Year 5

Year 5 programme of study (statutory requirements)	Notes and guidance (non-statutory)
Number, place value, approximation and estimation Pupils should be taught to: ■ 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 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.	**Number, place value, approximation and estimation** Pupils should identify the place value in large whole numbers. They should continue to use number in context, including measurement. Pupils extend and apply their understanding of the number system to the decimal numbers and fractions that they have met so far. They should recognise and describe linear number sequences, including those involving fractions and decimals, and find the term-to-term rule.
Addition and subtraction Pupils should be taught to: ■ add and subtract whole numbers with more than 4 digits, including using efficient written methods (columnar addition and subtraction)	**Addition and subtraction** Pupils should practise using the efficient written methods of columnar addition and subtraction with increasingly large numbers to aid fluency. They should practise mental calculations with increasingly large

Year 5 programme of study (statutory requirements)	Notes and guidance (non-statutory)
■ 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.	numbers to aid fluency (e.g. 12 462 – 2 300 = 10 162).
Multiplication and division Pupils should be taught to: ■ identify multiples and factors, including finding all factor pairs ■ solve problems involving multiplication and division where larger numbers are used by decomposing them into their factors ■ 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 an efficient 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	**Multiplication and division** Pupils should practise and extend their use of the efficient written methods of short multiplication and short division. They apply all the multiplication tables and related division facts frequently, commit them to memory and use them confidently to make larger calculations. They should use and understand the terms factor, multiple and prime, square and cube numbers. Pupils should interpret non-integer answers to division by expressing results in different ways according to the context, including with remainders, as fractions, as decimals or by rounding (e.g. $98 \div 4 = 24 \text{ r } 2 = 24\frac{1}{2} = 24.5 \approx 25$). Pupils use multiplication and division as inverses to support the introduction of ratio in Year 6, for example, by multiplying and dividing by powers of 10 in scale drawings or by multiplying and dividing by powers of a 1000 in converting between units such as

Year 5 programme of study (statutory requirements)	Notes and guidance (non-statutory)
the efficient 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 1000 ■ recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3}) ■ 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.	kilometres and metres.
Fractions Pupils should be taught to: ■ compare and order fractions whose denominators are all multiples of the same number ■ recognise mixed numbers and improper fractions and convert from one form to the other ■ add and subtract fractions with the same denominator and related fractions; write mathematical statements >1 as a mixed number (e.g. $\frac{2}{5} + \frac{4}{5} = \frac{6}{5} = 1\frac{1}{5}$) ■ multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams.	**Fractions** Pupils should connect equivalent fractions >1 that simplify to integers with division and fractions >1 to division with remainders, using the number line and other models, and hence move from these to improper and mixed fractions. Pupils should connect multiplication by a fraction to using fractions as operators, and to division, building on work from previous years. This relates to scaling by simple fractions. They should extend their knowledge of fractions to thousandths and connect to decimals and measures. Pupils continue to develop their understanding of fractions as numbers, measures and

Year 5 programme of study (statutory requirements)	Notes and guidance (non-statutory)
	operators by finding fractions of numbers and quantities, writing remainders as a fraction.
	Pupils should practise adding and subtracting fractions to become fluent through a variety of increasingly complex problems. They should extend their understanding of adding and subtracting fractions to calculations that exceed 1 as a mixed number.
	Pupils should read and write proper fractions and mixed numbers accurately and continue to practise counting forwards and backwards with mixed fractions.
Decimals and fractions Pupils should be taught to: ■ read and write decimal numbers as fractions (e.g. 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.	**Decimals and fractions** Pupils extend counting from Year 4, using decimals and fractions including bridging zero, for example on a number line. They should add and subtract decimals including a mix of whole numbers and decimals, decimals with different numbers of decimal places, and complements of 1 (e.g. 0.83 + 0.17 = 1). They should mentally add and subtract tenths, and one-digit whole numbers and tenths. Pupils should say, read and write decimal fractions and related tenths, hundredths and thousandths accurately and be confident in checking the reasonableness of their answers to problems.

Year 5 programme of study (statutory requirements)	Notes and guidance (non-statutory)
	Pupils should go beyond the measurement and money models of decimals, for example by solving puzzles involving decimals.
Percentages, decimals and fractions Pupils should be taught to: ■ 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 hundred, and as a decimal fraction ■ solve problems which require knowing percentage and decimal equivalents of $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{4}{5}$ and those with a denominator of a multiple of 10 or 25.	**Percentages, decimals and fractions** Pupils should be taught throughout that percentages, decimals and fractions are different ways of expressing numbers. Pupils should make connections between percentages, fractions and decimals (e.g. 100% represents a whole quantity and 1% is 1/100, 50% is 50/100, 25% is 25/100) and relate this to finding 'fractions of'. They recognise that percentages are proportions of quantities as well as operators on quantities.
Measures Pupils should be taught to: ■ convert between different units of measure (e.g. kilometre and metre; metre and centimetre; centimetre and millimetre; kilogram and gram; litre and millilitre) ■ understand and use basic equivalences between metric and common imperial units and express them in approximate terms ■ measure and calculate the perimeter of composite rectilinear shapes in centimetres and metres	**Measures** Pupils should use their knowledge of place value and multiplication and division to convert between standard units. Pupils should calculate the perimeter of rectangles and related composite shapes, including using the relations of perimeter or area to find unknown lengths. Missing number questions such as these are the beginning of algebraic understanding. They should also calculate the area of scale drawings using given measurements. Pupils should use all four operations in problems involving time and

Year 5 programme of study (statutory requirements)	Notes and guidance (non-statutory)
- calculate and compare the area of squares and rectangles including using standard units, square centimetres (cm^2) and square metres (m^2) and estimate the area of irregular shapes - recognise and estimate volume (e.g. using 1 cm^3 blocks to build cubes and cuboids) and capacity (e.g. using water) - solve problems involving converting between units of time - solve problems involving addition and subtraction of units of measure (e.g. length, mass, volume, money) using decimal notation.	money, including conversions (e.g. days to weeks, leaving the answer as weeks and days).
Geometry: properties of shapes Pupils should be taught to: - identify 3-D shapes, including cubes and cuboids, from 2-D representations - know angles are measured in degrees; estimate and measure them and draw a given angle, writing its size in degrees (^{o}) - identify: - multiples of 90° - angles at a point on a straight line and $^1/_2$ a turn (total 180°) - angles at a point and one whole turn (total 360°) - reflex angles, and	**Geometry: properties of shapes** Pupils should become accurate in drawing lines with a ruler to the nearest millimetre, and measuring with a protractor. They use conventional markings for parallel lines and right angles. Pupils should use the term diagonal and make conjectures about the angles formed by diagonals and sides, and other properties of quadrilaterals, for example using dynamic geometry ICT tools. Pupils should use angle sum facts and other properties to make deductions about missing angles and relate these to missing number problems.

Year 5 programme of study (statutory requirements)	Notes and guidance (non-statutory)
■ compare different angles ■ draw shapes using given dimensions and angles ■ state and use the properties of a rectangle (including squares) to deduce related facts ■ distinguish between regular and irregular polygons based on reasoning about equal sides and angles.	
Geometry: position, direction, motion Pupils should be taught to: ■ 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.	**Geometry: position, direction, motion** Pupils should recognise and use reflection and translation in a variety of diagrams, including continuing to use a 2-D grid and coordinates in the first quadrant. Reflection should be in lines that are parallel to the axes.
Data Pupils should be taught to: ■ solve comparison, sum and difference problems using information presented in line graphs ■ complete, read and interpret information in tables, including timetables.	**Data** Pupils should connect their work on coordinates and scales to their interpretation of time graphs using ICT tools, except where data are easily calculable. They should begin to decide which representations of data are most appropriate and why.

Year 6

Year 6 programme of study (statutory requirements)	Notes and guidance (non-statutory)
Number, place value and rounding Pupils should be taught to: ■ 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.	**Number, place value and rounding** Pupils should use the whole number system, including saying, reading and writing numbers accurately.
Addition, subtraction, multiplication and division Pupils should be taught to: ■ multiply multi-digit numbers up to 4 digits by a two-digit whole number using the efficient written method of long multiplication ■ divide numbers up to 4 digits by a two-digit whole number using the efficient written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context ■ perform mental calculations, including with mixed operations and large numbers	**Addition, subtraction, multiplication and division** Pupils should practise addition, subtraction, multiplication and division for larger numbers, using the efficient written methods of columnar addition and subtraction, short and long multiplication, and short and long division. They should undertake mental calculations with increasingly large numbers and more complex calculations. Pupils should continue to use all the multiplication tables to calculate mathematical statements in order to maintain their fluency.

Year 6 programme of study (statutory requirements)	Notes and guidance (non-statutory)
■ 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, levels of accuracy.	Pupils should round answers to a specified degree of accuracy. Pupils explore the order of operations using brackets; for example, $2 + 1 \times 3 = 5$ and $(2 + 1) \times 3 = 9$. Common factors can be related to finding equivalent fractions.
Fractions Pupils should be taught to: ■ use common factors to simplify fractions; use common multiples to express fractions in the same denomination ■ compare and order fractions, including fractions >1 ■ associate a fraction with division to calculate decimal fraction equivalents (e.g. 0.375) for a simple fraction (e.g. $^3/_8$) ■ 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 (e.g. $^1/_4 \times ^1/_2 = ^1/_8$) ■ divide proper fractions by whole numbers (e.g. $^1/_3 \div 2 = ^1/_6$).	**Fractions** Pupils should use their understanding of the relationship between unit fractions and division to work backwards by multiplying a quantity that represents a unit fraction to find the whole quantity (e.g. if $^1/_4$ of a length is 36cm, then the whole length is $36 \times 4 = 144$cm). They should practise with simple fractions and decimal fraction equivalents to aid fluency, including listing equivalent fractions to identify fractions with common denominators. Denominators of given fractions should not exceed 12, with the exception of 100 and 1000. Pupils can explore and make conjectures about converting a

Year 6 programme of study (statutory requirements)	Notes and guidance (non-statutory)
	simple fraction to a decimal fraction (e.g. 3 ÷ 8 = 0.375). For simple fractions with recurring decimal equivalents, pupils should learn about rounding the decimal to three decimal places. Pupils should practise, use and understand the addition and subtraction of fractions with different denominators by identifying equivalent fractions with the same denominator. They should start with fractions where the denominator of one fraction is a multiple of the other (e.g. $\frac{1}{2} + \frac{1}{8} = \frac{5}{8}$) and progress to varied and increasingly complex problems. Pupils should use a variety of images to support their understanding of multiplication with fractions. This follows earlier work about fractions as operators, as numbers, and as equal parts of objects, for example as parts of a rectangle.
Decimals and fractions Pupils should be taught to: ■ identify the value of each digit to three decimal places and multiply and divide numbers by 10, 100 and 1000 where the answers are up to three decimal places ■ multiply one-digit numbers with up to two decimal places by whole numbers ■ use written division methods in cases where the answer has up to two decimal places	**Decimals and fractions** Pupils should begin to multiply and divide numbers with up to two decimal places by one-digit and two-digit whole numbers. Pupils multiply decimals by whole numbers, starting with the simplest cases, such as 0.4 × 2 = 0.8, and in practical contexts, such as measures and money. Pupils should also be introduced to the division of decimal numbers by one-digit whole numbers and, initially, in practical contexts involving measures and money. They should recognise division

Year 6 programme of study (statutory requirements)	Notes and guidance (non-statutory)
■ solve problems which require answers to be rounded to specified degrees of accuracy.	calculations as the inverse of multiplication. Pupils should also develop their skills of rounding and estimating as a means of predicting and checking the order of magnitude of their answers to decimal calculations. This includes rounding answers to a specified degree of accuracy and checking the reasonableness of their answers.
Percentages, decimals and fractions Pupils should be taught to: ■ solve problems involving the calculation of percentages of whole numbers or measures such as 15% of 360 and the use of percentages for comparison ■ recall and use equivalences between simple fractions, decimals and percentages, including in different contexts.	**Percentages, decimals and fractions** Pupils should understand that calculating a percentage of a quantity is the same as calculating a fraction of a quantity.
Ratio and proportion Pupils should be taught to: ■ solve problems involving the relative sizes of two quantities, including similarity ■ solve problems involving unequal sharing and grouping.	**Ratio and proportion** Pupils should consolidate their understanding of ratio when comparing quantities, sizes and scale drawings by solving a variety of problems. They may use the notation a:b to record their work. Pupils should recognise proportionality in contexts when the relations between quantities are in the same ratio (e.g. similar shapes, recipes).

Year 6 programme of study (statutory requirements)	Notes and guidance (non-statutory)
Algebra Pupils should be taught to: ■ express missing number problems algebraically ■ use simple formulae expressed in words ■ generate and describe linear number sequences ■ find pairs of numbers that satisfy number sentences involving two unknowns.	**Algebra** Pupils should be introduced to the use of symbols and letters to represent variables and unknowns in mathematical situations that they already understand, such as: ■ missing numbers, lengths, coordinates and angles ■ formulae in mathematics and science ■ arithmetical rules (e.g. a + b = b + a) ■ generalisations of number patterns ■ number puzzles (e.g. what two numbers can add up to).
Measures Pupils should be taught to: ■ solve problems involving the calculation and conversion of units of measure, using decimal notation 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 to three decimal places ■ convert between miles and kilometres ■ recognise that shapes with the same areas can have different perimeters and vice versa	**Measures** Using the number line, pupils should use, add and subtract positive and negative integers for measures such as temperature. They should know approximate conversions and be able to tell if an answer is sensible. They should relate the area of rectangles to parallelograms and triangles, and be able to calculate their areas, understanding and using the formula to do this. Pupils could be introduced to other compound units for speed, such as miles per hour, and apply their knowledge in science or other subjects as appropriate.

Year 6 programme of study (statutory requirements)	Notes and guidance (non-statutory)
■ calculate the area of parallelograms and triangles ■ recognise when it is necessary to use the formulae for area and volume of shapes ■ calculate, estimate and compare volume of cubes and cuboids using standard units, including centimetre cubed (cm^3) and cubic metres (m^3) and extending to other units, such as mm^3 and km^3.	
Geometry: properties of shapes Pupils should be taught to: ■ 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 circles, including radius, diameter and circumference ■ find unknown angles where they meet at a point, are on a straight line, and are vertically opposite.	**Geometry: properties of shapes** Pupils should draw shapes and nets accurately, using measuring tools and conventional markings and labels for lines and angles. Pupils should describe the properties of shapes and explain how unknown angles and lengths can be derived from known measurements.

Year 6 programme of study (statutory requirements)	Notes and guidance (non-statutory)
Geometry: position, direction, motion Pupils should be taught to: ■ 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.	**Geometry: position, direction, motion** Pupils should draw and label a pair of axes in all four quadrants with equal scaling. This extends their knowledge of one quadrant to all four quadrants, including the use of negative numbers. Pupils should draw and label rectangles (including squares), parallelograms and rhombuses, specified by coordinates in the four quadrants, predicting missing coordinates using the properties of shapes.
Data Pupils should be taught to: ■ interpret and construct pie charts and line graphs and use these to solve problems ■ calculate and interpret the mean as an average.	**Data** Pupils should connect their work on angles, fractions and percentages to the interpretation of pie charts. Pupils should both encounter and draw graphs relating two variables, arising from their own enquiry and in other subjects. They should connect conversion from kilometres to miles in measure to its graphical representation. Pupils should know when it is appropriate to find the mean of a data set.