Mathematics Assessment Levels

I can do this	9=		8+	8=	8-	7+	7=	7-	6+	6=	6-	5+	5=	5-	4+	4=	4-	3+	3=	3-	2+	2=	2-	1+	1=	1-	F+	F=	F-
Number					Find the upper and lower bounds of more difficult calculations with quantities given to a various degrees of accuracy. • Simplify surds with brackets and give answer in the form a +b/c. • Use index notation and index laws for fractional powers such as 16¾			Rationalise the denominator of a surd. Use index notation and index laws for simple fractional and negative powers.			Understand the equivalence between recurring decimals and fractions, rational numbers, reciprocals and terminating decimals. **Estimate powers and roots of any given positive number**			Index laws including zero and negative powers (algebraic and numerical) 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. Understand the effects of multiplying and dividing by numbers between 0 and 1 • add, subtract, multiply and divide fractions (mixed numbers) • 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			Recognise that measurements given to the nearest whole unit may be inaccurate by up to one half of the unit in either direction			Working with indices. Standard form (introduction). Four rules of Negatives Comparing fractions Make and justify estimates and approximations of calculations; estimate calculations by rounding numbers to one significant figure and multiplying and dividing mentally Find the LCM and HCF and use prime factor decomposition Use the equivalence of fractions, decimals and percentages to compare proportions Calculate percentage increase or decrease, percentage change and percentage of an amount 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, one quantity as a fraction of another 4 rules of fractions (not mixed). Recognise and use number patterns and relationships Use equivalence between fractions and order fractions and decimals Use known facts, place value, knowledge of operations and brackets to calculate including using all four operations with decimals to two places Use order of operations correctly BIDMAS 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			Adding integers and decimals. Half way values Solve simple problems involving ordering, adding, subtracting negative numbers in context. Recognise and describe number patterns Recognise and describe number relationships including multiple, factor, prime and square, roots and cubes Introduction to powers. 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 Rounding to nearest 10,100 etc or to nearest decimal place. Introduction to fractions/ equivalent fractions/simplifying fractions. 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 all 4 operations. Money questions and real life questions using four operations. Multiply a simple decimal by a single digit. Recognise negative numbers in contexts such as temperature. Solve problems with or without a calculator. Check the reasonableness of results with reference to the context or size of numbers. Inverse operations. Check the reasonableness of results with reference to the context or size of number			Ordering integers and decimals. Reading scales. 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. 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.			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.

Algebra	Expanding products of two or more binomial. Factorising quadratic expressions of the form ax^2+bx+c. To include proofs. Interpret the reverse process as the inverse function. Interpret the succession of two functions as a 'composite function'. Deduce turning points by completing the square. Find approximate solutions to equations numerically using iteration. Sequences and geometric progressions where n is an integer and r is a rational number > 0 where r is a surd. Exponential functions $y=k^x$ for positive values of k, and trigonometric functions (with arguments in degrees), $y=\sin x$, $y=\cos x$, $y=\tan x$ for angles of any size. Calculate or estimate gradients of graphs and area under graphs, and interpret results in cases such as distance time graphs, velocity-time graphs in financial contexts. Solving quadratic Inequalities.	Solve fractional linear equations with the unknown in the denominator. Use completing the square to solve quadratic equations. Solve a pair of simultaneous equations where one is linear and one is non-linear. Recognise the shapes of graphs of functions. Solve simultaneous equations graphically, such as $y=2x-1$, $x^2 + y^2 = 13$. Algebraic Fractions. Inverse Functions. Composite Functions. Simplify harder rational expressions. Solve harder rational expressions. Use completing the square to find maximum and minimum values. Equations of Perpendicular Lines. Solve cubic equations by drawing appropriate lines on graphs. Transform the graphs of y=f(x), such as linear, quadratic, cubic, sine and cosine functions, using the transformations y=f(x) + a, y=f(x+a), y=f(ax) and y=af(x). Finding the nth term of a quadratic.	Solve direct and inverse proportion problems. Interpret the graphs of direct and inverse proportion relationships. Rearrange formulae where the variable appears twice. Solve a pair of simultaneous equations where one is linear and one is non-linear. Construct the graphs of loci, including the circle. Solve simultaneous equations graphically. Recognise and use the equation of a circle with centre at the origin. Find the equation of a tangent to a circle at a given point. Plot and sketch graphs of exponential functions. Factorising Hard quadratics. Algebraic Proof. Factorise harder quadratic expressions where a≠1. Use the points of intersection of a quadratic graph to solve other quadratic equations. Solve quadratics using the quadratic formula when a=1. Regions. Fractional Indices. Explore gradients of perpendicular straight-line graphs. Product of three binomials.	Iteration Processes. Iteration Trial and Improvement. 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. Recognise 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.	Direct and indirect algebraic proportion. Expand the product of two linear expressions. Factorise quadratic expressions in the form $x^2 +bx +c$. The difference of two squares. Error Intervals. Mathematical Reasoning. Use algebraic and graphical methods to solve simultaneous linear equations in two variables. Solve quadratic equations by factorisation. Plot graphs of simple quadratic cubic and reciprocal functions, e.g. $y = x^2$, $y = 3x^2 + 4$, $y = x^3$. Use inequality notation to specify simple error intervals. Deduce quadratic roots algebraically. Fibonacci type sequences, quadratic sequences and geometric progression. Roots and turning points of quadratics. Negative Indices. Square a linear expression, and expand and simplify the product of two linear expressions of the form $(x ± n)$ and simplify the corresponding quadratic expression. Solve inequalities in one variable and represent the solution set on a number line. Uuse 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	Forming formulae and equations. Inequalities of a number line. Solving linear equations. Recognise that equations of the form $y = mx + c$ correspond to straight-line graphs. Midpoint of a line of a graph. Rearranging simple formulae. Simultaneous Equations graphically. Fibonacci Sequences. Distance Time Graph. 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. Construct functions arising from real-life problems and plot their corresponding graphs; interpret graphs arising from real situations.	Simple factorisation. Substitution. Straight line Graphs. The Gradient of a line. Problems on the coordinate axes. Sketching functions. Solving equations using flow diagrams. Subject of a formula using flowcharts. Generate a sequence using nth term. Finding the nth term. Construct, express in symbolic form, and use simple formulae involving one or two operations. Use and interpret coordinates in all four quadrants.	Simplifying- using all four operations. Function machines. Begin to use simple formulae expressed in words. Use and interpret coordinates in the first quadrant.	Co ordinates. Introduction to algebraic conventions.	
Ratio and proportion	Interpret the gradient at a point on a curve as the instantaneous rate of change. Apply the concepts of average and instantaneous rates of change (gradients of chords and tangents) in numerical, algebraic and graphical contexts and work with general iterative processes.		Direct and inverse proportion (using k). Recognising graphs showing direct and indirect proportion.	Construct and interpret equations that describe direct and inverse proportion. 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.	Interpret equations that describe direct and inverse proportion. Set up, solve and interpret the answers in growth and decay problems, including compound interest. Interpret the gradient of a straight line graph as a rate of change. Recognise and interpret graphs that illustrate direct and inverse proportion. Understand that X is inversely proportion to Y is equivalent to X is proportional to 1/Y. Make links to similarity (including Trig Ratios). Solve problems involving direct and inverse proportion, including graphical and algebraic representations. Calculate direct and indirect proportion (numeric and algebraic). Relate ratios to linear functions. Interpret the gradient of a straight line graph as a rate of change. 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. Direct and indirect numeric proportion. Compare areas and volumes using ratio notation. Use compound units, such as density and pressure, in numerical and algebraic contexts. Solve more difficult speed problems.	Compare lengths using ratio notation. Work with percentages greater than 100%. Express a multiplicative relationship between two quantities as a ratio or fraction. Apply ratio real contexts and problems (such as those involving conversion, comparison, scaling, mixing concentrations). Change freely between compound units (eg speed, rates of pay, prices) in numerical contexts. Relate ratios to fractions and to linear functions. Understand and use proportion as equality of ratios. Divide a given quantity into two parts in a given part: part or part: whole ratio. Express the division of a quantity into two parts as a ratio. Solve problems involving percentage change, including percentage increase/decrease and original value problems and simple interest, including in financial mathematics. 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	Sharing using ratio. Simple Interest. Understand simple ratio. Solve simple problems involving ratio and direct proportion including recipe questions.	Use scale factors, scale diagrams and maps (including geometrical problems). Value for money questions (basic). Change freely between related standard units (eg time, length, area, volume, capacity and mass). Introduction to ratio and proportion. Express one quantity as a fraction of another, where the fraction is less than 1 or greater than 1. Begin to understand simple ratio, including reduction to simplest form.	Use ratio notation. Define percentage as "number of parts per hundred".	

	A	B	C	D	E	F	G	H	I	J
Statistics and probability			And and Or probability questions. Interpret and compare box plots.	Probability using Venn Diagrams. Estimate and find the median, quartiles and interquartile range for large data sets, including using a cumulative frequency diagram. Construct a box plot. 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. Calculate probabilities using Venn diagrams.	Stratified sampling. 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. 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. 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.	Use tree diagrams to calculate probabilities of combinations of independent events. Sampling populations. Communicate interpretations and results of a statistical survey using selected tables, graphs and diagrams in support. 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; Pie charts for categorical data. Compare two or more distributions and make inferences, using the shape of the distributions and measures of average and range. Simple time graphs for time series. Scatter graphs, and identify which are most useful in the context of the problem. Averages from a table.	Interpret graphs and diagrams, including pie charts, and draw conclusions. Construct and interpret a sample space and Venn diagram. Understand and use the mean of discrete data and compare two simple distributions, using the range and one of mode, median or mean. 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 that different outcomes may result from repeating an experiment. Create and interpret line graphs where the intermediate values have meaning.	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 Design and use two-way tables. Calculating probabilities. Mutually exclusive events. Averages and range. Frequency trees. Listing outcomes. Know the difference between continuous and discrete data. 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.	The probability scale (words). Tally Charts. Gather information. Construct bar charts (including vertical line 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.	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.
Geometry	Understand the graphs of trigonometric functions for angles of any size. Solve more difficult vector geometry problem.	Find the upper and lower bounds of more difficult calculations with quantities given to a various degrees of accuracy. Find the angle between a line and a plane. Use trigonometry to find sides and angles in three dimensions. Understand the relationship between parallel and perpendicular vectors. Use the cosine rule to find the missing sides and missing angles in any triangle. Use the conditions for congruent triangles in formal geometric proofs.	Use and prove the alternate segment theorem. Sketch and draw trigonometric graphs. Find the area of a 2-D shape, given the area of a similar shape and the ratio Find the volume of a 3-D solid, given the volume of a similar solid and the ratio. Use the sine rule to find the missing sides and missing angles in any triangle. Compare areas and volumes of enlarged shapes. Use Pythagoras' theorem in 3-D problems. Use the formula for the area of a non-right-angled triangle. Prove the angle properties of a circle. Prove the tangent / chord properties of a circle.	Enlarge a shape by a negative scale factor. Use the angle properties of a circle (circle theorems). Use the tangent / chord properties of a circle. Distinguish between formulae for perimeter, area and volume by considering dimensions. Find the upper and lower bounds of simple calculations (addition and subtraction) involving quantities given to a particular degree of accuracy. Understand and use congruence and mathematical similarity Understand the difference between formulae for perimeter, area and volume in simple contexts by considering dimensions. 3D coordinates.	Find the volume of the frustum of a truncated cone. Understand and use trigonometrical relationships in right-angled triangles, and use these to solve problems, including those involving bearings. Enlarge 2-D shapes, given a centre of enlargement including a fractional scale factor, on paper and using ICT; recognise the similarity of the resulting shapes. Add, subtract and multiply vectors to solve vector geometry problems. Identify and interpret roots, intercepts, turning points of quadratic functions graphically. Know the exact values of sin x and cos x for x = 0, 30, 45, 60, 90 degrees; know exact value of tan x for x = 0, 30, 45, 60 degrees. Lengths of arcs and areas of sectors of circles. Prove that two triangles are congruent. Match sides and angles of similar triangles, given some dimensions. Use sine, cosine and tangent to calculate an angle in a right-angled triangle. Use sine, cosine and tangent to calculate a side in a right-angled triangle. Calculate areas and volumes in right prisms cylinders, cones and spheres. Find the locus of a point that moves according to a given rule, both by reasoning and using ICT. Solve problems involving surface areas of prisms and cylinders. Combine reflections and rotations. Transform shapes by a combination of translation, reflection and rotation. Match one side and one angle of congruent triangles, given some dimensions. Find the distance between two points from their coordinates. Understand and apply Pythagoras' theorem when solving problems in 2-D.	Use Pythagoras' theorem to find the hypotenuse of a right-angled triangle. Use Pythagoras' theorem to find any side of a right-angled triangle. Use Pythagoras' theorem to find the height of an isosceles triangle. Use Pythagoras' theorem in practical problems. 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. Solve problems using angle and symmetry properties of polygons and properties of intersecting and parallel lines Calculate exterior and interior angles of a regular polygon. Calculate the area of a prism. know and use the formula for the circumference and area of a circle. Solve geometrical problems using properties of angles, of parallel and intersecting lines and 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°. Convert between measures of area. Convert between measures of volume. Find the midpoint of a line segment. Translate a shape by a vector. Enlarge a shape by a positive whole number or fractional scale factor. Recognise accuracy in measurements given to the nearest whole unit. Construct the perpendicular bisector of a line. Construct the perpendicular from a point to a line. Construct the perpendicular from a point on a line. Construct angles of 60° and 90°.	Reason about position and movement and transform shapes. Use the properties of 2-D and 3-D shapes. Find the area of parallelogram, kite and trapezium. Calculate the circumference of a circle to an appropriate degree of accuracy. Calculate the area of a circle to an appropriate degree of accuracy. Identify reflection symmetry in 3-D solids. Enlarge a shape by a positive scale factor from a given centre. Understand that the lengths of two sides & a non-included angle do not define a unique triangle. Bearings. Use a wider range of properties of 2-D and 3-D shapes and identify all the symmetries of 2-D shapes. 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. Reflect simple shapes in a mirror line, translate shapes horizontally or vertically and begin to rotate a simple shape or object about its center or a vertex. Choose and use appropriate units and instruments. Interpret, with appropriate accuracy, numbers on a range of measuring instruments. 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	Draw plans and elevations of 3-D solids. Construct and recognise the nets of 3-D solids such as pyramids and triangular prism. Translate a shape using a description such as 4 units right and 3 units down. Show that the angles of a triangle add up to 180° and use this to find angles. Show that an exterior angle of a triangle is equal to the sum of the interior opposite angles. Use angle properties of isosceles, equilateral and right-angled triangles. Find the area of a triangle. Investigate tessellations and congruent shapes. Reflect shapes in the axes of a graph. Enlarge a shape by a positive scale factor. Find the measurements of the dimensions of an enlarged shape. Solve simple speed problems. Find the area and perimeter of compound shapes. Find the area and perimeter of compound shapes. Calculate interior and exterior angles of a quadrilateral. Draw a triangle given three sides, or two angles and a side, or two sides and the included angle. Use map scales to find distance.	Classify 3-D and 2-D shapes in various ways using mathematical properties such as reflective symmetry for 2-D shapes Recognise shapes in different orientations and reflect shapes, presented on a grid, in a vertical or horizontal mirror line. Use a wider range of measures including non-standard units and standard metric units of length, capacity and mass in a range of contexts. Measure and draw angles accurately to the nearest degree. Name, draw or complete 2-D shapes from information about their symmetry. Convert between imperial and metric units. Make sensible estimates of a range of measures in everyday settings • describe position and movement Use standard units of time. Express fractions of full turns in degrees and vice versa. Recognise acute, obtuse and reflex angles. Estimate angles. Understand the terms 'perpendicular lines' and 'parallel lines'. Know angles on a straight line add up to 180°, and angles at a point add up to 360°. Know angles in a triangle add up to 180°. Draw the line of reflection for two shapes. Give a scale factor of an enlarged shape. Draw all the lines of symmetry on a 2-D shape. Give the order of rotations symmetry of a 2-D shape. Draw the net of a simple solid such as a cuboid. Convert one metric unit to another. Begin to recognise nets of familiar 3-D shapes, e.g. cube, cuboid, triangular prism, square-based pyramid. Work out the perimeter of a simple rectangle. Work out the area of a simple rectangle.	Identify isosceles, equilateral and right-angled triangles. Use the word 'congruent' when triangles are identical. Find the perimeter of a shape by counting sides of squares. Find the area of a square by counting squares. Estimate the area of an irregular shape by counting squares and part squares. Name the parts of a circle. Recognise and name shapes, such as isosceles triangle, parallelogram, rhombus, trapezium and hexagon. Draw the reflection of a shape in a mirror line. Draw a line of symmetry on a 2-D shape. Decide which metric unit to use for everyday measurements Measure a line accurately to the nearest millimetre. Recognise the net of a simple solid such as a cuboid. Find the volume of a solid by counting cubes and stating units. Recognise and name three-dimensional (3-D) solids. Sketch three-dimensional (3-D) solids. 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 every day 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