

KS3 Maths Learning Objectives

(excludes Year 9 extension objectives)

blue – Year 7 black – Year 8 green – Year 9

NUMBER

	Framework Objectives
N1 – Place value and standard form N1.1 Place value N1.2 Powers of ten	2.1 Understand and use decimal notation and place value; multiply and divide integers and decimals by 10, 100, 1000, and explain the effect. Read and write positive integer powers of 10; multiply and divide integers and decimals by 0.1, 0.01. Extend knowledge of integer powers of 10; recognise the equivalence of 0.1, $\frac{1}{10}$ and 10^{-1} ; multiply and divide by any integer power of 10.
N2 – Ordering decimals and rounding N2.1 Ordering decimals N2.2 Rounding	2.1 Compare and order decimals in different contexts; know that when comparing measurements the units must be the same. Order decimals. 2.1 Round positive whole numbers to the nearest 10, 100 or 1000, and decimals to the nearest whole number or one decimal place. Round positive numbers to any given power of 10; round decimals to the nearest whole number or to one or two decimal places. Use rounding to make estimates and to give solutions to problems to an appropriate degree of accuracy.
N3 – Negative numbers N3.1 Ordering integers N3.2 Adding and subtracting integers	2.2 Understand negative numbers as positions on a number line; order, add and subtract integers in context. Add, subtract, multiply and divide integers.
N4 – Multiplying and dividing negative numbers N4.1 Using negative numbers in context N4.2 Multiplying and dividing integers	2.2 Understand negative numbers as positions on a number line; order, add and subtract integers in context. Add, subtract, multiply and divide integers.

<p>N5 – Multiples and factors N5.1 Divisibility N5.2 Multiples and factors</p>	<p>2.2 Recognise and use multiples, factors, primes (less than 100), common factors, highest common factors and lowest common multiples in simple cases; use simple tests of divisibility. Use multiples, factors, common factors, highest common factors, lowest common multiples and primes; find the prime factor decomposition of a number, e.g. $8000 = 26 \times 53$.</p>
<p>N6 – Prime numbers N6.1 Prime numbers</p>	<p>2.2 Recognise and use multiples, factors, primes (less than 100), common factors, highest common factors and lowest common multiples in simple cases; use simple tests of divisibility. Use multiples, factors, common factors, highest common factors, lowest common multiples and primes; find the prime factor decomposition of a number, e.g. $8000 = 26 \times 53$. Use the prime factor decomposition of a number</p>
<p>N7 – Prime factor decomposition, HCF and LCM N7.1 Prime factor decomposition N7.2 HCF and LCM</p>	<p>2.2 Use multiples, factors, common factors, highest common factors, lowest common multiples and primes; find the prime factor decomposition of a number, e.g. $8000 = 26 \times 53$. Use the prime factor decomposition of a number</p>
<p>N8 – Squares and square roots N8.1 Square and triangular numbers N8.2 Square roots</p>	<p>2.2 Recognise the first few triangular numbers; recognise the squares of numbers to at least 12×12 and the corresponding roots. Use squares, positive and negative square roots, cubes and cube roots, and index notation for small positive integer powers. Use ICT to estimate square roots and cube roots</p>
<p>N9 – Powers and roots N9.1 Cubes and cube roots N9.2 Powers</p>	<p>2.2 Use squares, positive and negative square roots, cubes and cube roots, and index notation for small positive integer powers. Use ICT to estimate square roots and cube roots</p> <p>2.2 Use index notation for integer powers; know and use the index laws for multiplication and division of positive integer powers.</p>

<p>N10 – Fractions N10.1 Fractions of shapes N10.2 Equivalent fractions N10.3 One number as a fraction of another</p>	<p>2.3 Express a smaller whole number as a fraction of a larger one; simplify fractions by cancelling all common factors and identify equivalent fractions; convert terminating decimals to fractions, e.g. $0.23 = \frac{23}{100}$; use diagrams to compare two or more simple fractions. Understand the equivalence of simple algebraic fractions; know that a recurring decimal is an exact fraction.</p>
<p>N11 – Fractions and decimals N11.1 Fractions and decimals N11.2 Ordering fractions</p>	<p>2.3 Express a smaller whole number as a fraction of a larger one; simplify fractions by cancelling all common factors and identify equivalent fractions; convert terminating decimals to fractions, e.g. $0.23 = \frac{23}{100}$; use diagrams to compare two or more simple fractions. Recognise that a recurring decimal is a fraction; use division to convert a fraction to a decimal; order fractions by writing them with a common denominator or by converting them to decimals.</p>
<p>N12 – Adding and subtracting fractions N12.1 Adding and subtracting fractions</p>	<p>2.3 Add and subtract simple fractions and those with common denominators; calculate simple fractions of quantities and measurements (whole-number answers); multiply a fraction by an integer. Add and subtract fractions by writing them with a common denominator; calculate fractions of quantities (fraction answers); multiply and divide an integer by a fraction. Use efficient methods to add, subtract, multiply and divide fractions, interpreting division as a multiplicative inverse; cancel common factors before multiplying or dividing.</p>
<p>N13 – Fractions of amounts and multiplying fractions N13.1 Finding a fraction of an amount N13.2 Multiplying fractions</p>	<p>2.3 Add and subtract simple fractions and those with common denominators; calculate simple fractions of quantities and measurements (whole-number answers); multiply a fraction by an integer. Add and subtract fractions by writing them with a common denominator; calculate fractions of quantities (fraction answers); multiply and divide an integer by a fraction. Use efficient methods to add, subtract, multiply and divide fractions, interpreting division as a multiplicative inverse; cancel common factors before multiplying or dividing.</p>
<p>N14 – Dividing by fractions N14.1 Dividing by fractions</p>	<p>2.3 Add and subtract fractions by writing them with a common denominator; calculate fractions of quantities (fraction answers); multiply and divide an integer by a fraction. Use efficient methods to add, subtract, multiply and divide fractions, interpreting division as a multiplicative inverse; cancel common factors before multiplying or dividing.</p>
<p>N15 – Equivalent fractions, decimals and percentages N15.1 Equivalent fractions, decimals and percentages</p>	<p>2.3 Understand percentage as the 'number of parts per 100'; calculate simple percentages and use percentages to compare simple proportions. Interpret percentage as the operator 'so many hundredths of' and express one given number as a percentage of another; calculate percentages and find the outcome of a given percentage increase or decrease.</p> <p>2.3 Use the equivalence of fractions, decimals and percentages to compare proportions.</p>

<p>N16 – Calculating with percentages N16.1 Calculating percentages mentally N16.2 Calculating percentages on paper N16.3 Calculating percentages with a calculator</p>	<p>2.3 Understand percentage as the 'number of parts per 100'; calculate simple percentages and use percentages to compare simple proportions. Interpret percentage as the operator 'so many hundredths of' and express one given number as a percentage of another; calculate percentages and find the outcome of a given percentage increase or decrease.</p> <p>2.5 Strengthen and extend mental methods of calculation to include decimals, fractions and percentages, accompanied where appropriate by suitable jottings; solve simple problems mentally.</p>
<p>N17 – Proportions and percentage change N17.1 Comparing proportions N17.2 Percentage change</p>	<p>2.3 Understand percentage as the 'number of parts per 100'; calculate simple percentages and use percentages to compare simple proportions. Interpret percentage as the operator 'so many hundredths of' and express one given number as a percentage of another; calculate percentages and find the outcome of a given percentage increase or decrease. Recognise when fractions or percentages are needed to compare proportions; solve problems involving percentage changes.</p> <p>2.3 Use the equivalence of fractions, decimals and percentages to compare proportions.</p>
<p>N18 – Ratio N18.1 Ratio N18.2 Dividing in a given ratio</p>	<p>2.3 Understand the relationship between ratio and proportion; use direct proportion in simple contexts; use ratio notation, simplify ratios and divide a quantity into two parts in a given ratio; solve simple problems involving ratio and proportion using informal strategies. Apply understanding of the relationship between ratio and proportion; simplify ratios, including those expressed in different units, recognising links with fraction notation; divide a quantity into two or more parts in a given ratio; use the unitary method to solve simple problems involving ratio and direct proportion. Use proportional reasoning to solve problems, choosing the correct numbers to take as 100%, or as a whole; compare two ratios; interpret and use ratio in a range of contexts.</p>
<p>N19 – Proportion N19.1 Direct proportion N19.2 Using scale factors N19.3 Ratio and proportion problems</p>	<p>2.3 Understand the relationship between ratio and proportion; use direct proportion in simple contexts; use ratio notation, simplify ratios and divide a quantity into two parts in a given ratio; solve simple problems involving ratio and proportion using informal strategies. Apply understanding of the relationship between ratio and proportion; simplify ratios, including those expressed in different units, recognising links with fraction notation; divide a quantity into two or more parts in a given ratio; use the unitary method to solve simple problems involving ratio and direct proportion. Use proportional reasoning to solve problems, choosing the correct numbers to take as 100%, or as a whole; compare two ratios; interpret and use ratio in a range of contexts.</p>
<p>N20 – Order of operations N20.1 Order of operations</p>	<p>2.4 Use the order of operations, including brackets. Use the order of operations, including brackets, with more complex calculations. Understand the order of precedence of operations, including powers.</p>

<p>N21 – Mental methods N21.1 Addition and subtraction N21.2 Multiplication and division N21.3 Numbers between 0 and 1</p>	<p>2.4 Understand and use the rules of arithmetic and inverse operations in the context of positive integers and decimals.</p> <p>2.5 Recall number facts, including positive integer complements to 100 and multiplication facts to 10×10, and quickly derive associated division facts. Recall equivalent fractions, decimals and percentages; use known facts to derive unknown facts, including products involving numbers such as 0.7 and 6, and 0.03 and 8. Use known facts to derive unknown facts; extend mental methods of calculation, working with decimals, fractions, percentages, factors, powers and roots; solve problems mentally.</p>
<p>N22 – Mental methods N22.1 Problems and puzzles</p>	<p>2.4 Understand and use the rules of arithmetic and inverse operations in the context of positive integers and decimals.</p> <p>2.5 Recall number facts, including positive integer complements to 100 and multiplication facts to 10×10, and quickly derive associated division facts. Recall equivalent fractions, decimals and percentages; use known facts to derive unknown facts, including products involving numbers such as 0.7 and 6, and 0.03 and 8. Use known facts to derive unknown facts; extend mental methods of calculation, working with decimals, fractions, percentages, factors, powers and roots; solve problems mentally.</p>
<p>N23 – Estimation, calculator methods and checking results N23.1 Estimation and approximation N23.2 Using a calculator N23.3 Checking results</p>	<p>2.4 Understand and use the rules of arithmetic and inverse operations in the context of positive integers and decimals.</p> <p>2.5 Make and justify estimates and approximations of calculations. Make and justify estimates and approximations of calculations. Make and justify estimates and approximations of calculations.</p> <p>2.7 Carry out calculations with more than one step using brackets and the memory; use the square root and sign change keys. Carry out more difficult calculations effectively and efficiently using the function keys for sign change, powers, roots and fractions; use brackets and the memory. Use a calculator efficiently and appropriately to perform complex calculations with numbers of any size, knowing not to round during intermediate steps of a calculation; use the constant, π and sign change keys; use the function keys for powers, roots and fractions; use brackets and the memory.</p> <p>2.7 Enter numbers and interpret the display in different contexts (decimals, percentages, money, metric measures). Enter numbers and interpret the display in different contexts (extend to negative numbers, fractions, time).</p> <p>2.8 Check results by considering whether they are of the right order of magnitude and by working problems backwards. Select from a range of checking methods, including estimating in context and using inverse operations. Check results using appropriate methods.</p>

<p>N24 – Written methods N24.1 Addition and subtraction N24.2 Multiplication N24.3 Division</p>	<p>2.4 Understand and use the rules of arithmetic and inverse operations in the context of positive integers and decimals.</p> <p>2.6 Use efficient written methods to add and subtract whole numbers and decimals with up to two places. Use efficient written methods to add and subtract integers and decimals of any size, including numbers with differing numbers of decimal places Use efficient written methods to add and subtract integers and decimals of any size; multiply by decimals; divide by decimals by transforming to division by an integer.</p> <p>2.6 Multiply and divide three-digit by two-digit whole numbers; extend to multiplying and dividing decimals with one or two places by single-digit whole numbers. Use efficient written methods for multiplication and division of integers and decimals, including by decimals such as 0.6 or 0.06; understand where to position the decimal point by considering equivalent calculations.</p>
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ALGEBRA

	Framework Objectives
A1 – Algebraic expressions A1.1 Writing expressions A1.2 Collecting like terms	<p>3.1 Use letter symbols to represent unknown numbers or variables; know the meanings of the words term, expression and equation. Understand that algebraic operations, including the use of brackets, follow the rules of arithmetic; use index notation for small positive integer powers.</p> <p>3.1 Understand that algebraic operations follow the rules of arithmetic.</p> <p>3.1 Simplify linear algebraic expressions by collecting like terms; multiply a single term over a bracket (integer coefficients). Simplify or transform linear expressions by collecting like terms; multiply a single term over a bracket</p>
A2 – Multiplying and dividing algebraic terms A2.1 Multiplying terms A2.2 Dividing terms	<p>3.1 Understand that algebraic operations follow the rules of arithmetic. Understand that algebraic operations, including the use of brackets, follow the rules of arithmetic; use index notation for small positive integer powers. Use index notation for integer powers and simple instances of the index laws.</p> <p>3.1 Simplify linear algebraic expressions by collecting like terms; multiply a single term over a bracket (integer coefficients). Simplify or transform linear expressions by collecting like terms; multiply a single term over a bracket.</p>
A3 – Factorizing and substitution A3.1 Factorizing expressions A3.2 Substitution	<p>3.1 Use simple formulae from mathematics and other subjects; substitute positive integers into linear expressions and formulae and, in simple cases, derive a formula. Use formulae from mathematics and other subjects; substitute integers into simple formulae, including examples that lead to an equation to solve; substitute positive integers into expressions involving small powers e.g. $3x^2 + 4$ or $2x^3$; derive simple formulae. Simplify or transform algebraic expressions by taking out single-term common factors; add simple algebraic fractions.</p>
A4 – Equations A4.1 Solving simple equations A4.2 Equations with the unknown on both sides	<p>3.1 Construct and solve simple linear equations with integer coefficients (unknown on one side only) using an appropriate method (e.g. inverse operations). Construct and solve linear equations with integer coefficients (unknown on either or both sides, without and with brackets) using appropriate methods (e.g. inverse operations, transforming both sides in same way). Construct and solve linear equations with integer coefficients (with and without brackets, negative signs anywhere in the equation, positive or negative solution).</p>

<p>A5 – Equations involving brackets, division and proportion A5.1 Solving more difficult equations A5.2 Equations and proportion</p>	<p>3.1 Construct and solve linear equations with integer coefficients (unknown on either or both sides, without and with brackets) using appropriate methods (e.g. inverse operations, transforming both sides in same way). Construct and solve linear equations with integer coefficients (with and without brackets, negative signs anywhere in the equation, positive or negative solution).</p> <p>3.1 Use graphs and set up equations to solve simple problems involving direct proportion. Use systematic trial and improvement methods and ICT tools to find approximate solutions to equations such as $x^2 + x = 20$.</p> <p>3.1 Use algebraic methods to solve problems involving direct proportion; relate algebraic solutions to graphs of the equations; use ICT as appropriate.</p>
<p>A6 – Non-linear equations A6.1 Non-linear equations</p>	<p>3.1 Use systematic trial and improvement methods and ICT tools to find approximate solutions to equations such as $x^2 + x = 20$.</p> <p>3.1 Use algebraic methods to solve problems involving direct proportion; relate algebraic solutions to graphs of the equations; use ICT as appropriate.</p>
<p>A7 – Formulae A7.1 Introducing formulae A7.2 Using formulae</p>	<p>3.1 Use simple formulae from mathematics and other subjects; substitute positive integers into linear expressions and formulae and, in simple cases, derive a formula. Use formulae from mathematics and other subjects; substitute integers into simple formulae, including examples that lead to an equation to solve; substitute positive integers into expressions involving small powers e.g. $3x^2 + 4$ or $2x^3$; derive simple formulae. Use formulae from mathematics and other subjects; substitute numbers into expressions and formulae; derive a formula and, in simple cases, change its subject.</p>
<p>A8 – Changing the subject and deriving formulae A8.1 Changing the subject and deriving formulae A8.2 Deriving formulae</p>	<p>3.1 Use simple formulae from mathematics and other subjects; substitute positive integers into linear expressions and formulae and, in simple cases, derive a formula. Use formulae from mathematics and other subjects; substitute integers into simple formulae, including examples that lead to an equation to solve; substitute positive integers into expressions involving small powers e.g. $3x^2 + 4$ or $2x^3$; derive simple formulae. Use formulae from mathematics and other subjects; substitute numbers into expressions and formulae; derive a formula and, in simple cases, change its subject.</p>
<p>A9 – Sequences A9.1 Introducing sequences A9.2 Describing and continuing sequences</p>	<p>3.2 Describe integer sequences; generate terms of a simple sequence, given a rule (e.g. finding a term from the previous term, finding a term given its position in the sequence). Generate terms of a linear sequence using term-to-term and position-to-term rules, on paper and using a spreadsheet or graphics calculator.</p>

A10 – Generating sequences A10.1 Generating sequences	3.2 Generate sequences from patterns or practical contexts and describe the general term in simple cases. Generate terms of a linear sequence using term-to-term and position-to-term rules, on paper and using a spreadsheet or graphics calculator. Generate terms of a sequence using term-to-term and position-to-term rules, on paper and using ICT.
A11 – nth terms and sequences in context A11.1 Finding the n th term A11.2 Sequences from practical contexts	3.2 Generate sequences from patterns or practical contexts and describe the general term in simple cases. Generate sequences from practical contexts and write and justify an expression to describe the <i>n</i> th term of an arithmetic sequence. 3.2 Use linear expressions to describe the <i>n</i> th term of a simple arithmetic sequence, justifying its form by referring to the activity or practical context from which it was generated.
A12 – Functions A12.1 Function machines A12.2 Tables and mapping diagrams A12.3 Finding functions	3.2 Express simple functions in words, then using symbols; represent them in mappings. Express simple functions algebraically and represent them in mappings or on a spreadsheet.
A13 – Inverse functions A13.1 Inverse functions	3.2 Express simple functions algebraically and represent them in mappings or on a spreadsheet. Find the inverse of a linear function.
A14 – Graphs of functions A14.1 Graphs of functions	3.2 Generate coordinate pairs that satisfy a simple linear rule; plot the graphs of simple linear functions, where <i>y</i> is given explicitly in terms of <i>x</i>, on paper and using ICT; recognise straight-line graphs parallel to the <i>x</i>-axis or <i>y</i>-axis. Generate points in all four quadrants and plot the graphs of linear functions, where <i>y</i> is given explicitly in terms of <i>x</i> , on paper and using ICT; recognise that equations of the form $y = mx + c$ correspond to straight-line graphs. Generate points and plot graphs of linear functions, where <i>y</i> is given implicitly in terms of <i>x</i> (e.g. $ay + bx = 0$, $y + bx + c = 0$), on paper and using ICT; find the gradient of lines given by equations of the form $y = mx + c$, given values for <i>m</i> and <i>c</i> . 3.2 Plot and interpret the graphs of simple linear functions arising from real-life situations, e.g. conversion graphs.
A15 – Real-life graphs A15.1 Reading graphs A15.2 Plotting graphs A15.3 Conversion graphs A15.4 Distance-time graphs A15.5 Interpreting graphs	3.2 Generate coordinate pairs that satisfy a simple linear rule; plot the graphs of simple linear functions, where <i>y</i> is given explicitly in terms of <i>x</i>, on paper and using ICT; recognise straight-line graphs parallel to the <i>x</i>-axis or <i>y</i>-axis. Construct functions arising from real-life problems and plot their corresponding graphs; interpret graphs arising from real situations, e.g. time series graphs. 3.2 Plot and interpret the graphs of simple linear functions arising from real-life situations, e.g. conversion graphs. Construct linear functions arising from real-life problems and plot their corresponding graphs; discuss and interpret graphs arising from real situations, e.g. distance–time graphs

GEOMETRY AND MEASURES

Framework Objectives	
G1 – Parallel and perpendicular lines G1.1 Labelling lines and angles G1.2 Parallel and perpendicular lines	<p>4.1 Use correctly the vocabulary, notation and labelling conventions for lines, angles and shapes. Identify alternate angles and corresponding angles; understand a proof that:</p> <ul style="list-style-type: none"> • the angle sum of a triangle is 180° and of a quadrilateral is 360°; • the exterior angle of a triangle is equal to the sum of the two interior opposite angles. <p>Distinguish between conventions, definitions and derived properties.</p> <p>4.1 Identify parallel and perpendicular lines; know the sum of angles at a point, on a straight line and in a triangle; recognise vertically opposite angles. Solve problems using properties of angles, of parallel and intersecting lines, and of triangles and other polygons, justifying inferences and explaining reasoning with diagrams and text.</p>
G2 – Calculating angles G2.1 Calculating angles	<p>4.1 Identify parallel and perpendicular lines; know the sum of angles at a point, on a straight line and in a triangle; recognise vertically opposite angles. Identify alternate angles and corresponding angles; understand a proof that:</p> <ul style="list-style-type: none"> • the angle sum of a triangle is 180° and of a quadrilateral is 360°; • the exterior angle of a triangle is equal to the sum of the two interior opposite angles. <p>Solve problems using properties of angles, of parallel and intersecting lines, and of triangles and other polygons, justifying inferences and explaining reasoning with diagrams and text.</p>
G3 – Angles in polygons G3.1 Angles in polygons	<p>4.1 Identify alternate angles and corresponding angles; understand a proof that:</p> <ul style="list-style-type: none"> • the angle sum of a triangle is 180° and of a quadrilateral is 360°; • the exterior angle of a triangle is equal to the sum of the two interior opposite angles. <p>Explain how to find, calculate and use:</p> <ul style="list-style-type: none"> • the sums of the interior and exterior angles of quadrilaterals, pentagons and hexagons • the interior and exterior angles of regular polygons.

G4 – Triangles and quadrilaterals G4.1 Triangles and quadrilaterals	4.1 Identify and use angle, side and symmetry properties of triangles and quadrilaterals; explore geometrical problems involving these properties, explaining reasoning orally, using step-by-step deduction supported by diagrams. Solve geometrical problems using side and angle properties of equilateral, isosceles and right-angled triangles and special quadrilaterals, explaining reasoning with diagrams and text; classify quadrilaterals by their geometrical properties.
G5 – Polygons and congruence G5.1 Polygons G5.2 Congruence	4.1 Solve geometrical problems using side and angle properties of equilateral, isosceles and right-angled triangles and special quadrilaterals, explaining reasoning with diagrams and text; classify quadrilaterals by their geometrical properties. 4.1 Know that if two 2-D shapes are congruent, corresponding sides and angles are equal. Understand congruence and explore similarity.
G6 – Tessellations G6.1 Tessellations	4.1 Solve geometrical problems using side and angle properties of equilateral, isosceles and right-angled triangles and special quadrilaterals, explaining reasoning with diagrams and text; classify quadrilaterals by their geometrical properties.
G7 – Circles G7.1 Circles	4.1 Know the definition of a circle and the names of its parts; explain why inscribed regular polygons can be constructed by equal divisions of a circle.
G8 – 3-D shapes and representations G8.1 Solid shapes G8.2 2-D representations of 3-D spaces	4.1 Use 2-D representations to visualise 3-D shapes and deduce some of their properties. Visualise 3-D shapes from their nets; use geometric properties of cuboids and shapes made from cuboids; use simple plans and elevations. Visualise and use 2-D representations of 3-D objects; analyse 3-D shapes through 2-D projections, including plans and elevations.
G9 – Nets G9.1 Nets	4.1 Use 2-D representations to visualise 3-D shapes and deduce some of their properties. Visualise 3-D shapes from their nets; use geometric properties of cuboids and shapes made from cuboids; use simple plans and elevations. Visualise and use 2-D representations of 3-D objects; analyse 3-D shapes through 2-D projections, including plans and elevations.
G10 – Plans and elevations G10.1 Plans and elevations	4.1 Visualise 3-D shapes from their nets; use geometric properties of cuboids and shapes made from cuboids; use simple plans and elevations. Visualise and use 2-D representations of 3-D objects; analyse 3-D shapes through 2-D projections, including plans and elevations.

G11 – Cross-sections G11.1 Cross-sections	4.1 Visualise and use 2-D representations of 3-D objects; analyse 3-D shapes through 2-D projections, including plans and elevations.
G12 – Coordinates G12.1 Coordinates	4.2 Use conventions and notation for 2-D coordinates in all four quadrants; find coordinates of points determined by geometric information. Find the midpoint of the line segment AB, given the coordinates of points A and B.
G13 – Reflection and symmetry G13.1 Reflection G13.2 Reflection symmetry	4.2 Understand and use the language and notation associated with reflections, translations and rotations. Identify all the symmetries of 2-D shapes. Identify reflection symmetry in 3-D shapes. Recognise and visualise the symmetries of a 2-D shape. 4.2 Transform 2-D shapes by: <ul style="list-style-type: none"> • reflecting in given mirror lines; • rotating about a given point; • translating. Transform 2-D shapes by rotation, reflection and translation, on paper and using ICT. Recognise that translations, rotations and reflections preserve length and angle, and map objects on to congruent images. 4.2 Explore these transformations and symmetries using ICT. Try out mathematical representations of simple combinations of these transformations. Use the coordinate grid to solve problems involving translations, rotations, reflections and enlargements.
G14 – Rotation and rotation symmetry G14.1 Rotation G14.2 Rotation symmetry	4.2 Understand and use the language and notation associated with reflections, translations and rotations. Identify all the symmetries of 2-D shapes. Identify reflection symmetry in 3-D shapes. Recognise and visualise the symmetries of a 2-D shape. 4.2 Transform 2-D shapes by: <ul style="list-style-type: none"> • reflecting in given mirror lines; • rotating about a given point; • translating. Transform 2-D shapes by rotation, reflection and translation, on paper and using ICT. Recognise that translations, rotations and reflections preserve length and angle, and map objects on to congruent images. 4.2 Explore these transformations and symmetries using ICT. Try out mathematical representations of simple combinations of these transformations. Use the coordinate grid to solve problems involving translations, rotations, reflections and enlargements.

<p>G15 – Translation G15.1 Translation</p>	<p>4.2 Understand and use the language and notation associated with reflections, translations and rotations. Identify reflection symmetry in 3-D shapes.</p> <p>4.2 Transform 2-D shapes by:</p> <ul style="list-style-type: none"> • reflecting in given mirror lines; • rotating about a given point; • translating. <p>Transform 2-D shapes by rotation, reflection and translation, on paper and using ICT. Recognise that translations, rotations and reflections preserve length and angle, and map objects on to congruent images.</p> <p>4.2 Explore these transformations and symmetries using ICT. Try out mathematical representations of simple combinations of these transformations. Use the coordinate grid to solve problems involving translations, rotations, reflections and enlargements.</p>
<p>G16 – Enlargement and scale drawings G16.1 Enlargement G16.2 Scale drawings</p>	<p>4.2 Devise instructions for a computer to generate and transform shapes.</p> <p>4.2 Explore and compare mathematical representations of combinations of translations, rotations and reflections of 2-D shapes, on paper and using ICT.</p> <p>4.2 Understand and use the language and notation associated with enlargement; enlarge 2-D shapes, given a centre of enlargement and a positive integer scale factor; explore enlargement using ICT. Enlarge 2-D shapes, given a centre of enlargement and a positive integer scale factor, on paper and using ICT; identify the scale factor of an enlargement as the ratio of the lengths of any two corresponding line segments; recognise that enlargements preserve angle but not length, and understand the implications of enlargement for perimeter.</p> <p>4.2 Make scale drawings. Use and interpret maps and scale drawings in the context of mathematics and other subjects.</p>
<p>G17 – Combining transformations G17.1 Combining transformations</p>	<p>4.2 Identify reflection symmetry in 3-D shapes.</p> <p>4.2 Transform 2-D shapes by rotation, reflection and translation, on paper and using ICT. Recognise that translations, rotations and reflections preserve length and angle, and map objects on to congruent images.</p> <p>4.2 Try out mathematical representations of simple combinations of these transformations. Use the coordinate grid to solve problems involving translations, rotations, reflections and enlargements.</p>

<p>G18 – Construction G18.1 Drawing lines and angles G18.2 Constructing triangles G18.3 Constructing lines and angles G18.4 Constructing nets</p>	<p>4.3 Use a ruler and protractor to:</p> <ul style="list-style-type: none"> • measure and draw lines to the nearest millimetre and angles, including reflex angles, to the nearest degree; • construct a triangle, given two sides and the included angle (SAS) or two angles and the included side (ASA). <p>Use straight edge and compasses to construct:</p> <ul style="list-style-type: none"> • the midpoint and perpendicular bisector of a line segment; • the bisector of an angle; • the perpendicular from a point to a line; • the perpendicular from a point on a line; • a triangle, given three sides (SSS). <p>Use straight edge and compasses to construct triangles, given right angle, hypotenuse and side (RHS).</p> <p>4.3 Use ICT to explore constructions. Use ICT to explore these constructions. Use ICT to explore constructions of triangles and other 2-D shapes.</p> <p>4.3 Use ruler and protractor to construct simple nets of 3-D shapes, e.g. cuboid, regular tetrahedron, square-based pyramid, triangular prism.</p>
<p>G19 – Loci G19.1 Loci</p>	<p>4.3 Find simple loci, both by reasoning and by using ICT, to produce shapes and paths, e.g. an equilateral triangle. Find the locus of a point that moves according to a simple rule, both by reasoning and by using ICT.</p>
<p>G20 – Converting units G20.1 Converting units</p>	<p>4.4 Choose and use units of measurement to measure, estimate, calculate and solve problems in everyday contexts; convert one metric unit to another, e.g. grams to kilograms; read and interpret scales on a range of measuring instruments. Choose and use units of measurement to measure, estimate, calculate and solve problems in a range of contexts; know rough metric equivalents of imperial measures in common use, such as miles, pounds (lb) and pints. Solve problems involving measurements in a variety of contexts; convert between area measures (e.g. mm² to cm², cm² to m², and vice versa) and between volume measures (e.g. mm³ to cm³, cm³ to m³, and vice versa).</p>
<p>G21 – Estimating measurements and reading scales G21.1 Estimating measurements G21.2 Reading scales</p>	<p>4.4 Choose and use units of measurement to measure, estimate, calculate and solve problems in everyday contexts; convert one metric unit to another, e.g. grams to kilograms; read and interpret scales on a range of measuring instruments. Choose and use units of measurement to measure, estimate, calculate and solve problems in a range of contexts; know rough metric equivalents of imperial measures in common use, such as miles, pounds (lb) and pints. Solve problems involving measurements in a variety of contexts; convert between area measures (e.g. mm² to cm², cm² to m², and vice versa) and between volume measures (e.g. mm³ to cm³, cm³ to m³, and vice versa).</p>
<p>G22 – Angles and bearings G22.1 Estimating measurements G22.2 Bearings</p>	<p>4.4 Distinguish between and estimate the size of acute, obtuse and reflex angles. Choose and use units of measurement to measure, estimate, calculate and solve problems in a range of contexts; know rough metric equivalents of imperial measures in common use, such as miles, pounds (lb) and pints.</p> <p>4.4 Use bearings to specify direction.</p>

G23 – Perimeter G23.1 Perimeter	4.4 Know and use the formula for the area of a rectangle; calculate the perimeter and area of shapes made from rectangles.
G24 – Area G24.1 Area	4.4 Know and use the formula for the area of a rectangle; calculate the perimeter and area of shapes made from rectangles. Derive and use formulae for the area of a triangle, parallelogram and trapezium; calculate areas of compound shapes.
G25 – Surface area and volume G25.1 Surface area G25.2 Volume	4.4 Know and use the formula for the area of a rectangle; calculate the perimeter and area of shapes made from rectangles. Know and use the formula for the volume of a cuboid; calculate volumes and surface areas of cuboids and shapes made from cuboids. 4.4 Calculate the surface area of cubes and cuboids. Calculate the surface area and volume of right prisms.
G26 – Circumference and area of a circle	4.4 Know and use the formulae for the circumference and area of a circle.

STATISTICS

	Framework objectives
S1 – Planning and collecting data S1.1 Planning a statistical enquiry S1.2 Collecting data	<p>5.1 Suggest possible answers, given a question that can be addressed by statistical methods. Discuss a problem that can be addressed by statistical methods and identify related questions to explore. Suggest a problem to explore using statistical methods, frame questions and raise conjectures.</p> <p>5.1 Decide which data would be relevant to an enquiry and possible sources. Decide which data to collect to answer a question, and the degree of accuracy needed; identify possible sources; consider appropriate sample size. Discuss how different sets of data relate to the problem; identify possible primary or secondary sources; determine the sample size and most appropriate degree of accuracy.</p> <p>5.1 Collect small sets of data from surveys and experiments, as planned. Collect data using a suitable method (e.g. observation, controlled experiment, data logging using ICT). Design a survey or experiment to capture the necessary data from one or more sources; design, trial and if necessary refine data collection sheets; construct tables for gathering large discrete and continuous sets of raw data, choosing suitable class intervals; design and use two-way tables.</p> <p>Gather data from specified secondary sources, including printed tables and lists, and ICT-based sources, including the internet.</p>
S2 – Organizing data and writing a report S2.1 Organizing data S2.2 Writing a statistical report	<p>5.1 Plan how to collect and organise small sets of data from surveys and experiments:</p> <ul style="list-style-type: none"> • design data collection sheets or questionnaires to use in a simple survey; • construct frequency tables for gathering discrete data, grouped where appropriate in equal class intervals. <p>Plan how to collect the data; construct frequency tables with equal class intervals for gathering continuous data and two-way tables for recording discrete data. Discuss how different sets of data relate to the problem; identify possible primary or secondary sources; determine the sample size and most appropriate degree of accuracy.</p> <p>5.1 Design a survey or experiment to capture the necessary data from one or more sources; design, trial and if necessary refine data collection sheets; construct tables for gathering large discrete and continuous sets of raw data, choosing suitable class intervals; design and use two-way tables.</p> <p>5.3 Write a short report of a statistical enquiry, including appropriate diagrams, graphs and charts, using ICT as appropriate; justify the choice of presentation. Write about and discuss the results of a statistical enquiry using ICT as appropriate; justify the methods used. Review interpretations and results of a statistical enquiry on the basis of discussions; communicate these interpretations and results using selected tables, graphs and diagrams.</p>

<p>S3 – Mode, median and range S3.1 Finding the mode S3.2 Finding the median S3.3 Finding the range</p>	<p>5.2 Calculate statistics for small sets of discrete data: • find the mode, median and range, and the modal class for grouped data; • calculate the mean, including from a simple frequency table, using a calculator for a larger number of items. Calculate statistics for sets of discrete and continuous data, including with a calculator and spreadsheet; recognise when it is appropriate to use the range, mean, median and mode and, for grouped data, the modal class. Calculate statistics and select those most appropriate to the problem or which address the questions posed.</p>
<p>S4 – Mean and calculating statistics S4.1 Calculating the mean S4.2 Calculating statistics S4.3 Comparing data</p>	<p>5.2 Calculate statistics for sets of discrete and continuous data, including with a calculator and spreadsheet; recognise when it is appropriate to use the range, mean, median and mode and, for grouped data, the modal class. Calculate statistics and select those most appropriate to the problem or which address the questions posed.</p> <p>5.3 Compare two simple distributions using the range and one of the mode, median or mean. Compare two distributions using the range and one or more of the mode, median and mean. Compare two or more distributions and make inferences, using the shape of the distributions and appropriate statistics.</p>
<p>S5 – Bar charts and pie charts S5.1 Bar charts S5.2 Pie charts</p>	<p>5.2 Construct, on paper and using ICT, graphs and diagrams to represent data, including: • bar-line graphs; • frequency diagrams for grouped discrete data; • simple pie charts. Construct graphical representations, on paper and using ICT, and identify which are most useful in the context of the problem. Include: • pie charts for categorical data; • bar charts and frequency diagrams for discrete and continuous data; • simple line graphs for time series; • simple scatter graphs; • stem-and-leaf diagrams. Select, construct and modify, on paper and using ICT, suitable graphical representations to progress an enquiry and identify key features present in the data. Include: • line graphs for time series; • scatter graphs to develop further understanding of correlation.</p> <p>5.3 Interpret diagrams and graphs (including pie charts), and draw simple conclusions based on the shape of graphs and simple statistics for a single distribution. Interpret tables, graphs and diagrams for discrete and continuous data, relating summary statistics and findings to the questions being explored. Interpret graphs and diagrams and make inferences to support or cast doubt on initial conjectures; have a basic understanding of correlation.</p>

<p>S6 – Frequency diagrams, line and scatter graphs S6.1 Frequency diagrams S6.2 Line graphs S6.3 Scatter graphs</p>	<p>5.2 Construct, on paper and using ICT, graphs and diagrams to represent data, including:</p> <ul style="list-style-type: none"> • bar-line graphs; • frequency diagrams for grouped discrete data; • simple pie charts. <p>Construct graphical representations, on paper and using ICT, and identify which are most useful in the context of the problem. Include:</p> <ul style="list-style-type: none"> • pie charts for categorical data; • bar charts and frequency diagrams for discrete and continuous data; • simple line graphs for time series; • simple scatter graphs; • stem-and-leaf diagrams. <p>Select, construct and modify, on paper and using ICT, suitable graphical representations to progress an enquiry and identify key features present in the data. Include:</p> <ul style="list-style-type: none"> • line graphs for time series; • scatter graphs to develop further understanding of correlation. <p>5.3 Interpret diagrams and graphs (including pie charts), and draw simple conclusions based on the shape of graphs and simple statistics for a single distribution.</p> <p>Interpret tables, graphs and diagrams for discrete and continuous data, relating summary statistics and findings to the questions being explored.</p> <p>Interpret graphs and diagrams and make inferences to support or cast doubt on initial conjectures; have a basic understanding of correlation.</p>
<p>S7 – Probability S7.1 The language of probability S7.2 The probability scale</p>	<p>5.4 Use vocabulary and ideas of probability, drawing on experience.</p> <p>Interpret the results of an experiment using the language of probability; appreciate that random processes are unpredictable.</p> <p>Interpret results involving uncertainty and prediction.</p> <p>5.4 Understand and use the probability scale from 0 to 1; find and justify probabilities based on equally likely outcomes in simple contexts; identify all the possible mutually exclusive outcomes of a single event.</p>
<p>S8 – Calculating probability S8.1 Calculating probability</p>	<p>5.4 Understand and use the probability scale from 0 to 1; find and justify probabilities based on equally likely outcomes in simple contexts; identify all the possible mutually exclusive outcomes of a single event.</p> <p>Know that if the probability of an event occurring is p then the probability of it not occurring is $1 - p$; use diagrams and tables to record in a systematic way all possible mutually exclusive outcomes for single events and for two successive events.</p>
<p>S9 – Probability diagrams S9.1 Probability diagrams</p>	<p>5.4 Understand and use the probability scale from 0 to 1; find and justify probabilities based on equally likely outcomes in simple contexts; identify all the possible mutually exclusive outcomes of a single event.</p> <p>Know that if the probability of an event occurring is p then the probability of it not occurring is $1 - p$; use diagrams and tables to record in a systematic way all possible mutually exclusive outcomes for single events and for two successive events.</p> <p>Identify all the mutually exclusive outcomes of an experiment; know that the sum of probabilities of all mutually exclusive outcomes is 1 and use this when solving problems</p>

<p>S10 Experimental probability S10.1 Experimental probability</p>	<p>5.4 Interpret the results of an experiment using the language of probability; appreciate that random processes are unpredictable. <i>Interpret results involving uncertainty and prediction.</i></p> <p>5.4 <i>Estimate probabilities by collecting data from a simple experiment and recording it in a frequency table; compare experimental and theoretical probabilities in simple contexts.</i> Compare estimated experimental probabilities with theoretical probabilities, recognising that:</p> <ul style="list-style-type: none"> • if an experiment is repeated the outcome may, and usually will, be different; • increasing the number of times an experiment is repeated generally leads to better estimates of probability. <p><i>Compare experimental and theoretical probabilities in a range of contexts; appreciate the difference between mathematical explanation and experimental evidence</i></p>
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