

BAM indicators: Minimum expected outcomes by the end of each stage: 13 in every stage, critical in developing conceptual understanding and essential for pupils to make progress.

Essential knowledge: Critical information that pupils need to know.

BAM Indicators + Essential Knowledge = Fluency in the Fundamentals of Mathematics

	BAM Indicators	Essential Knowledge
Stage 1	<ul style="list-style-type: none"> • Read and write numbers from 1 to 20 in numerals and in words • Count to and across 100, forwards and backwards from any given number • Count from zero in multiples of 2, 5 and 10 • Add and subtract a two-digit number and a one-digit number up to 20 • Solve one-step multiplication and division problems by using concrete objects and pictorial representations • Write addition and subtraction statements using the symbols '+', '-' and '=' • Recognise and name the fractions $\frac{1}{2}$ and $\frac{1}{4}$ • Tell the time to the hour, and half past the hour, using an analogue clock • Sequence events in chronological order • Use the comparative vocabulary of length, mass, capacity and time • Recognise and name rectangles (including squares), circles and triangles • Recognise and name cuboids (including cubes), pyramids and spheres • Describe position and movement 	<ul style="list-style-type: none"> • Know the symbols =, +, - • Know doubles and halves up to 10 • Know number bonds to 10 • Know the value of different denominations of coins and notes • Know the days of the week • Know the meaning of 'weeks', 'months' and 'years'



stage 2	<ul style="list-style-type: none"> • Read and write numbers up to 100 in numerals and in words • Compare and order whole numbers up to 100 • Count from zero in multiples of 2, 3 and 5 • Count in tens from any number, forwards and backwards • Add and subtract numbers including a two-digit number and ones, a two-digit number and tens, two two-digit numbers, and three one-digit numbers • Derive addition and subtraction facts to 100 using known facts to 20 • Write multiplication and division statements using correct symbols • Understand that addition and multiplication of two numbers can be done in any order (commutative) and subtraction and division cannot • Recognise and name the fractions $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{4}$, $\frac{3}{4}$ • Tell the time to the nearest five minutes using an analogue clock, including 'quarter past' and 'quarter to'. • Use a ruler to measure lengths in millimetres and centimetres • Identify and describe 2D and 3D shapes • Use mathematical vocabulary to describe position, direction and movement 	<ul style="list-style-type: none"> • Know the place value headings of ones and tens • Know that zero is a placeholder • Know the symbols =, <, >, ×, ÷ • Know the meaning of odd and even numbers • Know doubles and halves up to 20 • Know addition and subtraction facts to 20 • Know multiplication facts for the 2, 5 and 10 multiplication tables • Know division facts related to the 2, 5 and 10 multiplication tables • Know that 60 minutes = 1 hour • Know that 24 hours = 1 day • Know the symbols for pounds (£) and pence (p) • Know the standard units for length (m, cm), mass (kg, g), temperature (°C) and capacity (litres/ml) • Know the names and number of sides of 2D shapes • Know the meaning of 'edges', 'faces' and 'vertices' • Know the names and number of faces of 3D shapes
stage 3	<ul style="list-style-type: none"> • Read and write numbers up to 1000 in numerals and in words • Compare and order whole numbers up to 1000 • Count from zero in multiples of 4, 8, 50 and 100 • Add and subtract numbers mentally including a three-digit number and ones, tens and hundreds • Use columnar addition and subtraction with numbers up to three digits • Use known facts to multiply and divide mentally within the 2, 3, 4, 8 and 10 multiplication tables • Multiply a two-digit number by a one-digit number • Understand fractions as proportions • Understand fractions as numbers • Count forward and backwards in tenths • Tell the time using analogue and digital 12-hour clocks • Measure length (mm, cm, m), mass (g, kg) and capacity (ml, l) • Measure perimeters of shapes 	<ul style="list-style-type: none"> • Know the place value headings of tenths, ones, tens and hundreds • Know multiplication facts for the 3, 4 and 8 multiplication tables • Know division facts related to the 3, 4 and 8 multiplication tables • Know that a right angle is $\frac{1}{4}$ of a turn • Know the number of days in each month • Know the number days in a year and a leap year • Know that 60 seconds = 1 minute • Know the Roman numerals from I to XII • Know the vocabulary of time including o'clock, a.m., p.m., morning afternoon, noon and midnight • Know the meaning of 'perimeter'



Stage 4	<ul style="list-style-type: none"> • Round any number to the nearest 10, 100, 1000 and round a number with one decimal place to the nearest whole number • Count backwards through zero • Use columnar addition and subtraction with numbers up to four digits • Multiply two- and three-digit numbers by a one-digit number • Use known and derived facts to multiply and divide mentally • Write any number of tenths or hundredths as a decimal • Find families of common equivalent fractions • Add and subtract fractions with the same denominator • Find areas of rectilinear shapes by counting squares • Use a line of symmetry to complete a symmetric shape or pattern • Identify lines of symmetry in 2D shapes • Use coordinates in the first quadrant • Interpret and construct bar charts and time graphs 	<ul style="list-style-type: none"> • Know the place value headings of ones, tens, hundreds and thousands • Know the Roman numerals I, V, X, L, C • Know the % symbol • Know multiplication facts up to 12×12 • Know division facts related to tables up to 12×12 • Know decimals equivalents of $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$ • Know adjacent time facts involving years, months, weeks, days, hours, minutes and seconds • Know 12- and 24-hour clock conversions • Know the names and connected properties of triangles and quadrilaterals • Know the definitions of acute and obtuse angles • Know that area is measured in squares • Know that perimeter is a measure of length
Stage 5	<ul style="list-style-type: none"> • Identify multiples and factors of a number • Count forwards and backwards through zero • Round to one decimal place • Use columnar addition and subtraction with numbers of any size • Multiply a three- or four-digit number by a two-digit number using long multiplication • Divide numbers up to four-digits by a single-digit number using short division and interpret the remainder • Add and subtract fractions with denominators that are multiples of the same number • Write decimals as fractions • Understand that per cent relates to number of parts per hundred • Convert between adjacent metric units of measure for length, capacity and mass • Measure and draw angles • Calculate the area of rectangles • Distinguish between regular and irregular polygons 	<ul style="list-style-type: none"> • Know the place value headings up to millions • Recall primes to 19 • Know the first 12 square numbers • Know the Roman numerals I, V, X, L, C, D, M • Know percentage and decimal equivalents for $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{4}{5}$ • Know rough conversions between metric and Imperial units • Know that angles are measured in degrees • Know angles in one whole turn total 360° • Know angles in half a turn total 180° • Know that area of a rectangle = length \times width



Stage 6	<ul style="list-style-type: none"> • Multiply and divide numbers with up to three decimal places by 10, 100, and 1000 • Use long division to divide numbers up to four digits by a two-digit number • Use simple formulae expressed in words • Generate and describe linear number sequences • Use simple ratio to compare quantities • Write a fraction in its lowest terms by cancelling common factors • Add and subtract fractions and mixed numbers with different denominators • Multiply pairs of fractions in simple cases • Find percentages of quantities • Solve missing angle problems involving triangles, quadrilaterals, angles at a point and angles on a straight line • Calculate the volume of cubes and cuboids • Use coordinates in all four quadrants • Calculate and interpret the mean as an average of a set of discrete data 	<ul style="list-style-type: none"> • Know percentage and decimal equivalents for fractions with a denominator of 2, 3, 4, 5, 8 and 10 • Know the rough equivalence between miles and kilometres • Know that vertically opposite angles are equal • Know that the area of a triangle = $\text{base} \times \text{height} \div 2$ • Know that the area of a parallelogram = $\text{base} \times \text{height}$ • Know that volume is measured in cubes • Know the names of parts of a circle • Know that the diameter of a circle is twice the radius • Know the conventions for a 2D coordinate grid • Know that mean = $\text{sum of data} \div \text{number of pieces of data}$
Stage 7	<ul style="list-style-type: none"> • Use positive integer powers and associated real roots • Apply the four operations with decimal numbers • Write a quantity as a fraction or percentage of another • Use multiplicative reasoning to interpret percentage change • Add, subtract, multiply and divide with fractions and mixed numbers • Check calculations using approximation, estimation or inverse operations • Simplify and manipulate expressions by collecting like terms • Simplify and manipulate expressions by multiplying a single term over a bracket • Substitute numbers into formulae • Solve linear equations in one unknown • Understand and use lines parallel to the axes, $y = x$ and $y = -x$ • Calculate surface area of cubes and cuboids • Understand and use geometric notation for labelling angles, lengths, equal lengths and parallel lines 	<ul style="list-style-type: none"> • Know the first 6 cube numbers • Know the first 12 triangular numbers • Know the symbols =, \neq, $<$, $>$, \leq, \geq • Know the order of operations including brackets • Know basic algebraic notation • Know that area of a rectangle = $l \times w$ • Know that area of a triangle = $b \times h \div 2$ • Know that area of a parallelogram = $b \times h$ • Know that area of a trapezium = $((a + b) \div 2) \times h$ • Know that volume of a cuboid = $l \times w \times h$ • Know the meaning of faces, edges and vertices • Know the names of special triangles and quadrilaterals • Know how to work out measures of central tendency • Know how to calculate the range



Stage 8	<ul style="list-style-type: none"> • Apply the four operations with negative numbers • Convert numbers into standard form and vice versa • Apply the multiplication, division and power laws of indices • Convert between terminating decimals and fractions • Find a relevant multiplier when solving problems involving proportion • Solve problems involving percentage change, including original value problems • Factorise an expression by taking out common factors • Change the subject of a formula when two steps are required • Find and use the nth term for a linear sequence • Solve linear equations with unknowns on both sides • Plot and interpret graphs of linear functions • Apply the formulae for circumference and area of a circle • Calculate theoretical probabilities for single events 	<ul style="list-style-type: none"> • Know how to write a number as a product of its prime factors • Know how to round to significant figures • Know the order of operations including powers • Know how to enter negative numbers into a calculator • Know that $a^0 = 1$ • Know percentage and decimal equivalents for fractions with a denominator of 3, 5, 8 and 10 • Know the characteristic shape of a graph of a quadratic function • Know how to measure and write bearings • Know how to identify alternate angles • Know how to identify corresponding angles • Know how to find the angle sum of any polygon • Know that circumference = $2\pi r = \pi d$ • Know that area of a circle = πr^2 • Know that volume of prism = area of cross-section \times length • Know to use the midpoints of groups to estimate the mean of a set of grouped data • Know that probability is measured on a 0-1 scale • Know that the sum of all probabilities for a single event is 1
Stage 9	<ul style="list-style-type: none"> • Calculate with roots and integer indices • Manipulate algebraic expressions by expanding the product of two binomials • Manipulate algebraic expressions by factorising a quadratic expression of the form $x^2 + bx + c$ • Understand and use the gradient of a straight line to solve problems • Solve two linear simultaneous equations algebraically and graphically • Plot and interpret graphs of quadratic functions • Change freely between compound units • Use ruler and compass methods to construct the perpendicular bisector of a line segment and to bisect an angle • Solve problems involving similar shapes • Calculate exactly with multiples of π • Apply Pythagoras' Theorem in two dimensions • Use geometrical reasoning to construct simple proofs • Use tree diagrams to list outcomes 	<ul style="list-style-type: none"> • Know how to interpret the display on a scientific calculator when working with standard form • Know the difference between direct and inverse proportion • Know how to represent an inequality on a number line • Know that the point of intersection of two lines represents the solution to the corresponding simultaneous equations • Know how to find the nth term of a quadratic sequence • Know the characteristic shape of the graph of a cubic function • Know the characteristic shape of the graph of a reciprocal function • Know the definition of speed • Know the definition of density • Know the definition of pressure • Know Pythagoras' Theorem • Know the definitions of arc, sector, tangent and segment • Know the conditions for congruent triangles



<p>Stage 10</p>	<ul style="list-style-type: none"> Manipulate fractional indices Solve problems involving direct and inverse proportion Convert between recurring decimals and fractions Solve equations using iterative methods Manipulate algebraic expressions by factorising a quadratic expression of the form $ax^2 + bx + c$ Solve quadratic equations by factorising Link graphs of quadratic functions to related equations Interpret a gradient as a rate of change Recognise and use the equation of a circle with centre at the origin Apply trigonometry in two dimensions Calculate volumes of spheres, cones and pyramids Understand and use vectors Analyse data through measures of central tendency, including quartiles 	<ul style="list-style-type: none"> Know the corresponding fraction for simple recurring decimals Know that $a^{\frac{1}{n}} = \sqrt[n]{a}$ Know that $a^{-n} = \frac{1}{a^n}$ Know how to set up an equation involving direct or inverse proportion Know set notation Know the special case of the difference of two squares Know the conventions for representing inequalities graphically Know the characteristic shape of the graph of an exponential function Know the meaning of roots, intercepts and turning points Know the conditions for perpendicular lines Know the definition of acceleration Know the convention for labelling the sides in a right-angle triangle Know the trigonometric ratios, $\sin\theta = \text{opposite/hypotenuse}$, $\cos\theta = \text{adjacent/hypotenuse}$, $\tan\theta = \text{opposite/adjacent}$ Know the exact values of $\sin\theta$ and $\cos\theta$ for $\theta = 0^\circ, 30^\circ, 45^\circ, 60^\circ$ and 90° Know the exact value of $\tan\theta$ for $\theta = 0^\circ, 30^\circ, 45^\circ$ and 60° Know the formulae for the volume of a sphere, a cone and a pyramid Know the formulae for the surface area of a sphere and a cone Know the circle theorems Know the information required to describe a transformation Know the values used to construct a box plot
<p>Stage 11</p>	<ul style="list-style-type: none"> Simplify surds, including rationalising the denominator of a surd expression Manipulate quadratic expressions by completing the square Deduce roots and turning points of quadratic functions Understand the concept of an instantaneous rate of change Sketch translations and reflections of given functions Solve quadratic inequalities in one variable Use the sine and cosine rules to solve problems 	<ul style="list-style-type: none"> Know that $\sqrt{a \pm b} \neq \sqrt{a} \pm \sqrt{b}$, $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ and $\sqrt{a \times b} = \sqrt{a} \times \sqrt{b}$ Know the formula for solving quadratic equations Know function notation Know graphs of exponential and trigonometric functions Know the sine rule, $a/\sin A = b/\sin B = c/\sin C$ Know the cosine rule, $a^2 = b^2 + c^2 - 2bc \cos A$ Know area of triangle = $\frac{1}{2}ab \sin C$ Know that histograms should be plotted using frequency density when groups are of unequal widths

