

## 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	<b>Number</b>						Diversity	<b>Algebra</b>				<b>Assessment</b>	
	<ul style="list-style-type: none"> <li>Two – way tables</li> <li>Frequency trees</li> <li>Venn Diagram</li> <li>Product of prime factors</li> <li>Multiples in context</li> </ul>				<ul style="list-style-type: none"> <li>Best values</li> <li>Exchange rates</li> <li>Rounding and error intervals</li> <li>Estimation</li> <li>Use of a calculator</li> </ul>			<ul style="list-style-type: none"> <li>Expand and Simplify</li> <li>Factorising</li> <li>Solving linear equations</li> <li>Inequalities</li> </ul>				<ul style="list-style-type: none"> <li>Revision of key material.</li> <li><b>End of term assessment</b></li> </ul>	
Spring	<b>Number</b>					Diversity	<b>Ratio and proportion</b>		Diversity	<b>Geometry</b>		<b>Assessment</b>	
	<ul style="list-style-type: none"> <li>Fractions</li> <li>Percentage of amounts</li> <li>Interest and growth</li> <li>Depreciation and decay</li> <li>Reverse Percentages</li> </ul>						<ul style="list-style-type: none"> <li>Ratio</li> <li>Proportion – Recipes</li> </ul>			<ul style="list-style-type: none"> <li>Alternate and corresponding angles</li> <li>Interior and exterior angles</li> </ul>		<ul style="list-style-type: none"> <li>Revision of key material.</li> <li><b>End of term assessment</b></li> </ul>	
Summer	<b>Statistics</b>						Diversity	<b>Number</b>		<b>Probability</b>		<b>Assessment</b>	
	<ul style="list-style-type: none"> <li>Sampling</li> <li>Averages</li> <li>Averages from table</li> <li>Averages from grouped data</li> <li>Frequency diagrams</li> <li>Scatter graphs and time series</li> </ul>							<ul style="list-style-type: none"> <li>Standard Index Form</li> <li>Index Laws</li> </ul>		<ul style="list-style-type: none"> <li>Probability</li> <li>Probability Trees</li> </ul>		<ul style="list-style-type: none"> <li>Revision of key material.</li> <li><b>End of term assessment</b></li> </ul>	

**Autumn Half Term 1****Block 1 – Weeks 1 to 3**

- Interpret and design two-way tables for discrete and grouped data.
- Calculate probabilities using two-way tables.
- Interpret and design frequency trees which will be used to calculate probabilities.
- Using set notation to interpret and design Venn diagrams to represent real-life situations.
- Use prime factorisation to solve problems involving HCF and LCM.

**Block 2 – Weeks 4 to 7**

- Solve worded problems which encourage students to calculate which product is the better buy.
- Convert between different currencies to determine the best value and when it is appropriate to do so.
- Estimate answers to one or two-step calculations by rounding numbers to one significant figures.

**Notes/Links/Interleaving**

- Many of the topics revisit probability.
- Links with students previous knowledge of factors, multiples and prime numbers.

**Additional Higher Content**

- Calculate conditional probabilities using two-way tables and Venn diagrams.
- Using inequality notation to specify error intervals due to truncation.

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

- Identify an expression/equation/formula/identity from a list.
- Manipulate and simplify algebraic expressions through the collection of like terms and cancelling.
- Expand and simplify single and double brackets involving positive and negative numbers and squaring a linear expression.
- Recognise factors of algebraic terms involving single brackets and simplify expressions by factorising, including subsequently collecting like terms.
- Factorise quadratic expressions including those that use the difference of two squares.

**Block 4 = Weeks 10 to 12**

- Writing expressions and set up simple equations which can be used to solve problems in context.
- Use both the balancing method and function machines to solve simple linear equations.
- Solve linear equations where unknowns appear on both sides, contain brackets including negative numbers.
- Display inequalities on a number line and determine the integers which satisfy an inequality.
- Solving one and two inequalities in which their solution sets are compared.

**Notes/Links/Interleaving**

- Revisit inequalities signs between numbers and constructing a number line.
- Solve equations in the contexts used in earlier topics.

**Additional Higher Content**

- Finding the roots of a quadratic function algebraically.
- Solve linear equations that contain unknowns along with fractional coefficients.

### Spring Half Term 1

#### Block 1 – Weeks 1 to 4

- Calculating a fraction of an amount.
- Add, subtract, multiply and divide fractions including mixed numbers and improper fractions.
- Calculate a percentage of a quantity or measurement along with percentages over 100%.
- Calculate percentage increase/decrease with or without a calculator.
- Calculate a percentage of a quantity using a multiplier in real-life situation.

#### Block 2 – Weeks 5 to 6

- Carry out calculations which involve repeated percentage change (without using the formula).
- Set up, solve and interpret the answers to growth and decay problems.
- Find the original amount with and without a calculator, after a percentage increase or decrease.

#### Notes/Links/Interleaving

- Students should have strong written and mental methods for both the four operations and using the order of operations.
- Revisit fractions, decimals and percentages.
- Revisit formal methods for calculations involving integers and fractions.

#### Additional Higher Content

- Understand “reciprocal” as multiplicative inverse, knowing that any non-zero number multiplied by its reciprocal is 1 (and that zero has no reciprocal because division by zero is not defined).
- Calculate interest using the compound interest rate formula.

### Spring Half Term 2

#### Block 3 – Weeks 7 to 9

- Solve ratio problems in context.
- Scale up recipes and decide if there is enough of each ingredient.
- Engage in proportion problem solving using the unitary method.

#### Block 4 - Weeks 10 to 12

- Recall and use key mathematical reasoning such as angles around a point, angles on a straight line and vertically opposite angles.
- Understand and use the angle properties of parallel lines and find missing angles using appropriate method and reasoning.
- Calculate the value of interior and exterior angles of a polygon using the key formulae including problems in context.
- Identify shapes which are congruent to each other (by eye).

#### Notes/Links/Interleaving

- Students should have an understanding of fractions as being ‘parts of a whole’

#### Additional Higher Content

- Express a multiplicative relationship between two quantities as a ratio or a fraction.

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

- Plan a statistical investigation to include data collection and statistical analysis needed.
- Understand the use of an ‘estimate’ when finding the mean of grouped data using the mid-interval values.
- Interpret a range of averages for continuous or grouped data from a table.

**Block 2 – Weeks 5 to 6**

- Produce and interpret frequency polygons for both discrete and continuous data.
- Draw and interpret scatter diagrams to include the line of best fit.
- Use the line of best fit to make predictions and identify correlations between variables.
- Construct tables for time series data and identify trends in the data.

**Notes/Links/Interleaving**

- Encourage students to revisit statistical diagrams and inequality notation.
- Students will have experience with tally charts and be able to calculate the midpoint of two numbers.

**Additional Higher Content**

- State how reliable scatter graph predictions are i.e. not reliable if extrapolated.

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

- Convert large and small numbers into standard form and vice versa.
- Add, subtract, multiply and divide numbers in standard form.
- Use the laws of indices to multiply and divide both numbers written in index notation and in algebraic terms.
- Use index laws to simplify and calculate the value of numerical expressions involving multiplication and division of integer powers, fractions and powers of a power.
- Use numbers raised to the power zero, including the zero power of 10.

**Block 4 - Weeks 10 to 12**

- Calculate probabilities including mutually exclusive outcomes
- Calculate the probability of independent and dependent combined events.
- Using  $1 - p$  as the probability of an event not occurring where  $p$  is the probability of it occurring.
- Find the probability of successive events, such as several throws of a single dice.
- Use tree diagrams to calculate the probability of two independent events or two dependent events.

**Notes/Links/Interleaving**

- Students should be able to write powers of 10 in index form and recognise and recall powers of 10, i.e.  $10^2 = 100$ .
- Revisit adding and multiplying fractions and decimals.

**Additional Higher Content**

- Interpret a calculator display using standard form and know how to enter numbers in standard form.
- Understand conditional probabilities and decide if two events are independent.

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

**Geometry**

- Straight line graphs
- Quadratic and cubic graphs
- Coordinate geometry
- Speed, distance and time
- Compound measures
- Real life graphs

**Algebra**

- Pythagoras Theorem
- Trigonometry

**Geometry**

- Alternate and corresponding angles
- Interior and exterior angles
- Bearings
- Plans and elevations
- Constructions

**Statistics and Probability**

Diversity

- Sampling
- Pie Charts
- Probability
- Probability trees

**Assessment**

- **PPE in November**

Autumn

**Geometry**

- Circles, Arcs and sectors
- Surface area and volume
- Congruence and Similarity
- Transformations
- Vectors

**Algebra**

Diversity

- Sequences
- Forming and solving equations
- Simultaneous equations

**Revision**

- Revision based on topics identified in PPEs.

**Assessment**

- **PPE in March**

Spring

**Revision**

- Revision based on topics identified in PPEs.

**Exams**

- **25<sup>th</sup> May 2021 – Paper 1 : Non – Calculator**  
Morning exam – 1 hour 30 minutes
- **8<sup>th</sup> June 2021 – Paper 2 : Calculator**  
Morning exam – 1 hour 30 minutes
- **15<sup>th</sup> June 2021 – Paper 3 : Calculator**  
Morning exam – 1 hour 30 minutes

Summer

## Autumn Half Term 1

## Block 1

- Recognise, plot and draw graphs of straight lines of the form  $y = mx + c$  with and without a table of values.
- Recognise, sketch and interpret linear, quadratic, cubic and reciprocal graphs.
- Understand and use compound measures including density, pressure and speed including conversions.
- Interpret gradient as the rate of change in distance–time and speed–time graphs, graphs of containers filling and emptying, and unit price graphs.
- Construct distance–time and velocity–time graphs.

## Block 2

- Solve multi-step problems that require the use of both Pythagoras and trigonometry.

## Notes/Links/Interleaving

- Students should be able to rearrange simple formulae and equations, as preparation for rearranging trigonometric formulae.

## Additional Higher Content

- Plot and draw graphs of straight lines in the form  $ax + by = c$
- Use both Pythagoras Theorem and trigonometry to engage with abstract problems.

## Autumn Half Term 2

## Block 3

- Recall and use key mathematical reasoning such as angles around a point, angles on a straight line and vertically opposite angles.
- Understand and use the angle properties of parallel lines and find missing angles using appropriate method and reasoning.
- Calculate the value of interior and exterior angles of a polygon using the key formulae including problems in context.
- Engage with locus problems including bearings and constructions.

## Block 4

- Plan a statistical investigation to include data collection and statistical analysis needed.
- Calculate the probability of independent and dependent combined events.
- Using  $1 - p$  as the probability of an event not occurring where  $p$  is the probability of it occurring.
- Use tree diagrams to calculate the probability of two independent events or two dependent events

## Notes/Links/Interleaving

- Revisit the plotting of coordinates in all four quadrants and draw axes.
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## Additional Higher Content

- Understand a proof for the exterior angles of a triangle.
- Explain why some polygons fit together and others do not.

## Spring Half Term 1

## Block 1

- Recall and use key formulae to successfully solve problems involving circles and 2-D shapes.
- Using the basic congruence criteria for triangles to solve angle problems.
- Identify shapes which are similar; including all circles or all regular polygons with equal number of sides.
- Transform 2D shapes using single reflections, rotations, translations and enlargements.
- Enlarge a given shape by a centre of enlargement and a positive or fractional scale factor.
- Identify two column vectors which are parallel.

## Block 2

- Generate the nth term for arithmetic and quadratic sequences.
- Answer 'show that' questions using consecutive integers ( $n$ ,  $n + 1$ ), squares  $a^2$ ,  $b^2$ , even numbers  $2n$ , and odd numbers  $2n + 1$ .
- 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.
- Solve word problems involving direct and inverse proportion.

## Notes/Links/Interleaving

- Students should be able to draw and recognise lines parallel to axes and  $y = x$ ,  $y = -x$ .
- Students should be able to set up and solve linear equations.
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## Additional Higher Content

- Enlarge a given shape by a centre of enlargement and a negative scale factor.
- Form and solve equations relating to area including compound shapes and those that result in quadratic expressions.

## Spring Half Term 2

## Block 3

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

## Block 4

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

## Notes/Links/Interleaving

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## Additional Higher Content

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**Summer Half Term 1****Block 1**

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

**Block 2**

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

**Notes/Links/Interleaving**

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**Additional Higher Content**

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**Summer Half Term 2****Block 3**

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

**Block 4**

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

**Notes/Links/Interleaving**

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**Additional Higher Content**

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