decreasing
- Differentiate using the product rule, the quotient rule and the chain rule, including problems involving connected rates of change and inverse functions
- Differentiate simple functions and relations defined implicitly or parametrically, 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)

Integration

- Know and use the Fundamental Theorem of Calculus
- Integrate $a^n x$ (excluding $n = -1$), and related sums, differences and constant multiples
- Integrate e^{kx} , $\ln x$, $\sin kx$, $\cos kx$ and related sums, differences and constant multiples
- Evaluate definite integrals; use a definite integral to find the area under a curve] and the area between two curves
- Understand and use integration as the limit of a sum
- Carry out simple cases of integration by substitution and integration by parts; 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
- Integrate using partial fractions that are linear in the denominator
- Evaluate the analytical solution of simple first order differential equations with separable variables, including finding particular solutions (Separation of variables may require factorisation involving a common factor)
- Interpret the solution of a differential equation in the context of solving a problem, including identifying limitations of the solution; includes links to kinematics

Numerical methods

- 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 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 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

Vectors

- Use vectors in two dimensions] and in three dimensions
- Calculate the magnitude and direction of a vector and convert between Cartesian 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] and kinematics

Statistical sampling

- Understand and use the terms 'population' and 'sample'
- Use samples to make informal inferences about the population
- Understand and use sampling techniques, including simple random sampling and opportunity

sampling

- Select or critique sampling techniques in the context of solving a statistical problem, including understanding that different samples can lead to different conclusions about the population

Data presentation and interpretation

- Interpret diagrams for single-variable data, including understanding that area in a histogram represents frequency] [Connect to probability distributions
- 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)
- Understand informal interpretation of correlation] [Understand that correlation does not imply causation
- 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

Probability

- Understand and use mutually exclusive and independent events when calculating probabilities] [Link to discrete and continuous distributions
- Understand and use conditional probability, including the use of tree diagrams, Venn diagrams, two-way tables Understand and use the conditional probability formula $P(A|B) = \frac{P(A \cap B)}{P(B)}$
- Modelling with probability, including critiquing assumptions made and the likely effect of more realistic assumptions

Statistical 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
- 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

Statistical hypothesis testing

- 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]; extend to correlation coefficients as measures of how close data points lie to a straight line and be able to 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 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 probability of incorrectly rejecting the null hypothesis
- Conduct a statistical hypothesis test for the mean of a Normal distribution with known, given or assumed variance and interpret the results in context

Quantities and units in mechanics

- Understand and use fundamental quantities and units in the S.I. system: length, time, mass] [Understand and use derived quantities and units: velocity, acceleration, force, weight], moment

Kinematics

- 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]; extend to 2 dimensions using vectors
- Use calculus in kinematics for motion in a straight line; extend to 2 dimensions using vectors
- Model motion under gravity in a vertical plane using vectors; projectiles

Forces and Newton's laws

- Understand the concept of a force; understand and use Newton's first law
- Understand and use Newton's second law for motion in a straight line (restricted to forces in two perpendicular directions or simple cases of forces given as 2-D vectors)]; extend to situations where forces need to be resolved (restricted to 2 dimensions)
- 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] [(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; 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]; resolving forces in 2 dimensions; equilibrium of a particle under coplanar forces
- Understand and use addition of forces; resultant forces; dynamics for motion in a plane
- Understand and use the $F R \leq \mu$ model for friction; coefficient of friction; motion of a body on a rough surface; limiting friction and statics

Moments

- Understand and use moments in simple static contexts

Year 12 & Year 13 Skills

- 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