

### Number and Place Value

- Children should practise counting (1, 2, 3), ordering (first, second, third), or to indicate a quantity (3 apples, 2 centimetres), including solving simple concrete problems, until they are fluent.
- They should begin to recognise place value in numbers beyond 20 by reading, writing, counting and comparing numbers up to 100, supported by concrete objects and pictorial representations.
- They should practise counting as reciting numbers and counting as enumerating objects, and counting in ones, twos, fives and tens from different multiples to develop their recognition of patterns in the number system (odd and even numbers). They connect these patterns with objects and with shapes, including through varied and frequent practice of increasingly complex questions.
- They recognise and create repeating patterns with objects and with shapes.

### Addition and Subtraction

- Children should memorise and reason with number bonds to 10 and 20 in several forms ( $9 + 7 = 16$ ;  $16 - 7 = 9$ ;  $7 = 16 - 9$ ). They should realise the effect of adding or subtracting zero. This establishes addition and subtraction as related operations.
- Children should combine and increase numbers, counting forwards and backwards.
- They should discuss and solve problems in familiar practical contexts, including using quantities. Problems should include the terms put together, add, altogether, total, take away, distance between, more than and less than, so that pupils develop the concept of addition and subtraction and are enabled to use these operations flexibly.

### Multiplication and Division

- Through grouping and sharing small quantities, children should begin to understand: multiplication and division; doubling numbers and quantities; and finding simple fractions of objects, numbers and quantities.
- They should make connections between arrays, number patterns, and counting in twos, fives and tens.

### Fractions

- Children should be taught half and quarter as 'fractions of' discrete and continuous quantities by solving problems using shapes, objects and quantities. For example, they could recognise and find half a length, quantity, set of objects or shape. Children connect halves and quarters to the equal sharing and grouping of sets of objects and to measures, as well as recognising and combining halves and quarters as parts of a whole.

### Measurements

- The pairs of terms mass and weight, volume and capacity, are used interchangeably at this stage.
- Children should move from using and comparing different types of quantities and measures using non-standard units, including discrete (e.g. counting) and

continuous (e.g. liquid) measures, to using manageable common standard units.

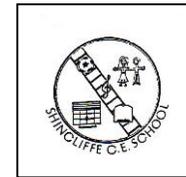
- In order to become familiar with standard measures, children begin to use measuring tools such as a ruler, weighing scales and containers.
- Children should use the language of time, including telling the time throughout the day, first using o'clock and then half past.

### **Geometry: position and direction**

- Children should use the language of position, direction and motion, including: left and right, top, middle and bottom, on top of, in front of, above, between, around, near, close and far, up and down, forwards and backwards, inside and outside.
- Children should make half, quarter and three- quarter turns and routinely make these turns in a clockwise direction.

### **Geometry: properties of shape**

- Children should handle common 2D and 3D shapes, naming these and related everyday objects fluently. They should recognise these shapes in different orientations and sizes, and know that rectangles, triangles, cuboids and pyramids can be different shapes.



### Number and Place Value

- Using materials and a range of representations, children should practise counting, reading, writing and comparing numbers to at least 100 and solving a variety of related problems to develop fluency. They should count in multiples of three to support their later understanding of a third.
- As they become more confident with numbers up to 100, children should be introduced to larger numbers to develop further their recognition of patterns within the number system and represent them in different ways, including spatial representations.
- Children should partition numbers in different ways to support subtraction. They become fluent and apply their knowledge of numbers to reason with, discuss and solve problems that emphasise the value of each digit in two-digit numbers. They begin to understand zero as a place holder.

### Addition and Subtraction

- Children should extend their understanding of the language of addition and subtraction to include sum and difference.
- Children should practise addition and subtraction to 20 to become increasingly fluent in deriving facts such as using  $3 + 7 = 10$ ,  $10 - 7 = 3$  and  $7 = 10 - 3$  to calculate  $30 + 70 = 100$ ,  $100 - 70 = 30$  and  $70 = 100 - 30$ . They should check their calculations, including by adding to check subtraction and adding numbers in a different order to check addition ( $5 + 2 + 1 = 1 + 5 + 2 = 1 + 2 + 5$ ). This establishes commutativity and associativity of addition.
- Recording addition and subtraction in columns supports place value and prepares for formal written methods with larger numbers.

### Multiplication and Division

- Children should use a variety of language to describe multiplication and division.
- Children should be introduced to the multiplication tables. They practise to become fluent in the 2, 5 and 10 multiplication tables and connect them to each other. They connect the 10 multiplication table to place value, and the 5 multiplication table to the divisions on the clock face. They begin to use other multiplication tables and recall multiplication facts, including using related division facts to perform written and mental calculations.
- Children should work with a range of materials and contexts in which multiplication and division relate to grouping and sharing discrete and continuous quantities, relating these to fractions and measures (e.g.  $40 \div 2 = 20$ , 20 is a half of 40). They use commutativity and inverse relations to develop multiplicative reasoning (e.g.  $4 \times 5 = 20$  and  $20 \div 5 = 4$ ).

### Fractions

- Children should use additional fractions as 'fractions of' discrete and continuous quantities by solving problems using shapes, objects and quantities. They connect unit fractions to equal sharing and grouping, to numbers when they can be calculated, and to measures, finding fractions of lengths, quantity, a set of objects or shapes. They meet  $\frac{3}{4}$  as the first example of a non-unit fraction.
- Children should count in fractions up to 10, starting from any number and using the  $\frac{1}{2}$  and  $\frac{2}{4}$  equivalence on the number line ( $\frac{11}{4}$ ,  $\frac{12}{4}$ , (or  $\frac{11}{2}$ ),  $\frac{13}{4}$ , 2). This reinforces the concept of fractions as numbers and that they can add up to more than one.

## **Measurement**

- Children should use standard units of measurement with increasing accuracy, using their knowledge of the number system. They should use the appropriate language and record using standard abbreviations.
- They should become fluent in telling the time on analogue clocks and recording it.
- Children should also become fluent in counting and recognising coins. They should read and say amounts of money confidently and use the symbols £ and p accurately, recording pounds and pence separately.

## **Geometry: position and direction**

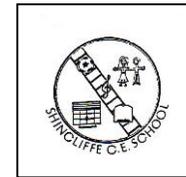
- Children should work with patterns of shapes, including those in different orientations.
- Children should use the concept and language of angles to describe *turn* by applying rotations, including in practical contexts (e.g. children themselves moving in turns, giving instructions to other children to do so, and programming robots using instructions given in right angles).

## **Geometry: properties of shape**

- Children should handle and name a wider variety of common 2D and 3D shapes and identify the properties of each shape. Children identify, compare and sort shapes on the basis of their properties and use vocabulary precisely, such as sides, edges, vertices and faces.
- Children should read and write names for shapes that are appropriate for their word reading and spelling.
- Children should draw lines and shapes using a straight edge.

## **Statistics**

- Children should record, interpret, collate, organise and compare information (e.g. using many-to-one correspondence with simple ratios 2, 5, 10).



### Number and Place Value

- Children should now be using multiples of 2, 3, 4, 5, 8, 50 and 100.
- Children should use larger numbers to at least 1000, applying partitioning related to place value using varied and increasingly complex problems, building on work in Year 2 (e.g.  $146 = 100$  and  $40$  and  $6$ ,  $46 = 30$  and  $16$ ).
- Using a variety of representations, including those related to measure, children should continue to count in ones, tens and hundreds, so that they become fluent in the order and place value of numbers to 1000.

### Addition and Subtraction

- Children should practise solving varied addition and subtraction questions. For mental calculations with two-digit numbers, the answers could exceed 100.
- Children should use their understanding of place value and partitioning, and practise using columnar addition and subtraction with increasingly large numbers up to three digits to become fluent (see National Curriculum Appendix 1).

### Multiplication and Division

- Children should continue to practise their mental recall of multiplication tables when they are calculating mathematical statements in order to improve fluency. Through doubling, they connect the 2, 4 and 8 multiplication tables.
- Children should develop efficient mental methods, for example, using commutativity (e.g.  $4 \times 12 \times 5 = 4 \times 5 \times 12 = 20 \times 12 = 240$ ) and multiplication and division facts (e.g. using  $3 \times 2 = 6$ ,  $6 \div 3 = 2$  and  $2 = 6 \div 3$ ) to derive related facts ( $30 \times 2 = 60$ ,  $60 \div 3 = 20$  and  $20 = 60 \div 3$ ).
- Children should develop reliable written methods for multiplication and division, starting with calculations of two-digit numbers by one-digit numbers and progressing to the formal written methods of short multiplication and division.
- Children should solve simple problems in contexts, deciding which of the four operations to use and why, including measuring and scaling contexts, and correspondence problems in which  $m$  objects are connected to  $n$  objects (e.g. 3 hats and 4 coats, how many different outfits; 12 sweets shared equally between 4 children; 4 cakes shared equally between 8 children).

### Fractions

- Children should connect tenths to place value and decimal measures, not restricted to decimals between 0 and 1 inclusive and to division by 10.
- They should begin to understand unit and non-unit fractions as numbers on the number line, and deduce relations between them, such as size and equivalence. They should go beyond the  $[0, 1]$  interval, and  $\frac{1}{4} + \frac{3}{4} = 1$  for example, relating this to measure.
- Children should understand the relation between unit fractions as operators and division by integers.
- They should continue to recognise fractions in the context of parts of a whole, numbers, measurements, a shape, or unit fractions as a division of a quantity.

- Children should practise adding and subtracting fractions with the same denominator through a variety of increasingly complex problems to improve fluency.

### **Measurement**

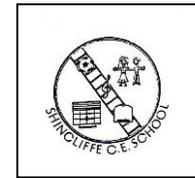
- Children should continue to measure using the appropriate tools and units, progressing to using a wider range of measures, including comparing and using mixed units (1 kg and 200g) and simple equivalents of mixed units (5m = 500cm).
- The comparison of measures should also include simple scaling and this should connect to multiplication.
- Children should continue to become fluent in recognising the value of coins, by adding and subtracting amounts, including mixed units, and giving change using manageable amounts. They should record £ and p separately. The decimal recording of money is introduced formally in Year 4.
- Children should use both analogue and digital 12- hour clocks and record their times. In this way they become fluent in and prepared for using digital 24- hour clocks in Year 4.

### **Geometry: properties of shape**

- Childrens' knowledge of the properties of shapes is extended at this stage to symmetrical and non- symmetrical polygons and polyhedra. Children extend their use of the properties of shapes. They should be able to describe the properties of 2D and 3D shapes using accurate language, including lengths of lines and acute and obtuse for angles greater or lesser than a right angle.
- Children should draw and measure straight lines in centimetres.

### **Statistics**

- Children should understand and use simple scales (e.g. 2, 5, 10 units per cm) in pictograms and bar charts with increasing accuracy.
- They should continue to interpret data presented in many contexts.



### Number and Place Value

- Using a variety of representations, including measures, children should become fluent in the order and place value of numbers beyond 1000, including counting in tens and hundreds, and maintaining fluency in other multiples through varied and frequent practice.
- They begin to extend their knowledge of the number system to include the decimal numbers and fractions that they have met so far.
- They connect estimation and rounding numbers to the use of measuring instruments.
- Roman numerals should be put in their historical context so children understand that there have been different ways to write whole numbers and that the important concepts of zero and place value were introduced over a period of time.

### Addition and Subtraction

- Children should continue to practise both mental methods and columnar addition and subtraction with increasingly large numbers to aid fluency (see National Curriculum Appendix 1).

### Multiplication and Division

- Children should continue to practise recalling and using multiplication tables and related division facts to aid fluency.
- Children should practise mental methods and extend this to three-digit numbers to derive facts, for example  $200 \times 3 = 600$  into  $600 \div 3 = 200$ .
- Children should practise to become fluent in the formal written method of short multiplication for multiplying using multi-digit numbers, and short division with exact answers when dividing by a one- digit number (see Appendix 1).
- Children should write statements about the equality of expressions (e.g. use the distributive law  $39 \times 7 = 30 \times 7 + 9 \times 7$  and associative law  $(2 \times 3) \times 4 = 2 \times (3 \times 4)$ ). They combine their knowledge of number facts and rules of arithmetic to solve mental and written calculations, e.g.  $2 \times 6 \times 5 = 10 \times 6$ .
- Children should solve two-step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers. This should include correspondence questions such as the number of choices of a meal on a menu, or three cakes shared equally between 10 children.

### Fractions

- Children should connect hundredths to tenths and place value and decimal measure.
- Children should extend the use of the number line to connect fractions, numbers and measures.
- Children should understand the relation between non-unit fractions and multiplication and division of quantities, with particular emphasis on tenths and hundredths.
- Children should make connections between fractions of a length, of a shape and as a representation of one whole or set of quantities. Children should use

factors and multiples to recognise equivalent fractions and simplify where appropriate.

- Children should continue practice in adding and subtracting fractions with the same denominator, to become fluent through a variety of increasingly complex problems beyond one whole. Children should be taught throughout that decimals and fractions are different ways of expressing numbers and proportions.
- Children's understanding of the number system and decimal place value should be extended at this stage to tenths and then hundredths. This includes relating the decimal notation to division of whole number by 10 and later 100.
- Children should practise counting using simple fractions and decimal fractions, both forwards and backwards.
- Children should learn decimal notation and the language associated with it, including in the context of measurements. They should make comparisons and order decimal amounts and quantities that are expressed to the same number of decimal places. They should be able to represent numbers with one or two decimal places in several ways, such as on number lines.

### **Measurement**

- Children should build on their understanding of place value and decimal notation to record measures, including money. They should use multiplication to convert from larger to smaller units.
- They should relate area to arrays and multiplication. Perimeter can be expressed algebraically as  $2(a + b)$  where  $a$  and  $b$  are the dimensions in the same unit.

### **Geometry: position and direction**

- Children should draw a pair of axes in one quadrant, with equal scales and integer labels. They should read, write and use pairs of coordinates  $(2, 5)$ , including using coordinate-plotting ICT tools.

### **Geometry: properties of shape**

- Children should continue to classify shapes using geometrical properties, extending to classifying different triangles and quadrilaterals.
- Children should compare and order angles in preparation for using a protractor and compare lengths and angles to decide if a polygon is regular or irregular.
- Children should draw symmetric patterns using a variety of media to become familiar with different orientations of lines of symmetry; and recognise line symmetry in a variety of diagrams, including where the line of symmetry does not dissect the reflected shape.

### **Statistics**

- Children should understand and use a greater range of scales in their representations and should begin to relate the graphical representation of data to recording change over time.



### Number and Place Value

- Children should identify the place value in large whole numbers.
- They should continue to use number in context, including measurement. Children extend and apply their understanding of the number system to the decimal numbers and fractions 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

- Children should practise using the formal written methods of columnar addition and subtraction with increasingly large numbers to aid fluency.
- They should practise mental calculations with increasingly large numbers to aid fluency.

### Multiplication and Division

- Children should practise and extend their use of the formal written methods of short multiplication and division (see National Curriculum Appendix 1). They apply all the multiplication tables and related division facts, 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.
- Children 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
- Children use multiplication and division as inverses to support the introduction of ratio in Year 6, 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 kilometres and metres. Distributivity can be expressed as  $a(b + c) = ab + ac$  in preparation for using algebra.

### Fractions, Decimals and Percentages

- Children should be taught throughout that percentages, decimals and fractions are different ways of expressing proportions. They extend their knowledge of fractions to thousandths and connect to decimals and measures.
- Children 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.
- Children should connect multiplication by a fraction to using fractions as operators (fractions of), and to division, building on work from previous years. This relates to scaling by simple fractions.
- Children 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.

- Children should read and write proper fractions and mixed numbers accurately and practise counting forwards and backwards in simple fractions.
- Children should continue to develop their understanding of fractions as numbers, measures and operators by finding fractions of numbers and quantities, writing remainders as fractions.
- Children extend counting from Year 4, using decimals and fractions including bridging zero, for example on a number line.
- Children should say, read and write decimal fractions and related tenths, hundredths and thousandths accurately and are confident in checking the reasonableness of their answers to problems.
- They should mentally add and subtract tenths, and one-digit whole numbers and tenths.
- They should practise adding and subtracting decimals including whole numbers and decimals, decimals with different numbers of decimal places and complements of 1. Children should go beyond the measurement and money models of decimals.
- Children should make connections between percentages, fractions and decimals and relate this to finding 'fractions of'. They recognise that percentages are proportions of quantities as well as operators on quantities.

### **Measurement**

- Children should use their knowledge of place value and multiplication and division to convert between standard units.
- Children should calculate the perimeter of rectangles and related composite shapes, including using the relations of perimeter or area to find unknown lengths. They calculate the area from scale drawings using given measurements.
- Children should use all four operations in problems involving time and money, including conversions.

### **Geometry: position and direction**

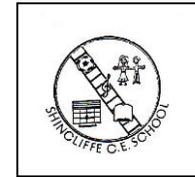
- Children recognise/use reflection and translation in a variety of diagrams, including continuing to use a 2D grid and coordinates in the first quadrant. Reflection should be in lines parallel to the axes.

### **Geometry: properties of shape**

- Children 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.
- Children 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.
- Children should use angle sum facts and other properties to make deductions about missing angles and relate these to missing number problems.

### **Statistics**

- Children should connect their work on coordinates and scales to their interpretation of time graphs.
- They should begin to decide which representations of data are most appropriate and why.



**Number and Place Value**

- Children should use the whole number system - saying, reading and writing numbers accurately.

**Addition, Subtraction, Multiplication and Division**

- Children 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 (see Appendix 1).
- They should undertake mental calculations with increasingly large numbers and more complex calculations.
- Children should continue to use all the multiplication tables to calculate mathematical statements in order to maintain their fluency.
- Children should round answers to a specified degree of accuracy.
- Children explore the order of operations using brackets.
- Common factors can be related to finding equivalent fractions.

**Fractions, Decimals and Percentages**

- Children 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 and progress to varied and increasingly complex problems.
- Children should use a variety of images to support their understanding of multiplication with fractions. They 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. They practise with simple fractions and decimal fraction equivalents to aid fluency, including listing equivalent fractions to identify fractions with common denominators.
- Children can explore and make conjectures about converting a simple fraction to a decimal fraction. For simple fractions with recurring decimal equivalents, children should learn about rounding the decimal to three decimal places, or other appropriate approximations depending on the context.
- Children are introduced to the division of decimal numbers by one-digit whole numbers and, initially, in practical contexts involving measures and money.
- Children 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.

**Ratio and Proportion**

- Pupils recognise proportionality in contexts when the relations between quantities are in the same ratio.
- Pupils link percentages or  $360^\circ$  to calculating angles of pie charts.
- Children 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.

- Children should solve problems involving unequal quantities. These problems are the foundation for later formal approaches to ratio and proportion.

## **Algebra**

- Children 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

## **Measurement**

- Using the number line, children 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.
- Children 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.

## **Geometry: position and direction**

- Children should draw and label a pair of axes in all four quadrants with equal scaling.
- Children draw and label rectangles, parallelograms and rhombuses, specified by coordinates in the four quadrants, predicting missing coordinates using the properties of shapes.

## **Geometry: properties of shape**

- Children should draw shapes and nets accurately, using measuring tools and conventional markings and labels for lines and angles.
- Children should describe the properties of shapes and explain how unknown angles and lengths can be derived from known measurements. These relationships might be expressed algebraically.

## **Statistics**

- Children should connect their work on angles, fractions and percentages to the interpretation of pie charts.
- Children 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.
- Children should know when it is appropriate to find the mean of a data set.

