



### Key Stage 3 Mathematics

Mathematics has developed over time as a means of solving problems and also as an academic discipline to be studied for its own sake. Mathematics can stimulate moments of pleasure and Wonder, when you solve a problem for the first time, discover a more elegant solution, or notice hidden connections.

#### General Aim of the subject

- 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, conjecture 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 simpler steps and persevering in seeking solutions

The expectation is that the majority of pupils will move through the programs of study at broadly the same pace. However, decision about when to progress should always be based on the security of 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.

|   | Year 7  | Year 8  | Year 9  |                   |
|---|---------|---------|---------|-------------------|
| 1 | Stage 7 | Stage 8 | Stage 9 | Year 7: 8 lessons |
| 2 | Stage 7 | Stage 8 | Stage 9 | Year 8: 9 lessons |
| 3 | Stage 7 | Stage 8 | Stage 8 | Year 9: lessons   |
| 4 | Stage 6 | Stage 7 | Stage 8 | Per fortnight     |
| 5 | Stage 6 | Stage 7 |         |                   |

#### Build a Mathematician Assessments:

Assessment tasks to support the process of building a picture of a mathematician. These BAM tasks are ideal to consolidate intended learning, support deliberate practice sessions and/ or use as homework tasks. The carefully crafted questions have been designed to assess fluency, reasoning, problem solving and a student's ability to apply their understanding. One further questions will always focus on a misconceptions.

## Mathematics overview: Stage 6

| Unit  | Hours | Build a Mathematician Assessments   | Essential knowledge  |
|---|-------|---|--|
| Numbers and the number system                   | 8     | Multiply and divide numbers with up to three decimal places by 10, 100, and 1000                                  | <p>Know percentage and decimal equivalents for fractions with a denominator of 2, 3, 4, 5, 8 and 10</p> <p>Know the rough equivalence between miles and kilometres</p> <p>Know that vertically opposite angles are equal</p> <p>Know that the area of a triangle = <math>\text{base} \times \text{height} \div 2</math></p> <p>Know that the area of a parallelogram = <math>\text{base} \times \text{height}</math></p> <p>Know that volume is measured in cubes</p> <p>Know the names of parts of a circle</p> <p>Know that the diameter of a circle is twice the radius</p> <p>Know the conventions for a 2D coordinate grid</p> <p>Know that mean = <math>\text{sum of data} \div \text{number of pieces of data}</math></p> |
| Calculating                                     | 8     | Use long division to divide numbers up to four digits by a two-digit number                                       |  |
| Calculating: division                           | 8     | Use simple formulae expressed in words  |  |
| Visualising and constructing                    | 8     | Generate and describe linear number sequences   |  |
| Investigating properties of shapes              | 8     | Use simple ratio to compare quantities<br>Write a fraction in its lowest terms by cancelling common factors       |  |
| Algebraic proficiency: using formulae           | 4     | Add and subtract fractions and mixed numbers with different denominators  |  |
| Exploring fractions, decimals and percentages   | 8     | Multiply pairs of fractions in simple cases<br>Find percentages of quantities                                     |  |
| Proportional reasoning                          | 4     | Solve missing angle problems involving triangles, quadrilaterals, angles at a point and angles on a straight line |  |
| Pattern sniffing                                | 4     | Calculate the volume of cubes and cuboids   |  |
| Measuring space                                 | 4     | Use coordinates in all four quadrants   |  |
| Investigating angles                            | 4     | Calculate and interpret the mean as an average of a set of discrete data<br>Stage 6 BAM Progress Tracker Sheet    |  |
| Calculating fractions, decimals and percentages | 12    |   |  |
| Solving equations and inequalities              | 4     |   |  |
| Calculating space                               | 8     |   |  |
| Checking, approximating and estimating          | 4     |   |  |
| Mathematical movement                           | 4     |   |  |
| Presentation of data                            | 4     |   |  |
| Measuring data                                  | 4     |   |  |

## Mathematics overview: Stage 7

| <i>Unit</i>                                     | <i>Hours</i> | <i>Build a Mathematician Assessments</i>  | <i>Essential knowledge</i>   |
|---|--------------|---|--|
| Numbers and the number system                   | 9            | <ul style="list-style-type: none"> <li>Use positive integer powers and associated real roots</li> </ul>   | <ul style="list-style-type: none"> <li>Know the first 6 cube numbers</li> </ul>  |
| Counting and comparing                          | 4            | <ul style="list-style-type: none"> <li>Apply the four operations with decimal numbers</li> </ul>  | <ul style="list-style-type: none"> <li>Know the first 12 triangular numbers</li> </ul>   |
| Calculating                                     | 9            | <ul style="list-style-type: none"> <li>Write a quantity as a fraction or percentage of another</li> <li>Use multiplicative reasoning to interpret percentage change</li> </ul>                          | <ul style="list-style-type: none"> <li>Know the symbols =, ≠, &gt;, ≤, ≥</li> </ul>  |
| Visualising and constructing                    | 5            | <ul style="list-style-type: none"> <li>Use multiplicative reasoning to interpret percentage change</li> </ul>   | <ul style="list-style-type: none"> <li>Know the order of operations including brackets</li> </ul>  |
| Investigating properties of shapes              | 6            | <ul style="list-style-type: none"> <li>Add, subtract, multiply and divide with fractions and mixed numbers</li> </ul>   | <ul style="list-style-type: none"> <li>Know basic algebraic notation</li> </ul>  |
| Algebraic proficiency: tinkering                | 9            | <ul style="list-style-type: none"> <li>Check calculations using approximation, estimation or inverse operations</li> </ul>  | <ul style="list-style-type: none"> <li>Know that area of a rectangle = <math>l \times w</math></li> </ul>  |
| Exploring fractions, decimals and percentages   | 3            | <ul style="list-style-type: none"> <li>Simplify and manipulate expressions by collecting like terms</li> <li>Simplify and manipulate expressions by multiplying a single term over a bracket</li> </ul> | <ul style="list-style-type: none"> <li>Know that area of a triangle = <math>b \times h \div 2</math></li> <li>Know that area of a parallelogram = <math>b \times h</math></li> <li>Know that area of a trapezium = <math>((a + b) \div 2) \times h</math></li> </ul> |
| Proportional reasoning                          | 4            | <ul style="list-style-type: none"> <li>Substitute numbers into formulae</li> </ul>  | <ul style="list-style-type: none"> <li>Know that volume of a cuboid = <math>l \times w \times h</math></li> </ul>  |
| Pattern sniffing                                | 3            | <ul style="list-style-type: none"> <li>Solve linear equations in one unknown</li> </ul>   | <ul style="list-style-type: none"> <li>Know the meaning of faces, edges and vertices</li> </ul>  |
| Measuring space                                 | 5            | <ul style="list-style-type: none"> <li>Understand and use lines parallel to the axes, <math>y = x</math> and <math>y = -x</math></li> </ul>   | <ul style="list-style-type: none"> <li>Know the names of special triangles and quadrilaterals</li> </ul>   |
| Investigating angles                            | 3            | <ul style="list-style-type: none"> <li>Calculate surface area of cubes and cuboids</li> </ul>   | <ul style="list-style-type: none"> <li>Know how to work out measures of central tendency</li> </ul>  |
| Calculating fractions, decimals and percentages | 12           | <ul style="list-style-type: none"> <li>Understand and use geometric notation for labelling angles, lengths, equal lengths and parallel lines</li> </ul>   | <ul style="list-style-type: none"> <li>Know how to calculate the range</li> </ul>  |
| Solving equations and inequalities              | 6            | <ul style="list-style-type: none"> <li>Stage 7 BAM Progress Tracker Sheet</li> </ul>  |  |
| Calculating space                               | 6            |   |  |
| Checking, approximating and estimating          | 2            |   |  |
| Mathematical movement                           | 8            |   |  |
| Presentation of data                            | 6            |   |  |
| Measuring data                                  | 5            |   |  |

## Mathematics overview: Stage 8

| Unit  | Hours | Build a Mathematician Assessments  | Essential knowledge  |
|---|-------|--|--|
| Numbers and the number system                   | 9     | <ul style="list-style-type: none"> <li>Apply the four operations with negative numbers</li> </ul>  | <ul style="list-style-type: none"> <li>Know how to write a number as a product of its prime factors</li> </ul>                               |
| Calculating                                     | 9     | <ul style="list-style-type: none"> <li>Convert numbers into standard form and vice versa</li> </ul>  | <ul style="list-style-type: none"> <li>Know how to round to significant figures</li> </ul>   |
| Visualising and constructing                    | 8     | <ul style="list-style-type: none"> <li>Apply the multiplication, division and power laws of indices</li> <li>Convert between terminating decimals and fractions</li> </ul> | <ul style="list-style-type: none"> <li>Know the order of operations including powers</li> </ul>  |
| Understanding risk I                            | 6     | <ul style="list-style-type: none"> <li>Find a relevant multiplier when solving problems involving proportion</li> </ul>  | <ul style="list-style-type: none"> <li>Know how to enter negative numbers into a calculator</li> </ul>                                       |
| Algebraic proficiency: tinkering                | 10    | <ul style="list-style-type: none"> <li>Solve problems involving percentage change, including original value problems</li> </ul>  | <ul style="list-style-type: none"> <li>Know that <math>a^0 = 1</math></li> </ul>   |
| Exploring fractions, decimals and percentages   | 3     | <ul style="list-style-type: none"> <li>Factorise an expression by taking out common factors</li> </ul>   | <ul style="list-style-type: none"> <li>Know percentage and decimal equivalents for fractions with a denominator of 3, 5, 8 and 10</li> </ul> |
| Proportional reasoning                          | 8     | <ul style="list-style-type: none"> <li>Change the subject of a formula when two steps are required</li> </ul>  | <ul style="list-style-type: none"> <li>Know the characteristic shape of a graph of a quadratic function</li> </ul>                           |
| Pattern sniffing                                | 4     | <ul style="list-style-type: none"> <li>Find and use the nth term for a linear sequence</li> </ul>  | <ul style="list-style-type: none"> <li>Know how to measure and write bearings</li> </ul>   |
| Investigating angles                            | 5     | <ul style="list-style-type: none"> <li>Solve linear equations with unknowns on both sides</li> <li>Plot and interpret graphs of linear functions</li> </ul>                | <ul style="list-style-type: none"> <li>Know how to identify alternate angles</li> <li>Know how to identify corresponding angles</li> </ul>   |
| Calculating fractions, decimals and percentages | 6     | <ul style="list-style-type: none"> <li>Apply the formulae for circumference and area of a circle</li> <li>Calculate theoretical probabilities for single events</li> </ul> | <ul style="list-style-type: none"> <li>Know how to find the angle sum of any polygon</li> </ul>  |
| Solving equations and inequalities              | 4     |  | <ul style="list-style-type: none"> <li>Know that circumference = <math>2\pi r = \pi d</math></li> </ul>                                      |
| Calculating space                               | 9     | <ul style="list-style-type: none"> <li>Stage 8 BAM Progress Tracker Sheet</li> </ul>   | <ul style="list-style-type: none"> <li>Know that area of a circle = <math>\pi r^2</math></li> </ul>  |
| Algebraic proficiency: visualising              | 9     |  | <ul style="list-style-type: none"> <li>Know that volume of prism = area of cross-section <math>\times</math> length</li> </ul>               |
| Understanding risk II                           | 5     |  | <ul style="list-style-type: none"> <li>Know to use the midpoints of groups to estimate the mean of a set of grouped data</li> </ul>          |
| Presentation of data                            | 4     |  | <ul style="list-style-type: none"> <li>Know that probability is measured on a 0-1 scale</li> </ul>   |
| Measuring data                                  | 6     |  | <ul style="list-style-type: none"> <li>Know that the sum of all probabilities for a single event is 1</li> </ul>                             |

## Mathematics overview: Stage 9

| Unit                                  | Hours | Build a Mathematician Assessments  | Essential knowledge  |
|---------------------------------------|-------|--|--|
| Calculating                           | 12    | <ul style="list-style-type: none"> <li>Calculate with roots and integer indices</li> </ul>   | <ul style="list-style-type: none"> <li>Know how to interpret the display on a scientific calculator when working with standard form</li> </ul>                         |
| Visualising and constructing          | 10    | <ul style="list-style-type: none"> <li>Manipulate algebraic expressions by expanding the product of two binomials</li> </ul>   | <ul style="list-style-type: none"> <li>Know the difference between direct and inverse proportion</li> </ul>  |
| Algebraic proficiency: tinkering      | 9     | <ul style="list-style-type: none"> <li>Manipulate algebraic expressions by factorising a quadratic expression of the form <math>x^2 + bx + c</math></li> </ul>                                 | <ul style="list-style-type: none"> <li>Know how to represent an inequality on a number line</li> </ul>   |
| Proportional reasoning                | 9     | <ul style="list-style-type: none"> <li>Understand and use the gradient of a straight line to solve problems</li> </ul>   | <ul style="list-style-type: none"> <li>Know that the point of intersection of two lines represents the solution to the corresponding simultaneous equations</li> </ul> |
| Pattern sniffing                      | 8     | <ul style="list-style-type: none"> <li>Solve two linear simultaneous equations algebraically and graphically</li> </ul>  | <ul style="list-style-type: none"> <li>Know the meaning of a quadratic sequence</li> </ul>   |
| Solving equations and inequalities I  | 5     | <ul style="list-style-type: none"> <li>Plot and interpret graphs of quadratic functions</li> </ul>   | <ul style="list-style-type: none"> <li>Know the characteristic shape of the graph of a cubic function</li> </ul>   |
| Calculating space                     | 13    | <ul style="list-style-type: none"> <li>Change freely between compound units</li> </ul>   | <ul style="list-style-type: none"> <li>Know the characteristic shape of the graph of a reciprocal function</li> </ul>  |
| Conjecturing                          | 6     | <ul style="list-style-type: none"> <li>Use ruler and compass methods to construct the perpendicular bisector of a line segment and to bisect an angle</li> </ul>                               | <ul style="list-style-type: none"> <li>Know the definition of speed</li> </ul>   |
| Algebraic proficiency: visualising    | 12    | <ul style="list-style-type: none"> <li>Solve problems involving similar shapes</li> </ul>  | <ul style="list-style-type: none"> <li>Know the definition of density</li> </ul>   |
| Solving equations and inequalities II | 8     | <ul style="list-style-type: none"> <li>Calculate exactly with multiples of <math>\pi</math></li> </ul>   | <ul style="list-style-type: none"> <li>Know the definition of pressure</li> </ul>  |
| Understanding risk                    | 8     | <ul style="list-style-type: none"> <li>Apply Pythagoras' theorem in two dimensions</li> </ul>  | <ul style="list-style-type: none"> <li>Know Pythagoras' theorem</li> </ul>   |
| Presentation of data                  | 5     | <ul style="list-style-type: none"> <li>Use geometrical reasoning to construct simple proofs</li> <li>Use tree diagrams to list outcomes</li> <li>Stage 9 BAM Progress Tracker Sheet</li> </ul> | <ul style="list-style-type: none"> <li>Know the definitions of arc, sector, tangent and segment</li> <li>Know the conditions for congruent triangles</li> </ul>        |