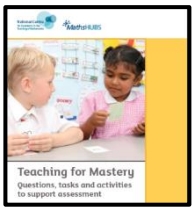


NCETM Teaching for Mastery Booklets

Programme of study

This section lists a ***selection*** of ***key National Curriculum programme of study statements***.

The Big Ideas

The big ideas are a ***selection*** of ***key ideas*** relevant to the ***selected programme of study statements.***

Year 1

Number and Place Value

Programme of Study

- count to and across 100, forwards and backwards, beginning with 0 or one, 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

Big Ideas

- The position a digit is placed in a number determines its value.
- The language used to name numbers does not always expose the place value, for example the word 'twelve' does not make it transparent that the value of this number is ten and two. It is important that children develop secure understanding of the value of each digit.
- Place value is based on unitising: treating a group of things as one 'unit'. In mathematics, units can be any size, for example units of 1, 2, 5 and 10 are used in money. In place value units of 1, 10 and 100 are used.

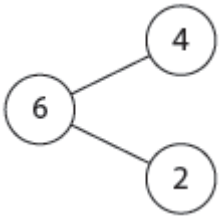
Addition and Subtraction

Programme of study

- represent and use number bonds and related subtraction facts within 20
- add and subtract 1-digit and 2-digit numbers to 20, including 0

Big Ideas

- Relating numbers to 5 and 10 helps develop knowledge of the number bonds within 20. For example, given 8 + 7, thinking of 7 as 2 + 5 and adding the 2 to 8 to make 10 and then the 5 to total 15.
- Thinking of part whole relationships is helpful in linking addition and subtraction. For example, where the whole is 6, and 4 and 2 are parts. This means that 4 and 2 together form the whole, which is 6 and 6 subtract 4 leaves the 2 and 6 subtract 2 leaves the 4.



Multiplication and Division

Programme of study

- solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher

Big Ideas

- Counting in steps of equal sizes is based on the big idea of 'unitising'; treating a group of, say, five objects as one unit of five.
- Working with arrays helps pupils to become aware of the commutative property of multiplication, that 2 × 5 is equivalent to 5 × 2.
-

Fractions

Programme of study

- recognise, find and name a half as one of two equal parts of an object, shape or quantity
- recognise, find and name a quarter as one of four equal parts of an object, shape or quantity

Big Ideas

- Fractions express a relationship between a whole and equal parts of the whole. Ensure children express this relationship when talking about fractions. For example, *'If the circle* (where the circle is divided into four equal parts with one part shaded) *is the whole, one part is one quarter of the whole circle.'*
- Halving involves partitioning an object, shape or quantity into two equal parts.
- The two parts need to be equivalent in, for example, area, mass or quantity.

Measurement

Programme of study

- compare, describe and solve practical problems for measurement and begin to record the following:
    - 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]
- tell the time to the hour and half past the hour and draw the hands on a clock face to show these times

Big Ideas

- Measurement is about comparison, for example measuring to find out which rope is the longest.
- Measurement is about equivalence, for example how many cubes are equivalent to the length of the table or the mass of the teddy?

- Standard units can initially be introduced through using a unit that is greater than the things being compared, for example comparing the capacity of a cup and a carton by filling each and pouring into matching bottles to compare the two.
- Measuring is a practical activity and all learning should be conducted in practical contexts, using real materials.

Geometry

Programme of study

- recognise and name common 2-D and 3-D shapes, including:
    - 2-D shapes [for example, rectangles (including squares), circles and triangles]
    - 3-D shapes [for example, cuboids (including cubes), pyramids and spheres]
- Describe position, direction and movement, including whole, half, quarter and three-quarter turns

Big Ideas

- It is important for children to be familiar with a range of 2-D and 3-D shapes and not just recognise them in specific orientations, e.g. thinking that this  is a triangle but this  or this  are not.
- It is preferable to introduce 3-D shapes before 2-D shapes, since 2-D shapes only exist in the real world as faces of 3-D shapes.
- An emphasis should be placed upon identifying and describing the properties of shapes. It is important that pupils develop the correct mathematical language to do so.
- The development of precise language to describe position and movement is important.

Year 2

Number and place value

Programme of study

- compare and order numbers from 0 up to 100
- use place value and number facts to solve problems
- use +, - and = signs correctly
- count in steps of two, three, and five from 0, and in tens from any number, forward and backward

Big Ideas

- The position (place) of a digit in a number determines its value. Hence the term *place value.*

Addition and subtraction

Programme of study

- solve problems with addition and subtraction:
    - using concrete objects and pictorial representations, including those involving numbers, quantities and measures
    - applying an 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 numbers using concrete objects, pictorial representations, and mentally, including:
    - a 2-digit number and ones
    - a 2-digit number and tens
    - two 2-digit numbers
    - adding three 1-digit numbers
- show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot

Big Ideas

- Understanding that addition of two or more numbers can be done in any order is important to support children's fluency. When adding two numbers it can be more efficient to put the larger number first. For example, given 3 + 8 it is easier to calculate 8 + 3.
- When adding three or more numbers it is helpful to look for pairs of numbers that are easy to add. For example, given 5 + 8 + 2 it is easier to add 8 + 2 first than to begin with 5 + 8.
- Understanding the importance of the equals sign meaning 'equivalent to' (i.e. that 6 + 4 = 10, 10 = 6 + 4 and 5 + 5 = 6 + 4 are all valid uses of the equals sign) is crucial for later work in algebra. Empty box problems can support the development of this key idea. Correct use of the equals sign should be reinforced at all times. Altering where the equals sign is placed develops fluency and flexibility.

Multiplication and division

Programme of study

- 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 (×), division (÷) 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

Big Ideas

- It is important that pupils both commit multiplication facts to memory and also develop an understanding of conceptual relationships. This will aid them in using known facts to work out unknown facts and in solving problems.
- Pupils should look for and recognise patterns within tables and connections between them (e.g. 5× is half of 10×).
- Pupils should recognise multiplication and division as inverse operations and use this knowledge to solve problems. They should also recognise division as both grouping and sharing.
- The recognition of pattern in multiplication helps pupils commit facts to memory, for example doubling twice is the same as multiplying by four, or halving a multiple of ten gives you the related multiple of five.

Fractions

Programme of study

- recognise, find, name and write fractions 1/ 3, 1/ 4, 2/ 4 and 3 4 of a length, shape, set of objects or quantity
- write simple fractions, for example 1 /2 of 6 = 3 and recognise the equivalence of 2/ 4 and 1

Big Ideas

- Fractions involve a relationship between a whole and parts of a whole. Ensure children express this relationship when talking about fractions. For example, *'If the bag of 12 sweets is the whole, then 4 sweets are one third of the whole.'*
- Partitioning or 'fair share' problems when each share is less than one gives rise to fractions.
- Measuring where the unit is longer than the item being measured gives rise to fractions.

Measurement

Programme of study

- choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm); mass (kg/g); temperature (°C); capacity (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels

- solve simple problems in a practical context involving addition and subtraction of money of the same unit, including giving change

Big Ideas

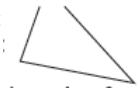
- We need standard units of measure in order to compare things more accurately and consistently.

Geometry

Programme of study

- 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
- order and arrange combinations of mathematical objects in patterns and sequences

Big Ideas

- It is not uncommon for pupils to say that this is a square  and this  is not, or that something like this  is a triangle.
- It is important for pupils to know what the properties are that make up certain shapes, and for them not to just learn the names of typical proto looking shapes.
- It is helpful to think about non-examples of shapes. For example, why this is not a triangle: 
- Recognising pattern and generalising structures and relationships are key elements for laying the foundations for later work in algebra.

Statistics

Programme of study

- 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

Big Ideas

- Data need to be collected with a question or purpose in mind.
- Tally charts are used to collect data over time (cars passing the school, birds on the bird table).

Year 3

Number and place value

Programme of study

- count from 0 in multiples of 4, 8, 50 and 100
- work out if a given number is greater or less than 10 or 100
- recognise the place value of each digit in a 3-digit number (hundreds, tens, and ones)
- solve number problems and practical problems involving these ideas

Big Ideas

- The value of a digit is determined by its position in a number.
- Place value is based on unitising, treating a group of things as one 'unit'. This generalises to 3 units + 2 units = 5 units (where the units are the same size).

Addition and subtraction

Programme of study

- add and subtract numbers mentally, including:
    - a 3-digit number and ones
    - a 3-digit number and tens
    - a 3-digit number and hundreds
- add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction

Big Ideas

- Relating numbers to 5 and 10 helps develop knowledge of the number bonds within 20. For example, given 8 + 7, thinking of 7 as 2 + 5, and adding the 2 and 8 to make 10, then the 5 to 15. This should then be applied when calculating with larger numbers.
- Subtraction bonds can be thought of in terms of addition: for example, in answering 15 – 8, thinking what needs to be added to 8 to make 15. Counting on for subtraction is a useful strategy that can also be applied to larger numbers.

Multiplication and division

Programme of study

- 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 2-digit numbers times 1-digit numbers, using mental and progressing to formal written methods
- solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which *n* objects are connected to *m* objects

Big Ideas

- It is important for children not just to be able to chant their multiplication tables but also to understand what the facts in them mean, to be able to use these facts to figure out others and to use in problems. It is also important for children to be able to link facts within the tables (e.g. 5× is half of 10×).

- They understand what multiplication means, see division as both grouping and sharing, and see division as the inverse of multiplication.

Fractions

Programme of study

- count up and down in tenths; recognise that tenths arise from dividing an object into ten equal parts and in dividing 1-digit numbers or quantities by ten
- recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators
- 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 fraction*-s, and fractions with the same denominators
- solve problems that involve all of the above

Big Ideas

- Fractions are equal parts of a whole.
- Equal parts of shapes do not need to be congruent but need to be equal in area.
- Decimal fractions are linked to other fractions.
- The number line is a useful representation that helps children to think about fractions as numbers.

Measurement

Programme of study

- measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)
- 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, and 12 and 24-hour clock

Big Ideas

- Developing benchmarks to support estimation skills is important as pupils become confident in their use of standard measures. The height of a door frame, for example, is approximately 2 metres, and a bag of sugar weighs approximately 1 kilogram.

Geometry

Programme of study

- 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

Big Ideas

- During this year there is an increasing range of shapes that pupils are familiar with. The introduction of symmetrical and non-symmetrical polygons and the requirement that pupils should be able to draw them will give rise to discussions about lengths of sides and sizes of angles. Pupils need to appreciate these features as properties of shapes as well as the number of sides and vertices.
- Pupils recognise that angles are about the amount of turn – the lengths of the lines used to represent angles do not affect the size of the angle.
- Pupils recognise that relationships are at the heart of properties of shapes, not particular measurements. For example, the opposite sides of any rectangle will always be equal, not that rectangles have a pair of long sides and a pair of short sides.

Statistics

Programme of study

- 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

Big Ideas

- Data needs to be collected with a question or purpose in mind.
- Tally charts are used to collect data over time (cars passing the school, birds on the bird table). They can also be used to keep track of counting.

Year 4

Number and Place value

Programme of study

- count in multiples of 6, 7, 9, 25 and 1000
- order and compare numbers beyond 1000
- count backwards through 0 to include negative numbers
- round any number to the nearest 10, 100 or 1000

Big Ideas

- Imagining the position of numbers on a horizontal number line helps us to order them: the number to the right on a number line is the larger number. So 5 is greater than 4, as 5 is to the right of 4. But –4 is greater than –5 as –4 is to the right of –5.
- Rounding numbers in context may mean rounding up or down. Buying packets of ten cakes, we might round up to the nearest ten to make sure everyone gets a cake.
- Estimating the number of chairs in a room for a large number of people we might round down to estimate the number of chairs to make sure there are enough.
- We can think of place value in additive terms: 456 is 400 + 50 + 6, or in multiplicative terms: one hundred is ten times as large as ten.

Addition and subtraction

Programme of study

- add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate
- solve addition and subtraction two-step problems in context, deciding which operations and methods to use and why

Big Ideas

- It helps to round numbers before carrying out a calculation to get a sense of the size of the answer. For example, 4786 – 2135 is close to 5000 – 2000, so the answer will be around 3000. Looking at the numbers in a calculation and their relationship to each other can help make calculating easier. For example, 3012 – 2996. Noticing that the numbers are close to each other might mean this is more easily calculated by thinking about subtraction as difference.

Multiplication and division

Programme of study

- 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 2-digit and 3-digit numbers by a 1-digit number using formal written layout
- solve problems involving multiplying and adding, including using the distributive law to multiply 2-digit numbers by 1-digit, integer scaling problems and harder correspondence problems such as *n* objects are connected to *m* objects

Big Ideas

- It is important for children not just to be able to chant their multiplication tables but to understand what the facts in them mean, to be able to use these facts to figure out others and to use them in problems.
- It is also important for children to be able to link facts within the tables (e.g. 5× is half of 10×).
- They understand what multiplication means and see division as both grouping and sharing, and to see division as the inverse of multiplication.
- The distributive law can be used to partition numbers in different ways to create equivalent calculations. For example, $4 \times 27 = 4 \times (25 + 2) = (4 \times 25) + (4 \times 2) = 108$.
- Looking for equivalent calculations can make calculating easier. For example, 98×5 is equivalent to $98 \times 10 \div 2$ or to $(100 \times 5) - (2 \times 5)$. The array model can help show equivalences.

Fractions

Programme of study

- recognise and show, using diagrams, families of common equivalent fractions
- 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
- add and subtract fractions with the same denominator
- recognise and write decimal equivalents of any number of tenths or hundredths
- recognise and write decimal equivalents to 1/4, 1/2, 3/4
- 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

Big Ideas

- Fractions arise from solving problems, where the answer lies between two whole numbers.
- Fractions express a relationship between a whole and equal parts of a whole. Children should recognise this and speak in full sentences when answering a question involving fractions. For example, in response to the question *What fraction of the chocolate bar is shaded?* the pupil might say *Two sevenths of the whole chocolate bar is shaded.*
- Equivalency in relation to fractions is important. Fractions that look very different in their symbolic notation can mean the same thing.

Measurement

Programme of study

- 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

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

Big Ideas

- The smaller the unit, the greater the number of units needed to measure (that is, there is an inverse relationship between size of unit and measure).

Geometry

Programme of study

- 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

Big Ideas

- During this year, pupils increase the range of 2-D and 3-D shapes that they are familiar with. They know the correct names for these shapes, but, more importantly, they are able to say why certain shapes are what they are by referring to their properties, including lengths of sides, size of angles and number of lines of symmetry.
- The naming of shapes sometimes focuses on angle properties (e.g. a rectangle is right-angled), and sometimes on properties of sides (e.g. an equilateral triangle is an equal sided triangle).
- Shapes can belong to more than one classification. For example, a square is a rectangle, a parallelogram, a rhombus and a quadrilateral.

Statistics

Programme of study

- 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

Big Ideas

- In mathematics the focus is on numerical data. These can be discrete or continuous. Discrete data are counted and have fixed values, for example the number of children who chose red as their favourite colour (this has to be a whole number and cannot be anything in between). Continuous data are measured, for example at what time did each child finish the race? (Theoretically this could be any time: 67·3 seconds, 67·33 seconds or 67·333 seconds, depending on the degree of accuracy that is applied.) Continuous data are best represented with a line graph where every point on the line has a potential value.

Year 5

Number and place value

Programme of study

- read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit
- interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers including through zero

Big Ideas

- Large numbers of six digits are named in a pattern of three: hundreds of thousands, tens of thousands, ones of thousands, mirroring hundreds, tens and ones.
- It is helpful to relate large numbers to real-world contexts, for example the number of people that a local sports arena can hold.

Addition and subtraction

Programme of study

- add and subtract whole numbers with more than four digits, including using formal written methods (columnar addition and subtraction)
- add and subtract numbers mentally with increasingly large numbers (e.g. 12 462 – 2300 = 10 162)
- solve problems involving numbers up to three decimal places *(Taken from Y5 Fractions, Decimals and Percentages)*

Big Ideas

- Before starting any calculation is it helpful to think about whether or not you are confident that you can do it mentally. For example, 3689 + 4998 may be done mentally, but 3689 + 4756 may require paper and pencil.
- Carrying out an equivalent calculation might be easier than carrying out the given calculation. For example; 3682 – 2996 is equivalent to 3686 – 3000 (constant difference).

Multiplication and division

Programme of study

- identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers
- multiply numbers up to four digits by a 1 or 2-digit number using a formal written method, including long multiplication for 2-digit numbers
- multiply and divide numbers mentally drawing upon known facts
- divide numbers up to four digits by a 1-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 1000
- 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

Big Ideas

- Pupils have a firm understanding of what multiplication and division mean and have a range of strategies for dealing with large numbers, including both mental and standard written methods. They see the idea of factors, multiples and prime numbers as connected and not separate ideas to learn.
- They recognise how to use their skills of multiplying and dividing in new problem solving situations.
- Fractions and division are connected ideas: 36 ÷ 18 = 31/68 = 2; 18/36 = ½
- Factors and multiples are connected ideas: 48 is a multiple of 6 and 6 is a factor of 48.

Fractions

Programme of study

- identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths
- recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements G 1 as a mixed number (for example, 2/ 5 + 4/ 5 = 6/ 5 = 1 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
- 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 1/ 2, 1/ 4, 1/ 5, 2/ 5, 4/ 5 and those fractions with a denominator of a multiple of 10 or 25

Big Ideas

- Representations that may appear different sometimes have similar underlying ideas. For example; 1/ 4, 0·25 and 25% are used in different contexts but are all connected to the same idea.

Measurement

Programme of study

- convert between different units of metric measure (for example, kilometre and metre; centimetre and metre; centimetre and millimetre; gram and kilogram; litre and millilitre)
- 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

Big Ideas

- The relationship between area and perimeter is not a simple one. Increasing or decreasing area does not necessarily mean the perimeter increases or decreases respectively, or vice versa.
- Area is measured in square units. For rectangles, measuring the length and breadth is a shortcut to finding out how many squares would fit into each of these dimensions.

Geometry

Programme of study

- 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 (o)
- identify:
    - angles at a point and one whole turn (total 360 o)
    - angles at a point on a straight line and 1/ 2 a turn (total 180 o)
    - other multiples of 90 o
- 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

Big Ideas

- During this year, pupils increase the range of 2-D and 3-D shapes that they are familiar with. With 3-D shapes they think about the faces as well as the number of vertices and through considering nets think about the 2-D shapes that define the 3-D shapes.
- Pupils learn about a range of angle facts and use them to describe certain shapes and derive facts about them.
- Regular shapes have to have all sides and all angles the same. Although non-square rectangles have four equal angles, the fact that they do not have four equal sides means that they are not regular.
- Some properties of shapes are dependent upon other properties. For example, a rectangle has opposite sides equal because it has four right angles. A rectangle is defined as a quadrilateral with four right angles. It does not have to be defined as a quadrilateral with four right angles and two pairs of equal sides.

Statistics

Programme of study

- solve comparison, sum and difference problems using information presented in a line graph
- complete, read and interpret information in tables, including timetables

Big Ideas

- Different representations highlight different aspects of data.
- It is important to be able to answer questions about data using inference and deduction, not just direct retrieval

Year 6

Number and place value

Programme of study

- 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 0
- solve number and practical problems that involve all of the above

Big Ideas

- For whole numbers, the more digits a number has, the larger it must be: any 4-digit whole number is larger than any 3-digit whole number. But this is not true of decimal numbers: having more digits does not make a decimal number necessarily bigger. For example, 0·5 is larger than 0·35.
- Ordering decimal numbers uses the same process as for whole numbers ie we look at the digits in matching places in the numbers, starting from the place with the highest value ie from the left. The number with the higher different digit is the higher number. For example, 256 is greater than 247 because 256 has 5 tens but 247 has only 4 tens. Similarly, 1·0843 is smaller than 1·524 because 1·0843 has 0 tenths but 1·524 has 5 tenths.

Addition and subtraction

Programme of study

- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why
- use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy

Big Ideas

- Deciding which calculation method to use is supported by being able to take apart and combine numbers in many ways. For example, calculating 8·78 + 5·26 might involve calculating 8·75 + 5·25 and then adjusting the answer.
- The associative rule helps when adding three or more numbers: 367 + 275 + 525 is probably best thought of as 367 + (275 + 525) rather than (367 + 275) + 525.

Multiplication and division

Programme of study

- multiply multi-digit numbers up to four digits by a 2-digit whole number using the formal written method of long multiplication
- divide numbers up to four digits by a 2-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 four digits by a 2-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context

- use their knowledge of the order of operations to carry out calculations involving the four operations
- solve problems involving addition, subtraction, multiplication and division
- multiply 1-digit numbers with up to two decimal places by whole numbers *(taken from Fractions including Decimals and Percentages)*

Big Ideas

- Standard written algorithms use the conceptual structures of the mathematics to produce efficient methods of calculation.
- Standard written multiplication method involves a number of partial products. For example, 36 × 24 is made up of four partial products 30 × 20, 30 × 4, 6 × 20, 6 × 4.
- There are connections between factors, multiples and prime numbers and between fractions, division and ratios.

Fractions and decimals

Programme of study

- use factors to simplify fractions; use common multiples to express fractions in the same denominator
- compare and order fractions, including fractions G 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, 1/ 4 × 1/ 2 = 1/ 8]
- divide proper fractions by whole numbers [for example, 1/ 3 ÷ 2 = 1/ 6]
- multiply 1-digit numbers with up to two decimal places by whole numbers and use equivalences between simple fractions, decimals and percentages, including in different contexts

Big Ideas

- Fractions express a relationship between a whole and equal parts of a whole. Pupils should recognise this and speak in full sentences when answering a question involving fractions. For example, in response to the question 'What fraction of the journey has Tom travelled?' the pupil might respond, 'Tom has travelled two thirds of the whole journey.'
- Equivalent fractions are connected to the idea of ratio: keeping the numerator and denominator of a fraction in the same proportion creates an equivalent fraction.
- Putting fractions in place on the number lines helps understand fractions as numbers in their own right.

Ratio and proportion

Programme of study

- 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 the use of 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

Big Ideas

- It is important to distinguish between situations with an additive change or a multiplicative change (which involves ratio). For example, if four children have six sandwiches to share and two more children join them, although two more children have been added, the number of sandwiches then needed for everyone to still get the same amount is calculated multiplicatively.

Algebra

Programme of study

- generate and describe linear number sequences
- express missing number problems algebraically
- find pairs of numbers that satisfy an equation with two unknowns

Big Ideas

- A linear sequence of numbers is where the difference between the values of neighbouring terms is constant. The relationship can be generated in two ways: the sequence-generating rule can be **recursive**, i.e. one number in the sequence is generated from the preceding number (e.g. by adding 3 to the preceding number), or **ordinal**, i.e. the position of the number in the sequence generates the number (e.g. by multiplying the position by 3, and then subtracting 2).
- Sometimes sequence generating rules that seem different can generate the same sequence: the ordinal rule 'one more than each of the even numbers, starting with 2' generates the same sequence as the recursive rule 'start at 1 and add on 2, then another 2, then another 2, and so on'.
- Sequences can arise from naturally occurring patterns in mathematics and it is exciting for pupils to discover and generalise these. For example; adding successive odd numbers will generate a sequence of square numbers.
- Letters or symbols are used to represent unknown numbers in a symbol sentence (i.e. an equation) or instruction. Usually, but not necessarily, in any one symbol sentence (equation) or instruction, different letters or different symbols represent different unknown numbers.
- A value is said to **solve** a symbol sentence (or an equation) if substituting the value into the sentence (equation) **satisfies** it, i.e. results in a **true statement**. For example, we can say that 4 **solves** the symbol

  sentence (equation) $9 - \triangle = \triangle + 1$ (or $9 - x = x + 1$) because it is a **true statement** that $9 - 4 = 4 + 1$. We say that 4 **satisfies** the symbol sentence (equation) $9 - \triangle = \triangle + 1$ (or $9 - x = x + 1$).

Measurement

Programme of study

- 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 to up to three decimal places
- recognise that shapes with the same areas can have different perimeters and vice versa
- calculate the area of parallelograms and triangles

Big Ideas

- To read a scale, first work out how much each mark or division on the scale represents.
- The unit of measure must be identified before measuring. Selecting a unit will depend on the size and nature of the item to be measured and the degree of accuracy required.

Geometry

Programme of study

- 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 circles, 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

Big Ideas

- Variance and invariance are important ideas in mathematics, particularly in geometry. A set of quadrilaterals for example may vary in many ways in terms of area, length of sides and the size of individual angles. However, there are a set of invariant properties which remain common to all quadrilaterals, namely they have four sides and their internal angles sum to 360o. Some of these properties emerge from naturally occurring constraints, for example the sum of the internal angles will always sum to 360o, they can do nothing else! The questions 'What's the same?' and 'What's different?' can draw pupils' attention to variance and invariance.
- Shapes can be alike in essentially two different ways: congruent and similar. Congruent shapes are alike in all ways: they could occupy exactly the same space. Similar shapes share identical geometrical properties but can differ in size. All equilateral triangles are similar, but only identically sized ones are congruent. Not all isosceles triangles are similar.
- Angle properties are a mix of necessary conditions and conventions. It is a necessary condition that angles on a straight line combine to a complete half turn. That we measure the half turn as 180o is conventional.

Statistics

Programme of study

- interpret and construct pie charts and line graphs and use these to solve problems
- calculate and interpret the mean as an average

Big Ideas

- Pie charts visually display relative proportions, for example, that the proportion of pupils at School A liking reading is greater than the proportion at School B.