

Stage 1

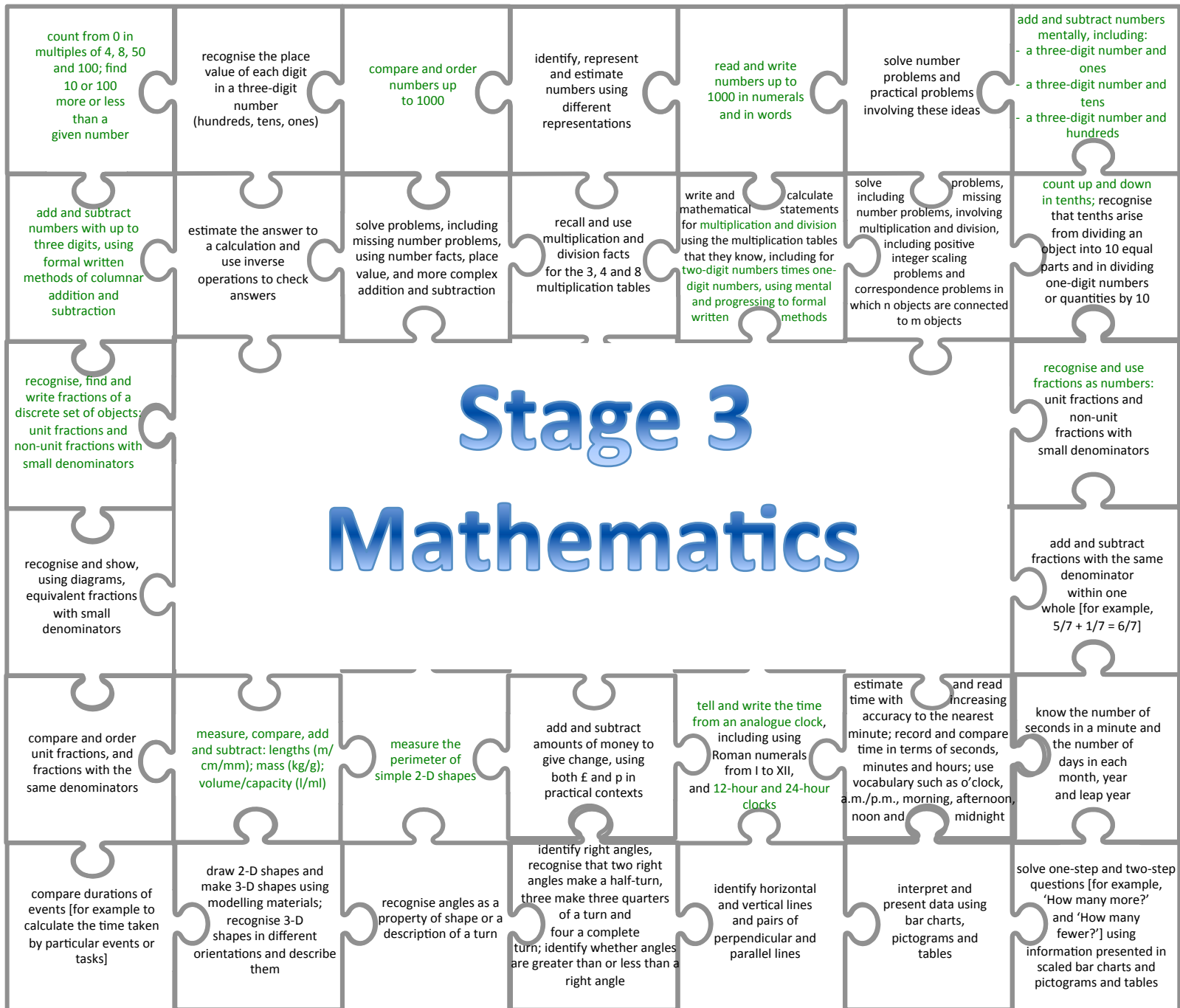
Mathematics

count to and across 100, forwards and backwards, beginning with 0 or 1, or from any given number	count, read and write numbers to 100 in numerals; count in multiples of twos, fives and tens	given a number, identify one more and one less	identify and represent numbers using objects and pictorial representations including the number line, and use the language of: equal to, more than, less than (fewer), most, least	read and write numbers from 1 to 20 in numerals and words.	read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs	represent and use number bonds and related subtraction facts within 20
add and subtract one-digit and two-digit numbers to 20, including zero numbers	solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as $7 = \square - 9$	Stage 1		solve problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.	one-step involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.	recognise, find and name a half as 1 of 2 equal parts of an object, shape or quantity
recognise, find and name a quarter as 1 of 4 equal parts of an object, shape or quantity	Mathematics			compare, describe and solve practical problems for: - lengths and heights [for example, long/short, longer/shorter, tall/short double/half] - mass/weight [for example, heavy/light, heavier than, lighter than] - capacity and volume [for example, full/empty, more than, less than, half, half full, quarter] - time [for example, quicker, slower, earlier, later]		
measure and begin to record the following: - lengths and heights - mass/weight - capacity and volume - time (hours, minutes, seconds)			recognise and know the value of different denominations of coins and notes	sequence events in chronological order using language [for example, before and after, next, first, today, yesterday, tomorrow, morning, afternoon and evening]	recognise and use language relating to dates, including days of the week, weeks, months and years	tell the time to the hour and half past the hour and draw the hands on a clock face to show these times

Stage 2

Mathematics

count in steps of 2, 3, and 5 from 0, and in tens from any number, forward and backward	recognise the place value of each digit in a two-digit number (tens, ones)	identify, represent and estimate numbers using different representations, including the number line	compare and order numbers from 0 up to 100; use <, > and = signs	read and write numbers to at least 100 in numerals and in words	use place value and number facts to solve problems	solve problems with addition and subtraction: - using concrete objects and pictorial representations, including those involving numbers, quantities and measures - applying their increasing knowledge of mental and written methods
recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100	add and subtract using concrete objects, pictorial representations, and mentally, including: - a two-digit number and ones - a two-digit number and tens - two two-digit numbers - adding three one-digit numbers	show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot	recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.	recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers	calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (\times), division (\div) and equals (=) signs	show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot
Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts	recognise, find, name and write fractions $1/3$, $1/4$, $2/4$ and $3/4$ of a length, shape, set of objects or quantity	Stage 2			write simple fractions for example, $1/2$ of 6 = 3 and recognise the equivalence of $2/4$ and $1/2$	
choose appropriate units to estimate and measure length/height in any direction (m/cm); mass (kg/g); temperature ($^{\circ}$ C); capacity (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels	Mathematics			compare and order lengths, mass, volume/capacity and record the results using >, < and =		
recognise and use symbols for pounds (£) and pence (p); combine amounts to make a particular value	find different combinations of coins that equal the same amounts of money	solve simple problems in a practical context involving addition and subtraction of money of the same unit, including giving change	compare and sequence intervals of time	tell and write the time to five minutes, including quarter past/to the hour and draw the hands on a clock face to show these times	know the number of minutes in an hour and the number of hours in a day.	identify and describe the properties of 2-D shapes, including the number of sides and line symmetry in a vertical line
identify and describe the properties of 3-D shapes, including the number of edges, vertices and faces	identify 2-D shapes on the surface of 3-D shapes, [for example, a circle on a cylinder and a triangle on a pyramid]	compare and sort common 2-D and 3-D shapes and everyday objects	use mathematical vocabulary to describe position, direction and movement, including movement in a straight line and distinguishing between rotation as a turn and in terms of right angles for quarter, half and three-quarter turns (clockwise and anti-clockwise)	interpret and construct simple pictograms, tally charts, block diagrams and simple tables	ask and answer simple questions by counting the number of objects in each category and sorting the categories by quantity	ask and answer questions about totalling and comparing categorical data



count from 0 in multiples of 4, 8, 50 and 100; find 10 or 100 more or less than a given number

recognise the place value of each digit in a three-digit number (hundreds, tens, ones)

compare and order numbers up to 1000

identify, represent and estimate numbers using different representations

read and write numbers up to 1000 in numerals and in words

solve number problems and practical problems involving these ideas

add and subtract numbers mentally, including:
 - a three-digit number and ones
 - a three-digit number and tens
 - a three-digit number and hundreds

add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction

estimate the answer to a calculation and use inverse operations to check answers

solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction

recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables

write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods

solve problems, including number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects

count up and down in tenths; recognise that tenths arise from dividing an object into 10 equal parts and in dividing one-digit numbers or quantities by 10

recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators

Stage 3

Mathematics

recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators

recognise and show, using diagrams, equivalent fractions with small denominators

add and subtract fractions with the same denominator within one whole [for example, $5/7 + 1/7 = 6/7$]

compare and order unit fractions, and fractions with the same denominators

measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

measure the perimeter of simple 2-D shapes

add and subtract amounts of money to give change, using both £ and p in practical contexts

tell and write the time from an analogue clock, including using Roman numerals from I to XII, and 12-hour and 24-hour clocks

estimate and read time with increasing accuracy to the nearest minute; record and compare time in terms of seconds, minutes and hours; use vocabulary such as o'clock, a.m./p.m., morning, afternoon, noon and midnight

know the number of seconds in a minute and the number of days in each month, year and leap year

compare durations of events [for example to calculate the time taken by particular events or tasks]

draw 2-D shapes and make 3-D shapes using modelling materials; recognise 3-D shapes in different orientations and describe them

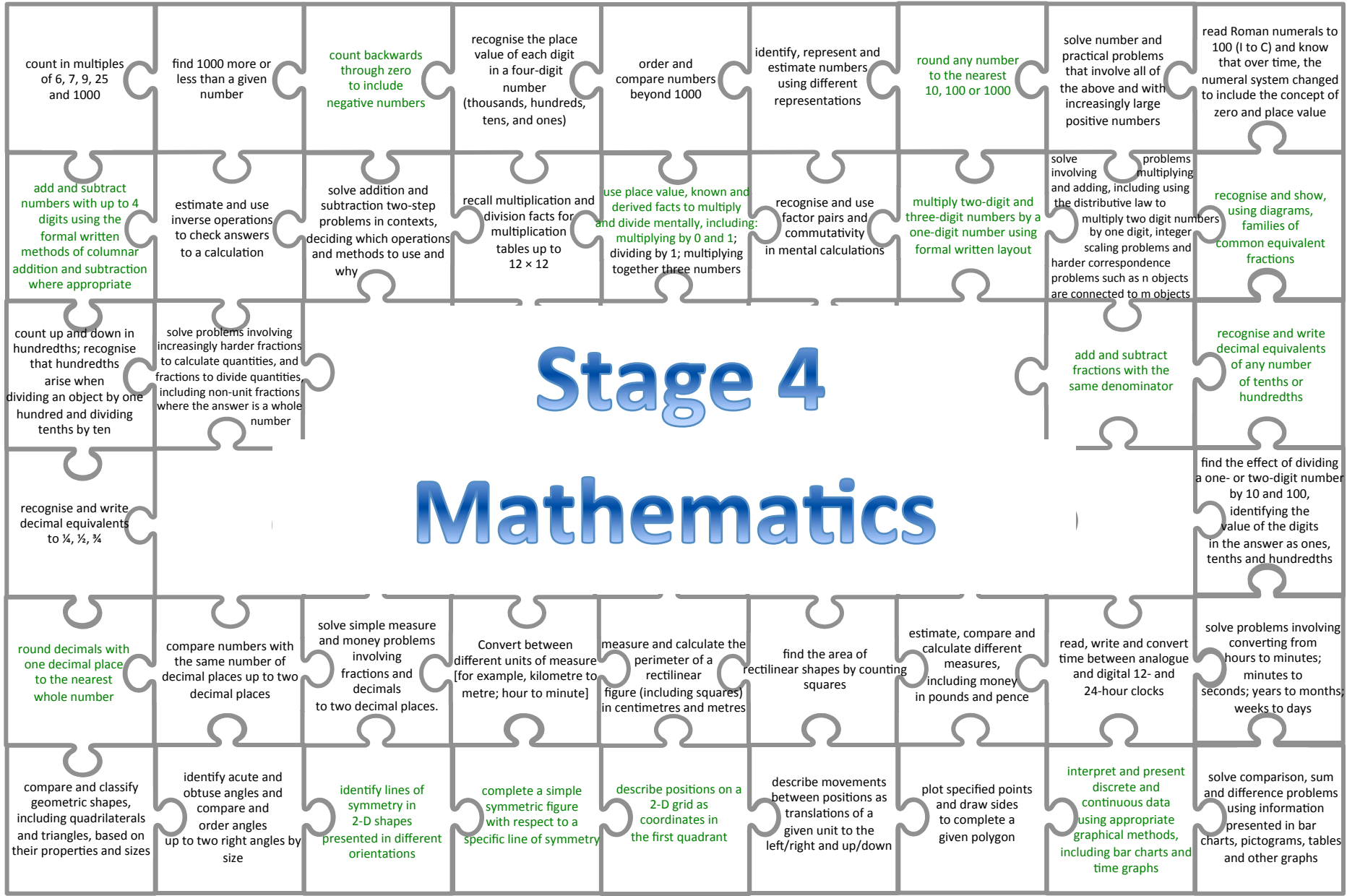
recognise angles as a property of shape or a description of a turn

identify right angles, recognise that two right angles make a half-turn, three make three quarters of a turn and four a complete turn; identify whether angles are greater than or less than a right angle

identify horizontal and vertical lines and pairs of perpendicular and parallel lines

interpret and present data using bar charts, pictograms and tables

solve one-step and two-step questions [for example, 'How many more?' and 'How many fewer?'] using information presented in scaled bar charts and pictograms and tables



count in multiples of 6, 7, 9, 25 and 1000

find 1000 more or less than a given number

count backwards through zero to include negative numbers

recognise the place value of each digit in a four-digit number (thousands, hundreds, tens, and ones)

order and compare numbers beyond 1000

identify, represent and estimate numbers using different representations

round any number to the nearest 10, 100 or 1000

solve number and practical problems that involve all of the above and with increasingly large positive numbers

read Roman numerals to 100 (I to C) and know that over time, the numeral system changed to include the concept of zero and place value

add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate

estimate and use inverse operations to check answers to a calculation

solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why

recall multiplication and division facts for multiplication tables up to 12×12

use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers

recognise and use factor pairs and commutativity in mental calculations

multiply two-digit and three-digit numbers by a one-digit number using formal written layout

solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects

recognise and show, using diagrams, families of common equivalent fractions

count up and down in hundredths; recognise that hundredths arise when dividing an object by one hundred and dividing tenths by ten

solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities including non-unit fractions where the answer is a whole number

Stage 4

add and subtract fractions with the same denominator

recognise and write decimal equivalents of any number of tenths or hundredths

Mathematics

recognise and write decimal equivalents to $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$

find the effect of dividing a one- or two-digit number by 10 and 100, identifying the value of the digits in the answer as ones, tenths and hundredths

round decimals with one decimal place to the nearest whole number

compare numbers with the same number of decimal places up to two decimal places

solve simple measure and money problems involving fractions and decimals to two decimal places.

Convert between different units of measure [for example, kilometre to metre; hour to minute]

measure and calculate the perimeter of a rectilinear figure (including squares) in centimetres and metres

find the area of rectilinear shapes by counting squares

estimate, compare and calculate different measures, including money in pounds and pence

read, write and convert time between analogue and digital 12- and 24-hour clocks

solve problems involving converting from hours to minutes; minutes to seconds; years to months; weeks to days

compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes

identify acute and obtuse angles and compare and order angles up to two right angles by size

identify lines of symmetry in 2-D shapes presented in different orientations

complete a simple symmetric figure with respect to a specific line of symmetry

describe positions on a 2-D grid as coordinates in the first quadrant

describe movements between positions as translations of a given unit to the left/right and up/down

plot specified points and draw sides to complete a given polygon

interpret and present discrete and continuous data using appropriate graphical methods, including bar charts and time graphs

solve comparison, sum and difference problems using information presented in bar charts, pictograms, tables and other graphs

read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit	count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000	interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers, including through zero	round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000	solve number problems and practical problems that involve all of the above	read Roman numerals to 1000 (M) and recognise years written in Roman numerals	add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)	add and subtract numbers mentally with increasingly large numbers	use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why	identify multiples and factors , including finding all factor pairs of a number, and common factors of 2 numbers	know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers	establish whether a number up to 100 is prime and recall prime numbers up to 19	multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers	multiply and divide numbers mentally, drawing upon known facts	divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context	multiply and divide whole numbers and those involving decimals by 10, 100 and 1,000	recognise and use square numbers and cube numbers, and the notation for squared (²) and cubed (³)
solve problems involving multiplication and division, including using their knowledge of factors and multiples, squares and cubes	solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign	solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates	<h1>Stage 5</h1> <h1>Mathematics</h1>		compare and order fractions whose denominators are all multiples of the same number	identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths	recognise mixed and improper fractions and convert from one form to the other and write mathematical statements >1 as a mixed number [eg $\frac{2}{5} + \frac{1}{5} = \frac{6}{5} = 1\frac{1}{5}$]	add and subtract fractions with the same denominator and denominators that are multiples of the same number
multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams	read and write decimal numbers as fractions [for example, $0.71 = \frac{71}{100}$]	recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents			round decimals with two decimal places to the nearest whole number and to one decimal place	read, write, order and compare numbers with up to three decimal places	solve problems involving number up to three decimal places	
recognise the per cent symbol (%) and understand that per cent relates to 'number of parts per hundred' , and write percentages as a fraction with denominator 100, and as a decimal	solve problems which require knowing percentage and decimal equivalents of $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{2}{5}$ and those fractions with a denominator of a multiple of 10 or 25.	convert between different units of metric measure (for example, kilometre and metre; centimetre and metre; centimetre and millimetre; gram and kilogram; litre and millilitre)	understand and use approximate equivalences between metric units and common imperial units such as inches, pounds and pints	measure and calculate the perimeter of composite rectilinear shapes in centimetres and metres	calculate and compare the area of rectangles (including squares), and including using standard units, square centimetres (cm²) and square metres (m²) and estimate the area of irregular shapes	estimate volume [for example, using 1 cm ³ blocks to build cuboids (including cubes)] and capacity [for example, using water]	solve problems involving converting between units of time	use all four operations to solve problems involving measure [for example, length, mass, volume, money] using decimal notation, including scaling.
identify 3-D shapes, including cubes and other cuboids, from 2-D representations	know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles	draw given angles, and measure them in degrees (°)	identify: - angles at a point and one whole turn (total 360°) - angles at a point on a straight line and $\frac{1}{2}$ a turn (total 180°) - other multiples of 90°	use the properties of rectangles to deduce related facts and find missing lengths and angles	distinguish between regular and irregular polygons based on reasoning about equal sides and angles	identify, describe and represent the position of a shape following a reflection or translation, using the appropriate language, and know that the shape has not changed	solve comparison, sum and difference problems using information presented in a line graph	complete, read and interpret information in tables, including timetables

read, write, order and compare numbers up to 10 000 000 and determine the value of each digit	round any whole number to a required degree of accuracy	use negative numbers in context, and calculate intervals across zero	solve number problems and practical problems that involve all of the above	multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication	divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context	divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context	perform mental calculations, including with mixed operations and large numbers	identify common factors, common multiples and prime numbers
use their knowledge of the order of operations to carry out calculations involving the four operations	solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why	solve problems involving addition, subtraction, multiplication and division	use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.	use common factors to simplify fractions; use common multiples to express fractions in the same denomination	compare and order fractions, including fractions >1	add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions	multiply simple pairs of proper fractions, writing the answer in its simplest form [for example, $\frac{1}{3} \times \frac{2}{5} = \frac{2}{15}$]	divide proper fractions by whole numbers [for example, $\frac{1}{3} \div 2 = \frac{1}{6}$]
associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction [for example, $\frac{3}{8}$]	identify the value of each digit in numbers given to three decimal places and multiply and divide numbers by 10, 100 and 1000 giving answers up to 3 decimal places	multiply one-digit numbers with up to two decimal places by whole numbers	<h1>Stage 6</h1> <h1>Mathematics</h1>		use written division methods in cases where the answer has up to two decimal places	solve problems which require answers to be rounded to specified degrees of accuracy	recall and use equivalences between simple fractions, decimals and percentages including in different contexts.	solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts
solve problems involving the calculation of percentages [for example, of measures, and such as 15% of 360] and use percentages for comparison	solve problems involving similar shapes where the scale factor is known or can be found	solve problems involving unequal sharing and grouping using knowledge of fractions and multiples			use simple formulae	generate and describe linear number sequences	express missing number problems algebraically	
find pairs of numbers that satisfy number sentences involving two unknowns	enumerate possibilities of combinations of two variables	solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places where appropriate	use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation up to 3 decimal places	convert between miles and kilometres	recognise that shapes with the same areas can have different perimeters and vice versa	recognise when it is possible to use the formulae for area and volume of shapes	calculate the area of parallelograms and triangles	calculate, estimate and compare volume of cubes and cuboids using standard units, including cubic centimetres (cm ³) and cubic metres (m ³), and extending to other units [eg, mm ³ and km ³]
draw 2-D shapes using given dimensions and angles	recognise, describe and build simple 3-D shapes including making nets	compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals, and regular polygons	illustrate and name parts of circle, including radius, diameter and circumference and know that the diameter is twice the radius	recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles.	describe positions on the full coordinate grid (all four quadrants)	draw and translate simple shapes on the coordinate plane, and reflect them in the axes	interpret and construct pie charts and line graphs and use these to solve problems	calculate and interpret the mean as an average

order positive and negative integers, decimals and fractions	use the symbols =, ≠, <, >, ≤, ≥	apply the four operations, including formal written methods, to integers, decimals and simple fractions (proper and improper), and mixed numbers	understand and use place value (e.g. when working with very large or very small numbers, and when calculating with decimals)	recognise and use relationships between operations, including inverse operations (e.g. cancellation) to simplify calculations and expressions	use conventional notation for priority of operations, including brackets	use the concepts and vocabulary of prime numbers, factors (divisors), multiples, common factors, common multiples, highest common factor and lowest common multiples	use positive integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5	use standard units of mass, length, time, money and other measures (including standard compound measures) using decimal quantities where appropriate
use their knowledge of the order of operations to carry out calculations involving the four operations	estimate answers; check calculations using approximation and estimation, including answers obtained using technology	Round numbers and measures to an appropriate degree of accuracy (e.g. to a specified number of decimal places or significant figures)	use and interpret algebraic notation, including: ab in place of $a \times b$, $3y$ in place of $y + y + y$ and $3 \times y$, a^2 in place of $a \times a$, a^3 in place of $a \times a \times a$, a/b in place of $a \div b$, brackets	substitute numerical into formulae and expressions	understand and use the concepts and vocabulary of expressions, equations, formulae and terms	compare and order fractions, including fractions >1	simplify and manipulate algebraic expressions by collecting like terms and multiplying a single term over a bracket	understand and use standard mathematical formulae
where appropriate, interpret simple expressions as functions with inputs and outputs	work with coordinates in all four quadrants	understand and use lines parallel to the axes, $y=x$ and $y=-x$	solve linear equations in one unknown algebraically	Stage 7 Mathematics	generate terms of a sequence from a term-to-term rule	recognise and use sequences of triangular, square and cube numbers, simple arithmetic progressions	change freely between related standard units (e.g. time, length, area, volume/capacity, mass) in numerical contexts	express one quantity as a fraction of another, where the fraction is less than 1 or greater than 1
use ratio notation, including reduction to simplest form	divide a given quantity into two parts in a given part:part or part:whole ratio	define percentage as 'number of parts per hundred'	interpret percentages and percentage changes as a fraction or a decimal, and interpret these multiplicatively			express one quantity as a percentage of another	compare two quantities using percentages	solve problems involving percentage change, including percentage increase/decrease
use conventional terms and notations: points, lines, vertices, edges, planes, parallel lines, perpendicular lines, right angles, polygons, regular polygons and polygons with reflection and/or rotation symmetries	use the standard conventions for labelling and referring to the sides and angles of triangles	solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places where appropriate	draw diagrams from written description	apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles	derive and apply the properties and definitions of: special types of quadrilaterals, including square, rectangle, parallelogram, trapezium, kite and rhombus; and triangles and other plane figures using appropriate language	identify, describe and construct congruent shapes including on coordinate axes, by considering rotation, reflection and translation	solve geometrical problems on coordinate axes	identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres
use standard units of measure and related concepts (length, area, volume/capacity, mass, time, money, etc.)	measure line segments and angles in geometric figures	know and apply formulae to calculate area of triangles, parallelograms, trapezia	calculate perimeters of 2D shapes	know and apply formulae to calculate volume of cuboids	calculate surface area of cuboids	describe translations as 2D vectors	interpret and construct tables, charts and diagrams, including frequency tables, bar charts, pie charts and pictograms for categorical data, vertical line charts for ungrouped discrete numerical data and know their appropriate use	interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (median, mean, mode and modal class) and spread (range)

<p>apply the four operations, including formal written methods, to integers, decimals and simple fractions (proper and improper), and mixed numbers – all both positive and negative</p>	<p>use conventional notation for priority of operations, including brackets, powers, roots and reciprocals</p>	<p>use the concepts and vocabulary of prime numbers, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation theorem</p>	<p>calculate exactly with fractions</p>	<p>interpret standard form $A \times 10^n$, where $1 \leq A < 10$ and n is an integer</p>	<p>apply systematic listing strategies</p>	<p>work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and $7/2$ or 0.375 or $3/8$)</p>	<p>identify and work with fractions in ratio problems</p>	<p>interpret fractions and percentages as operators</p>
<p>round numbers and measures to an appropriate degree of accuracy (e.g. to a specified number of decimal places or significant figures)</p>	<p>use and interpret algebraic notation, including: a^b in place of $a \times a \times b$, coefficients written as fractions rather than as decimals</p>	<p>substitute numerical values into scientific formulae</p>	<p>understand and use the concepts and vocabulary of factors</p>	<p>simplify and manipulate algebraic expressions by taking out common factors and simplifying expressions involving sums, products and powers, including the laws of indices</p>	<p>rearrange formulae to change the subject</p>	<p>plot graphs of equations that correspond to straight-line graphs in the coordinate plane</p>	<p>identify and interpret gradients and intercepts of linear functions graphically and algebraically</p>	<p>recognise, sketch and interpret graphs of linear functions and simple quadratic functions</p>
<p>plot and interpret graphs and graphs of non-standard (piece-wise linear) functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance and speed</p>	<p>solve linear equations with the unknown on both sides of the equation</p>	<p>find approximate solutions to linear equations using a graph</p>	<p>generate terms of a sequence from either a term-to-term or a position-to-term rule</p>	<p>deduce expressions to calculate the nth term of linear sequences</p>	<p>change freely between compound units (e.g. speed, rates of pay, prices) in numerical contexts</p>	<p>use compound units such as speed, rates of pay, unit pricing)</p>	<p>use scale factors, scale diagrams and maps</p>	<p>express the division of a quantity into two parts as a ratio; apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations)</p>
<h1>Stage 8 Mathematics</h1>								
<p>express a multiplicative relationship between two quantities as a ratio or a fraction</p>	<p>understand and use proportion as equality of ratios</p>	<p>relate ratios to fractions and to linear functions</p>	<p>compare lengths, areas and volumes using ratio notation</p>	<p>work with percentages greater than 100%</p>	<p>solve problems involving percentage change, including original value problems, and simple interest including in financial mathematics</p>	<p>understand and use alternate and corresponding angles on parallel lines</p>	<p>derive and use the sum of angles in a triangle (e.g. to deduce and use the angle sum in any polygon, and to derive properties of regular polygons)</p>	<p>identify, describe and construct similar shapes, including on coordinate axes, by considering enlargement</p>
<p>interpret plans and elevations of 3D shapes</p>	<p>measure line segments and angles in geometric figures, including interpreting maps and scale drawings and use of bearings</p>	<p>identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference know the formulae: circumference of a circle = $2\pi r = \pi d$, area of a circle = πr^2</p>	<p>calculate perimeters of 2D shapes, including circles</p>	<p>calculate areas of circles and composite shapes</p>	<p>know and apply formulae to calculate volume of right prisms (including cylinders)</p>	<p>apply statistics to describe a population</p>	<p>use and interpret scatter graphs of bivariate data</p>	<p>recognise correlation</p>
<p>interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate graphical representation involving discrete, continuous and grouped data</p>	<p>interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (median, mean, mode and modal class) and spread (range, including consideration of outliers)</p>	<p>record describe and analyse the frequency of outcomes of probability experiments using tables and frequency trees</p>	<p>apply ideas of randomness, fairness and equally likely events to calculate expected outcomes of multiple future experiments</p>	<p>relate relative expected frequencies to theoretical probability, using appropriate language and the 0 - 1 probability scale</p>	<p>construct theoretical possibility spaces for single experiments with equally likely outcomes and use these to calculate theoretical probabilities</p>	<p>apply the property that the probabilities of an exhaustive set of outcomes sum to one; apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one</p>	<p>enumerate sets and combinations of sets systematically, using tables, grids and Venn diagrams</p>	<p>construct theoretical possibility spaces for combined experiments with equally likely outcomes and use these to calculate theoretical probabilities</p>

calculate with roots, and with integer indices

calculate exactly with multiples of π

calculate with standard form $A \times 10^n$, where $1 \leq A < 10$ and n is an integer

use inequality notation to specify simple error intervals due to truncation or rounding

apply and interpret limits of accuracy

understand and use the concepts and vocabulary of identities

simplify and manipulate algebraic expressions by expanding products of two binomials and factorising quadratic expressions of the form $x^2 + bx + c$

argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments

understand and use the concepts and vocabulary of inequalities

use the form $y = mx + c$ to identify parallel lines

find the equation of the line through two given points, or through one point with a given gradient

recognise, sketch and interpret graphs of quadratic functions

recognise, sketch and interpret graphs of simple cubic functions and the reciprocal function $y = 1/x$ with $x \neq 0$

plot and graphs (including reciprocal graphs) and graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration

solve, in simple cases, two linear simultaneous equations in two variables algebraically

find approximate solutions to simultaneous equations using a graph

translate simple situations or procedures into algebraic expressions or formulae

derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution

solve linear inequalities in one variable

Stage 9

represent the solution set to an inequality on a number line

recognise and use Fibonacci type sequences, quadratic sequences

change freely between compound units (e.g. density, pressure) in numerical and algebraic contexts

Mathematics

use compound units such as density and pressure

interpret the gradient of a straight line graph as a rate of change;

solve problems involving direct and inverse proportion, including graphical and algebraic representations

use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle)

use these to construct figures and solve loci problems; know that the perpendicular distance from a point to a line is the shortest distance to the line

apply angle facts, triangle congruence, similarity and properties of quadrilaterals to conjecture and derive results about angles and sides, including Pythagoras' Theorem and the fact that the base angles of an isosceles triangle are equal, and use known results to obtain simple proofs

use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS)

identify and apply circle definitions and properties, including: tangent, arc, sector and segment

construct plans and elevations of 3D shapes

calculate arc lengths, angles and areas of sectors of circles

calculate surface area of right prisms (including cylinders)

apply the concepts of congruence and similarity, including the relationships between lengths in similar figures

know the formulae for: Pythagoras' theorem, $a^2 + b^2 = c^2$, and apply it to find lengths in right-angled triangles in two dimensional figures

interpret and construct tables, charts and diagrams, including tables and line graphs for time series data and know their appropriate use

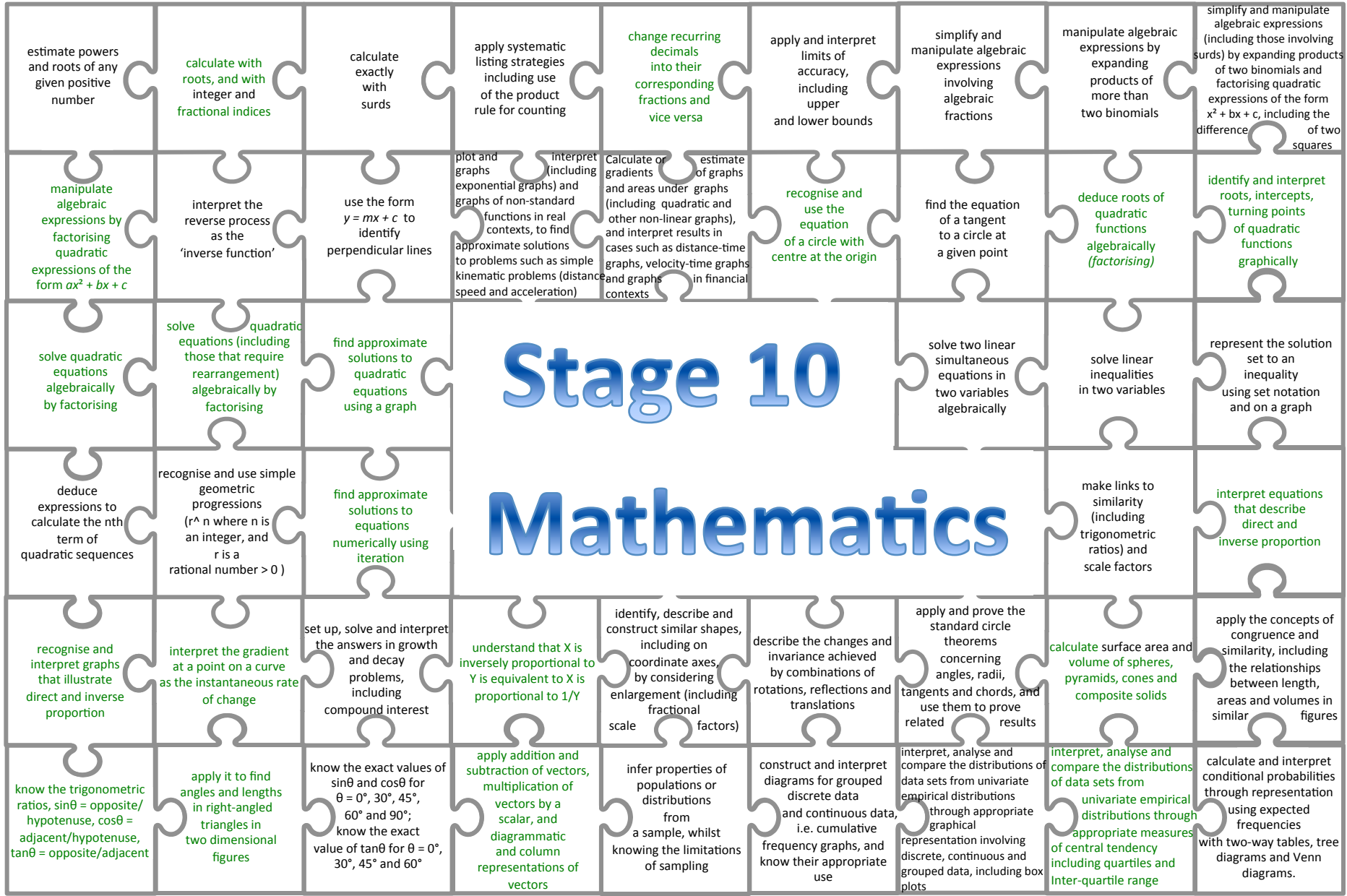
draw estimated lines of best fit; make predictions

know correlation does not indicate causation; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing

enumerate sets and combinations of sets systematically, using tree diagrams

understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size

calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions



estimate powers and roots of any given positive number

calculate with roots, and with integer and fractional indices

calculate exactly with surds

apply systematic listing strategies including use of the product rule for counting

change recurring decimals into their corresponding fractions and vice versa

apply and interpret limits of accuracy, including upper and lower bounds

simplify and manipulate algebraic expressions involving algebraic fractions

manipulate algebraic expressions by expanding products of more than two binomials

simplify and manipulate algebraic expressions (including those involving surds) by expanding products of two binomials and factorising quadratic expressions of the form $x^2 + bx + c$, including the difference of two squares

manipulate algebraic expressions by factorising quadratic expressions of the form $ax^2 + bx + c$

interpret the reverse process as the 'inverse function'

use the form $y = mx + c$ to identify perpendicular lines

plot and interpret graphs (including exponential graphs) and graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematic problems (distance, speed and acceleration)

Calculate or estimate of gradients and areas under graphs (including quadratic and other non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial contexts

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

deduce roots of quadratic functions algebraically (factorising)

identify and interpret roots, intercepts, turning points of quadratic functions graphically

solve quadratic equations algebraically by factorising

solve quadratic equations (including those that require rearrangement) algebraically by factorising

find approximate solutions to quadratic equations using a graph

Stage 10

solve two linear simultaneous equations in two variables algebraically

solve linear inequalities in two variables

represent the solution set to an inequality using set notation and on a graph

deduce expressions to calculate the n th term of quadratic sequences

recognise and use simple geometric progressions (r^n where n is an integer, and r is a rational number > 0)

find approximate solutions to equations numerically using iteration

Mathematics

make links to similarity (including trigonometric ratios) and scale factors

interpret equations that describe direct and inverse proportion

recognise and interpret graphs that illustrate direct and inverse proportion

interpret the gradient at a point on a curve as the instantaneous rate of change

set up, solve and interpret the answers in growth and decay problems, including compound interest

understand that X is inversely proportional to Y is equivalent to X is proportional to $1/Y$

identify, describe and construct similar shapes, including on coordinate axes, by considering enlargement (including fractional scale factors)

describe the changes and invariance achieved by combinations of rotations, reflections and translations

apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results

calculate surface area and volume of spheres, pyramids, cones and composite solids

apply the concepts of congruence and similarity, including the relationships between length, areas and volumes in similar figures

know the trigonometric ratios, $\sin\theta = \text{opposite}/\text{hypotenuse}$, $\cos\theta = \text{adjacent}/\text{hypotenuse}$, $\tan\theta = \text{opposite}/\text{adjacent}$

apply it to find angles and lengths in right-angled triangles in two dimensional figures

know the exact values of $\sin\theta$ and $\cos\theta$ for $\theta = 0^\circ, 30^\circ, 45^\circ, 60^\circ$ and 90° ; know the exact value of $\tan\theta$ for $\theta = 0^\circ, 30^\circ, 45^\circ$ and 60°

apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors

infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling

construct and interpret diagrams for grouped discrete data and continuous data, i.e. cumulative frequency graphs, and know their appropriate use

interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate graphical representation involving discrete, continuous and grouped data, including box plots

interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency including quartiles and inter-quartile range

calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables, tree diagrams and Venn diagrams.

