

Assessing Pupils' Progress

Assessment criteria:
Number and algebra

The National Strategies



Name



	Algebra	Numbers and the number system	Calculating
Level 8	<ul style="list-style-type: none"> factorise quadratic expressions including the difference of two squares, e.g. $x^2 - 9 = (x + 3)(x - 3)$ manipulate algebraic formulae, equations and expressions, finding common factors and multiplying two linear expressions derive and use more complex formulae and change the subject of a formula evaluate algebraic formulae, substituting fractions, decimals and negative numbers solve inequalities in two variables and find the solution set sketch, interpret and identify graphs of linear, quadratic, cubic and reciprocal functions, and graphs that model real situations understand the effect on a graph of addition of (or multiplication by) a constant 	<ul style="list-style-type: none"> understand the equivalence between recurring decimals and fractions 	<ul style="list-style-type: none"> use fractions or percentages to solve problems involving repeated proportional changes or the calculation of the original quantity given the result of a proportional change solve problems involving calculating with powers, roots and numbers expressed in standard form, checking for correct order of magnitude and using a calculator as appropriate
Level 7	<ul style="list-style-type: none"> square a linear expression, and expand and simplify the product of two linear expressions of the form $(x \pm n)$ and simplify the corresponding quadratic expression use algebraic and graphical methods to solve simultaneous linear equations in two variables solve inequalities in one variable and represent the solution set on a number line use formulae from mathematics and other subjects; substitute numbers into expressions and formulae; derive a formula and, in simple cases, change its subject find the next term and nth term of quadratic sequences and functions and explore their properties plot graphs of simple quadratic and cubic functions, e.g. $y = x^2$, $y = 3x^2 + 4$, $y = x^3$ 	<ul style="list-style-type: none"> understand and use proportionality 	<ul style="list-style-type: none"> calculate the result of any proportional change using multiplicative methods understand the effects of multiplying and dividing by numbers between 0 and 1 add, subtract, multiply and divide fractions make and justify estimates and approximations of calculations; estimate calculations by rounding numbers to one significant figure and multiplying and dividing mentally 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
Level 6	<ul style="list-style-type: none"> use systematic trial and improvement methods and ICT tools to find approximate solutions to equations such as $x^3 + x = 20$ construct and solve linear equations with integer coefficients, using an appropriate method generate terms of a sequence using term-to-term and position-to-term definitions of the sequence, on paper and using ICT; write an expression to describe the nth term of an arithmetic sequence. plot the graphs of linear functions, where y is given explicitly in terms of x; recognise that equations of the form $y = mx + c$ correspond to straight-line graphs construct functions arising from real-life problems and plot their corresponding graphs; interpret graphs arising from real situations 	<ul style="list-style-type: none"> use the equivalence of fractions, decimals and percentages to compare proportions 	<ul style="list-style-type: none"> calculate percentages and find the outcome of a given percentage increase or decrease divide a quantity into two or more parts in a given ratio and solve problems involving ratio and direct proportion use proportional reasoning to solve a problem, choosing the correct numbers to take as 100%, or as a whole 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
Level 5	<ul style="list-style-type: none"> construct, express in symbolic form, and use simple formulae involving one or two operations use and interpret coordinates in all four quadrants 	<ul style="list-style-type: none"> use understanding of place value to multiply and divide whole numbers and decimals by 10, 100 and 1000 and explain the effect round decimals to the nearest decimal place and order negative numbers in context recognise and use number patterns and relationships use equivalence between fractions and order fractions and decimals reduce a fraction to its simplest form by cancelling common factors understand simple ratio 	<ul style="list-style-type: none"> use known facts, place value, knowledge of operations and brackets to calculate including using all four operations with decimals to two places use a calculator where appropriate to calculate fractions/percentages of quantities/measurements understand and use an appropriate non-calculator method for solving problems that involve multiplying and dividing any three digit number by any two-digit number solve simple problems involving ordering, adding, subtracting negative numbers in context solve simple problems involving ratio and direct proportion apply inverse operations and approximate to check answers to problems are of the correct magnitude
Level 4	<ul style="list-style-type: none"> begin to use simple formulae expressed in words use and interpret coordinates in the first quadrant 	<ul style="list-style-type: none"> recognise and describe number patterns recognise and describe number relationships including multiple, factor and square use place value to multiply and divide whole numbers by 10 or 100 recognise approximate proportions of a whole and use simple fractions and percentages to describe these order decimals to three decimal places begin to understand simple ratio 	<ul style="list-style-type: none"> use a range of mental methods of computation with all operations recall multiplication facts up to 10×10 and quickly derive corresponding division facts use efficient written methods of addition and subtraction and of short multiplication and division multiply a simple decimal by a single digit solve problems with or without a calculator check the reasonableness of results with reference to the context or size of numbers
Level 3	<ul style="list-style-type: none"> recognise a wider range of sequences begin to understand the role of '=' (the 'equals' sign) 	<ul style="list-style-type: none"> understand place value in numbers to 1000 use place value to make approximations recognise negative numbers in contexts such as temperature use simple fractions that are several parts of a whole and recognise when two simple fractions are equivalent begin to use decimal notation in contexts such as money 	<ul style="list-style-type: none"> derive associated division facts from known multiplication facts add and subtract two-digit numbers mentally add and subtract three digit numbers using written method multiply and divide two digit numbers by 2, 3, 4 or 5 as well as 10 with whole number answers and remainders use mental recall of addition and subtraction facts to 20 in solving problems involving larger numbers solve whole number problems including those involving multiplication or division that may give rise to remainders
Level 2	<ul style="list-style-type: none"> recognise sequences of numbers, including odd and even numbers 	<ul style="list-style-type: none"> count sets of objects reliably begin to understand the place value of each digit; use this to order numbers up to 100 begin to use halves and quarters and relate the concept of half of a small quantity to the concept of half of a shape 	<ul style="list-style-type: none"> use the knowledge that subtraction is the inverse of addition and understand halving as a way of 'undoing' doubling and vice versa use mental recall of addition and subtraction facts to 10 use mental calculation strategies to solve number problems including those involving money and measures record their work in writing choose the appropriate operation when solving addition and subtraction problems

Assessing Pupils' Progress

Assessment criteria: Using and applying mathematics Shape, space and measure Handling data

Name



The National Strategies



	Using and applying mathematics	Shape, space and measure	Handling data
Level 8	<ul style="list-style-type: none"> develop and follow alternative methods and approaches reflect on lines of enquiry when exploring mathematical tasks select and combine known facts and problem solving strategies to solve problems of increasing complexity convey mathematical meaning through precise and consistent use of symbols examine generalisations or solutions reached in an activity, commenting constructively on the reasoning and logic or the process employed, or the results obtained distinguish between practical demonstration and proof; know underlying assumptions, recognising their importance and limitations, and the effect of varying them 	<ul style="list-style-type: none"> understand and use congruence and mathematical similarity understand and use trigonometrical relationships in right-angled triangles, and use these to solve problems, including those involving bearings understand the difference between formulae for perimeter, area and volume in simple contexts by considering dimensions 	<ul style="list-style-type: none"> estimate and find the median, quartiles and interquartile range for large data sets, including using a cumulative frequency diagram compare two or more distributions and make inferences, using the shape of the distributions and measures of average and spread including median and quartiles know when to add or multiply two probabilities use tree diagrams to calculate probabilities of combinations of independent events
Level 7	<ul style="list-style-type: none"> solve increasingly demanding problems and evaluate solutions; explore connections in mathematics across a range of contexts: number, algebra, shape, space and measures, and handling data; refine or extend the mathematics used to generate fuller solutions give reasons for choice of presentation, explaining selected features and showing insight into the problems structure justify generalisations, arguments or solutions appreciate the difference between mathematical explanation and experimental evidence 	<ul style="list-style-type: none"> understand and apply Pythagoras' theorem when solving problems in 2-D calculate lengths, areas and volumes in plane shapes and right prisms enlarge 2-D shapes, given a centre of enlargement and a fractional scale factor, on paper and using ICT; recognise the similarity of the resulting shapes find the locus of a point that moves according to a given rule, both by reasoning and using ICT recognise that measurements given to the nearest whole unit may be inaccurate by up to one half of the unit in either direction understand and use measures of speed (and other compound measures such as density or pressure) to solve problems 	<ul style="list-style-type: none"> suggest a problem to explore using statistical methods, frame questions and raise conjectures; identify possible sources of bias and plan how to minimise it select, construct and modify, on paper and using ICT suitable graphical representation to progress an enquiry including frequency polygons and lines of best fit on scatter graphs estimate the mean, median and range of a set of grouped data and determine the modal class, selecting the statistic most appropriate to the line of enquiry compare two or more distributions and make inferences, using the shape of the distributions and measures of average and range understand relative frequency as an estimate of probability and use this to compare outcomes of an experiment examine critically the results of a statistical enquiry, and justify the choice of statistical representation in written presentation
Level 6	<ul style="list-style-type: none"> solve problems and carry through substantial tasks by breaking them into smaller, more manageable tasks, using a range of efficient techniques, methods and resources, including ICT; give solutions to an appropriate degree of accuracy interpret, discuss and synthesise information presented in a variety of mathematical forms present a concise, reasoned argument, using symbols, diagrams, graphs and related explanatory texts use logical argument to establish the truth of a statement 	<ul style="list-style-type: none"> classify quadrilaterals by their geometric properties solve geometrical problems using properties of angles, of parallel and intersecting lines, and of triangles and other polygons identify alternate and corresponding angles: understand a proof that the sum of the angles of a triangle is 180° and of a quadrilateral is 360° devise instructions for a computer to generate and transform shapes and paths visualise and use 2-D representations of 3-D objects enlarge 2-D shapes, given a centre of enlargement and a positive whole-number scale factor know that translations, rotations and reflections preserve length and angle and map objects onto congruent images use straight edge and compasses to do standard constructions deduce and use formulae for the area of a triangle and parallelogram, and the volume of a cuboid; calculate volumes and surface areas of cuboids know and use the formulae for the circumference and area of a circle 	<ul style="list-style-type: none"> 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 large discrete and continuous sets of raw data, choosing suitable class intervals; design and use two-way tables select, construct and modify, on paper and using ICT: <ul style="list-style-type: none"> pie charts for categorical data bar charts and frequency diagrams for discrete and continuous data simple time graphs for time series scatter graphs and identify which are most useful in the context of the problem find and record all possible mutually exclusive outcomes for single events and two successive events in a systematic way know that the sum of probabilities of all mutually exclusive outcomes is 1 and use this when solving problems communicate interpretations and results of a statistical survey using selected tables, graphs and diagrams in support
Level 5	<ul style="list-style-type: none"> identify and obtain necessary information to carry through a task and solve mathematical problems check results, considering whether these are reasonable solve word problems and investigations from a range of contexts show understanding of situations by describing them mathematically using symbols, words and diagrams draw simple conclusions of their own and give an explanation of their reasoning 	<ul style="list-style-type: none"> use a wider range of properties of 2-D and 3-D shapes and identify all the symmetries of 2-D shapes use language associated with angle and know and use the angle sum of a triangle and that of angles at a point reason about position and movement and transform shapes measure and draw angles to the nearest degree, when constructing models and drawing or using shapes read and interpret scales on a range of measuring instruments, explaining what each labelled division represents solve problems involving the conversion of units and make sensible estimates of a range of measures in relation to everyday situations understand and use the formula for the area of a rectangle and distinguish area from perimeter 	<ul style="list-style-type: none"> ask questions, plan how to answer them and collect the data required in probability, select methods based on equally likely outcomes and experimental evidence, as appropriate understand and use the probability scale from 0 to 1 understand and use the mean of discrete data and compare two simple distributions, using the range and one of mode, median or mean understand that different outcomes may result from repeating an experiment interpret graphs and diagrams, including pie charts, and draw conclusions create and interpret line graphs where the intermediate values have meaning
Level 4	<ul style="list-style-type: none"> develop own strategies for solving problems use their own strategies within mathematics and in applying mathematics to practical contexts present information and results in a clear and organised way search for a solution by trying out ideas of their own 	<ul style="list-style-type: none"> use the properties of 2-D and 3-D shapes make 3-D models by linking given faces or edges and draw common 2-D shapes in different orientations on grids reflect simple shapes in a mirror line, translate shapes horizontally or vertically and begin to rotate a simple shape or object about its centre or a vertex choose and use appropriate units and instruments interpret, with appropriate accuracy, numbers on a range of measuring instruments find perimeters of simple shapes and find areas by counting squares 	<ul style="list-style-type: none"> collect and record discrete data group data, where appropriate, in equal class intervals continue to use Venn and Carroll diagrams to record their sorting and classifying of information construct and interpret frequency diagrams and simple line graphs understand and use the mode and range to describe sets of data
Level 3	<ul style="list-style-type: none"> select the mathematics they use in a wider range of classroom activities try different approaches and find ways of overcoming difficulties that arise when they are solving problems begin to organise their work and check results use and interpret mathematical symbols and diagrams understand a general statement by finding particular examples that match it review their work and reasoning 	<ul style="list-style-type: none"> classify 3-D and 2-D shapes in various ways using mathematical properties such as reflective symmetry for 2-D shapes begin to recognise nets of familiar 3-D shapes, e.g. cube, cuboid, triangular prism, square-based pyramid recognise shapes in different orientations and reflect shapes, presented on a grid, in a vertical or horizontal mirror line describe position and movement use a wider range of measures including non-standard units and standard metric units of length, capacity and mass in a range of contexts use standard units of time 	<ul style="list-style-type: none"> gather information construct bar charts and pictograms, where the symbol represents a group of units use Venn and Carroll diagrams to record their sorting and classifying of information extract and interpret information presented in simple tables, lists, bar charts and pictograms
Level 2	<ul style="list-style-type: none"> select the mathematics they use in some classroom activities discuss their work using mathematical language begin to represent their work using symbols and simple diagrams predict what comes next in a simple number, shape or spatial pattern or sequence and give reasons for their opinions explain why an answer is correct 	<ul style="list-style-type: none"> use mathematical names for common 3-D and 2-D shapes describe their properties, including numbers of sides and corners describe the position of objects distinguish between straight and turning movements, recognise right angles in turns and understand angle as a measurement of turn begin to use a wider range of measures including to use everyday non-standard and standard units to measure length and mass begin to understand that numbers can be used not only to count discrete objects but also to describe continuous measures 	<ul style="list-style-type: none"> sort objects and classify them using more than one criterion understand vocabulary relating to handling data collect and sort data to test a simple hypothesis record results in simple lists, tables, pictograms and block graphs communicate their findings, using the simple lists, tables, pictograms and block graphs they have recorded