

MATHEMATICS DEPARTMENT KEY STAGE 4 CURRICULUM OVERVIEW

The Mathematics department key stage 4 curriculum is designed to implement the Academy's vision of "Deepening Learning, Raising Aspiration", in line with the OAT curriculum strategy of "Teach, Develop, Change". Our curriculum is carefully designed to build resilience, aspiration and independence in our learners. We carefully design the KS4 curriculum to further develop and build upon prior learning at KS3.

Purpose of Study

Mathematics is a creative and highly inter-connected discipline that has been developed over centuries, providing the solution to some of history's most intriguing problems. It is essential to everyday life, critical to science, technology and engineering, and necessary for financial literacy and most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, an appreciation of the beauty and power of mathematics, and a sense of enjoyment and curiosity about the subject.

Mathematics is an interconnected subject in which pupils need to be able to move fluently between representations of mathematical ideas. The programmes of study are, by necessity, organised into apparently distinct domains, but pupils should make rich connections across mathematical ideas to develop fluency, mathematical reasoning and competence in solving increasingly sophisticated problems. They should also apply their mathematical knowledge to science and other subjects.

The expectation is that the majority of pupils will move through the programmes of study at broadly the same pace. However, decisions about when to progress should always be based on the security of the pupils' understanding and their readiness to progress to the next stage. Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content. Those who are not sufficiently fluent with earlier material should consolidate their understanding, including through additional practice before moving on.

Aims

The national curriculum for mathematics aims to ensure that all pupils:

- *Become **fluent** in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.*
- ***Reason mathematically** by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language.*
- *can **solve problems** by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of similar steps and persevering in seeking solutions.*


 Year
10

Week 1 Week 2 Week 3 Week 4 Week 5 Week 6 Week 7 Week 8 Week 9 Week 10 Week 11 Week 12 Week 13 Week 14

Autumn

Algebra

- Pythagoras Theorem
- Trigonometry

Geometry

- Alternate/ Corresponding angles
- Exterior/Interior angles
- Bearings
- Plans and elevations

Geometry

- Constructions
- Circles
- Arcs and sectors
- Surface area and Volume
- Congruence/Similar shapes

Assessment

- Revision of key material.
- **End of term assessment**

Spring

Statistics and probability

- Sampling
- Pie charts
- Probability
- Probability trees

Probability trees

- Transformations
 - Enlargements
 - Rotations
 - Reflections
 - Translation

Geometry

- Vectors

Algebra

- Sequences
- Forming and solving equations
- Simultaneous equations

Assessment

- Revision of key material.
- **End of term assessment**

Summer

Proportion

- Direct and inverse proportion

Number

- Recurring fractions
- Fractional/Negative Indices
- Product rule
- Upper and Lower Bounds
- Surds including rationalising the denominator

Algebra

- Expanding and factorising
- Rearranging equations
- Sequences (including quadratics)

Geometry

- Coordinate geometry (higher)

Assessment

- Revision of key material.
- **End of term assessment**

Autumn Half Term 1	
Block 1 – Weeks 1 to 3	Block 2 – Weeks 4 to 7
<ul style="list-style-type: none"> Understand, recall and apply Pythagoras' Theorem in 2D, including a triangle drawn on a coordinate grid. Understand, use and recall SOHCAHTOA, and apply them to find angles and lengths in general triangles in 2D figures. Solve multi-step problems that require the use of both Pythagoras and trigonometry. 	<ul style="list-style-type: none"> Recall and use key mathematical reasoning such as angles around a point, angles on a straight line and vertically opposite angles. Understand and use both the angle properties of parallel lines and interior/exterior angles of polygons including problems in context. Identify shapes which are congruent to each other (by eye). Use accurate drawing to solve bearings including those involving locus. Engage with locus problems including bearings. Understand and draw elevations for simple solids including 3D solids.
Notes/Links/Interleaving <ul style="list-style-type: none"> Students should be able to rearrange simple formulae and equations, as preparation for rearranging trigonometric formulae. Revisit the plotting of coordinates in all four quadrants and draw axes. Revisit shapes and symmetry. 	Additional Higher Content <ul style="list-style-type: none"> Use both Pythagoras Theorem and trigonometry to engage with abstract problems. Understand a proof for the exterior angles of a triangle. Explain why some polygons fit together and others do not.
Autumn Half Term 2	
Block 3 – Weeks 7 to 9	Block 4 = Weeks 10 to 14
<ul style="list-style-type: none"> Use a ruler and a compass to construct triangles, perpendicular bisector, angle bisector and loci problems. Recall and use key formulae of circles to calculate its perimeter and area. 	<ul style="list-style-type: none"> Calculate the surface area and volume of prisms made from composite 3D solids using a variety of metric measures. Engage with problem solving involving more complex shapes and solids, including segments of circles and frustums of cones. Using similarity and congruence to successfully solve complex problems
Notes/Links/Interleaving <ul style="list-style-type: none"> Students should be able to measure and draw lines. Construct diagrams of everyday 2D situations involving rectangles, triangles, perpendicular and parallel lines. Students should know how to use the four operations on a calculator. 	Additional Higher Content <ul style="list-style-type: none"> Use constructions to solve loci problems involving 3D shapes. Know that scale diagrams, including bearings and maps are 'similar' to the real-life examples.

Spring Half Term 1**Block 1 – Weeks 1 to 4**

- Plan a statistical investigation to include data collection and statistical analysis needed.
- Calculate probabilities involving mutually exclusive outcomes and both independent and dependent combined events.
- Using $1 - p$ as the probability of an event not occurring where p is the probability of it occurring.

Block 2 – Weeks 5 to 6

- Describe and transform 2D shapes using single transformations including reflections, rotations, enlargements and translations.

Notes/Links/Interleaving

- Encourage students to revisit statistical diagrams and inequality notation.
- Students should be able to draw and recognise lines parallel to axes and $y = x$, $y = -x$.

Additional Higher Content

- Understand conditional probabilities and decide if two events are independent.
- Enlarge a given shape by a centre of enlargement and a negative scale factor.

Spring Half Term 2**Block 3 – Weeks 7 to 9**

- Understand and use column notation to represent vectors.
- Recognise sequences of odd and even numbers and other sequences including the Fibonacci sequence and pattern sequences.
- Find the n th term of an arithmetic sequence to generate terms and determine if a certain number is in the sequence.
- Continue quadratic and geometric progression and use the n th term to generate terms.

Block 4 - Weeks 10 to 12

- Write expressions to solve problems representing a situation including simple equations.
- Form and solve equations in various contexts such as; Perimeter, area, probability etc.
- Write and solve linear simultaneous equations algebraically and graphically in the context of the problem.

Notes/Links/Interleaving

- Recall and apply Pythagoras' Theorem on a coordinate grid.
- Students should be able to set up and solve linear equations.
- Revisit student's understanding of the difference between equations, expressions etc.

Additional Higher Content

- Investigations involving vectors around 2D shapes such as a square can be extended to include considering the area enclosed in the same shapes.
- Form and solve equations relating to area including compound shapes and those that result in quadratic expressions.

Summer Half Term 1**Block 1 – Weeks 1 to 4**

- Solve word problems involving direct and inverse proportion in real-life context.
- Convert a fraction to a recurring decimal and vice versa.
- Use index laws to simplify and calculate the value of numerical expressions involving fractional and negative powers.

Block 2 – Weeks 5 to 6

- Use the product rule for counting in a real-life context.
- Calculate the upper and lower bounds of numbers given to a varying degree of accuracy in real-life context.
- Understand surd notation and how to simplify surd expressions involving squares.
- Rationalising the denominator involving surds.

Notes/Links/Interleaving

- Students should know the four operations of number and basic understanding of fractions as being 'parts of a whole'.
- Revisit inequality notation to specify an error interval due to truncation or rounding.
- Recall and use the hierarchy of operations.

Additional Higher Content

- Prove that the square root of a number lies between certain values.
- Find the upper and lower bounds of calculations involving 3D shapes.
- Links with other areas of Mathematics can be made by using surds in Pythagoras and when using trigonometric ratios.

Summer Half Term 2**Block 3 – Weeks 7 to 9**

- Expand the product of two or more linear expressions, working up to negatives in both brackets.
- Factorise quadratic expressions using a variety of methods including the difference of two squares.
- Understand how to change the subject of the formula in complex equations.
- Recognise, continue and generate quadratic sequences and simple geometric progressions involving real-life situations.

Block 4 - Weeks 10 to 12

- Sketch a graph to represent a linear function, using the gradient and y-intercept.
- Find the equation of the line using one point along with the given gradient.
- Recognise a linear, quadratic, cubic, reciprocal and circle graph from its shape.

Notes/Links/Interleaving

- Simplifying expressions involving brackets, powers and cancelling.
- Recognise factors of algebraic terms involving brackets – both single and double.

Additional Higher Content

- Evaluate statements and justify which answer is correct by providing a counter-argument by way of a correct solution.
- Draw circles which have a centre that is the origin and equation $x^2 + y^2 = r^2$

Year 11

Year 11	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14
Autumn	Geometry			Algebra Diversity		Probability Diversity		Rates Proportion Diversity		Statistics Diversity		Geometry	Assessment	
	<ul style="list-style-type: none"> Coordinate Geometry Surface Area & Volume (cylinder, cones, sphere & frustums) Transformation 			<ul style="list-style-type: none"> Quadratics including the formula & iteration Simultaneous equations 		<ul style="list-style-type: none"> Conditional Probability 		<ul style="list-style-type: none"> Direct and inverse Proportion Similarity in 2D and 3D shapes 		<ul style="list-style-type: none"> Sampling Cumulative frequency & box plots Histograms 		<ul style="list-style-type: none"> Graphs of trig functions Further trigonometry Using graphs Gradient and area under graphs 	<ul style="list-style-type: none"> PPE in November 	
Spring	Algebra				Geometry				Revision				Assessment	
	<ul style="list-style-type: none"> Algebraic fractions Functions Algebraic proof 				<ul style="list-style-type: none"> Circle geometry – gradients/tangents Circle theorems Congruence and geometric proof Vectors 				<ul style="list-style-type: none"> Revision based on topics identified in PPEs. 				<ul style="list-style-type: none"> PPE in March 	
Summer	Revision							Exams						
	<ul style="list-style-type: none"> Revision based on topics identified in PPEs. 							<ul style="list-style-type: none"> 25th May 2021 – Paper 1 : Non – Calculator Morning exam – 1 hour 30 minutes 8th June 2021 – Paper 2 : Calculator Morning exam – 1 hour 30 minutes 15th June 2021 – Paper 3 : Calculator Morning exam – 1 hour 30 minutes 						

Autumn Half Term 1**Block 1 – Weeks 1 to 4**

- Find the equation of the line using one point along with the given gradient.
- Recognise a linear, quadratic, cubic, reciprocal and circle graph from its shape.
- Solve problems involving surface area and volume for more complex shapes and solids including segments of circles and frustums of cones.
- Describe and transform 2D shapes using a combination of rotations, reflections, translations and enlargements.

Notes/Links/Interleaving

- Revisit approximating solutions of a quadratic equations from the graph.
- Revisit inequality notations and the use of key algebraic methods including substitution.

Block 2 – Weeks 5 to 7

- Solve quadratic equations (including equations which need rearranging) by factorisation, completing the square and quadratic formula.
- Solve quadratic (and cubic) equations using an iterative process.
- Set up and solve simultaneous equations and interpret the solution in the context of the problem.
- Use a variety of methods (including two-way tables, tree diagrams and Venn diagrams) to calculate conditional probability.
- Understand the capture-recapture method for selection.
- Compare experimental data and theoretical data.

Additional Higher Content

- Solve two linear inequalities in x , find the solution sets and compare them to see which value of x satisfies both solve linear inequalities in two variables algebraically.

Autumn Half Term 2**Block 3 – Weeks 7-10**

- Set up and use equations to solve word and other problems involving direct proportion or inverse proportion.
- Understand similarity of triangles and of other plane shapes and use this to make geometric inferences.
- Construct and interpret a range of statistical diagrams including cumulative frequency tables/diagrams and histograms to calculate averages.

Notes/Links/Interleaving

- Revisit writing of statements of direct and inverse proportion.
- Students should understand the data handling cycle.

Block 4 - Weeks 11 to 14

- Recognise, sketch, interpret and apply trigonometric functions.
- Know the sine and cosine rules, and use to solve 2D problems including involving bearings.
- Use your understanding of sketching quadratic graphs to solve simultaneous equations graphically
- Solve linear inequalities in two variables graphically.
- Use calculators to explore exponential growth and decay problems.

Additional Higher Content

- Justify and infer relationships in real-life scenarios to direct and inverse proportion such as ice cream sales and sunshine.

Spring Half Term 1**Block 1 – Weeks 7 to 9**

- Multiply and divide algebraic fractions.
- Solve linear and quadratic equations which arise from algebraic fractions.
- Understand inverse and composite functions.
- Solve 'Show that' and proof questions in context including (but not limited to) area, perimeter and volume.

Block 2 – Weeks 10 to 12

- Find the equation of the tangent to a circle at a given point.
- Recognise and construct the graph of a circle using $x^2 + y^2 = r^2$ for the radius r centred at the origin.
- Prove and use circle theorems (facts) to determine missing angles on diagrams.
- Use formal geometric proof for the similarity of two given triangles.
- Solve geometric problems in 2D where vectors are divided into a given ratio.

Notes/Links/Interleaving

- Revisit the basics of fractions including multiplying and dividing fractions.
- Recall and use the hierarchy of operations.
- Be able to recall key terminology relating to circles
- Revisit the relationship between the gradients of two perpendicular lines.

Additional Higher Content

- Interpret and analyse transformations of graphs of functions and write the functions algebraically.
- Select and apply construction techniques and understanding of loci to draw graphs based on circles and perpendicular lines.
- Solve angle problems by first proving congruence.
- Produce geometrical proofs to prove points are collinear.

Spring Half Term 2**Block 3 – Weeks 1 to 4**

- Revision to be determined by question level analysis (QLA) completed on the PPEs

Block 4 - Weeks 5 to 6

- Revision to be determined by question level analysis (QLA) completed on the PPEs.

Notes/Links/Interleaving

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Additional Higher Content

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Summer Half Term 1	
Block 1 – Weeks 1 to 4	Block 2 – Weeks 4 to 7
<ul style="list-style-type: none"> Revision to be determined by question level analysis (QLA) completed on the PPEs. Exams to be completed on dates outlined above. 	<ul style="list-style-type: none"> Revision to be determined by question level analysis (QLA) completed on the PPEs. Exams to be completed on dates outlined above.
<p>Notes/Links/Interleaving</p> <ul style="list-style-type: none"> 	<p>Additional Higher Content</p> <ul style="list-style-type: none">
Summer Half Term 2	
Block 3 – Weeks 8 to 11	Block 4 – Weeks 12 to 14
<ul style="list-style-type: none"> Revision to be determined by question level analysis (QLA) completed on the PPEs. Exams to be completed on dates outlined above. 	<ul style="list-style-type: none"> Revision to be determined by question level analysis (QLA) completed on the PPEs. Exams to be completed on dates outlined above.
<p>Notes/Links/Interleaving</p> <ul style="list-style-type: none"> 	<p>Additional Higher Content</p> <ul style="list-style-type: none">