Name .....

department for children, schools and families

Assessing Pupils' Progress

Assessment criteria: Number and algebra

The National Strategies

QCA Qualifications and Curriculum Authority

	Algebra	Numbers and the number system	Calculating
Level 8	• 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	• understand the equivalence between recurring decimals and fractions	• 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	• 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. $y = x^2$, $y = 3x^2 + 4$, $y = x^3$	• understand and use proportionality	• 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	• 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	• use the equivalence of fractions, decimals and percentages to compare proportions	• 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	• construct, express in symbolic form, and use simple formulae involving one or two operations • use and interpret coordinates in all four quadrants	• 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	• 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	• begin to use simple formulae expressed in words • use and interpret coordinates in the first quadrant	• 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	• 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	• recognise a wider range of sequences • begin to understand the role of '=' (the 'equals' sign)	• 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	• 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	• recognise sequences of numbers, including odd and even numbers	• 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	• 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
Level 1		• count up to 10 objects • read, write numbers to 10 • order numbers to 10 • begin to use the fraction, one-half	• understand addition as finding the total of two or more sets of objects • understand subtraction as 'taking away' objects from a set and finding how many are left • add and subtract numbers of objects to 10 • begin to know some addition facts • solve addition/subtraction problems involving up to 10 objects • record their work

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

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	Using and applying mathematics	Shape, space and measure	Handling data
Level 8	• 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	• 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	• 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	• 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	• 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	• 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	• 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	• 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	• 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: – 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	• 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	• 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	• 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	• 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	• 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	• 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	• 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	• 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	• 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	• 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	• 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	• 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
Level 1	• use mathematics as an integral part of classroom activities • represent their work with objects or pictures • discuss their work • draw simple conclusions from their work • recognise and use a simple pattern or relationship	• use everyday language to describe properties of 2-D and 3-D shapes • use everyday language to describe positions of 2-D and 3-D shapes • measure and order objects using direct comparison • order events	• sort and classify objects • represent their work • demonstrate the criterion they have used