

## 6.1 NUMBER SENSE

3-week sequence

### Success criteria

Pupils can represent and explain the multiplicative nature of the number system, understanding how to multiply and divide by 10, 100 and 1000. Pupils make appropriate decisions about when to use their understanding of counting, place value and rounding for solving problems including adding and subtracting.

*I can explain and represent how I know that 7017 g is lighter than 7.07 kg, explain why it is easy to subtract 70 g from 7.07 kg and why rounding both weights to the nearest whole kilogram gives the same result, suggesting other numbers that would also round to 7 kg. I can explain and represent the relationship between 7017 and 7.017.*

### Learning objectives

Pupils should be taught to:

#### Number and place value

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

#### Fractions (including decimals and percentages)

- identify the value of each digit in numbers given to three decimal places and multiply and divide numbers by 10, 100 and 1000 giving answers up to three decimal places

#### Measurement

- use, read, write and convert between standard units, converting measurements of length, mass and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to up to three decimal places
- convert between miles and kilometres.

### Guidance

Pupils know approximate conversions and are able to tell if an answer is sensible.

Pupils connect conversion (for example, from kilometers to miles) to a graphical representation as preparation for understanding linear/proportional graphs.

For further guidance see appendix.

## 6.2 ADDITIVE REASONING

3-week sequence

### Success criteria

Pupils can solve addition and subtraction problems in different contexts, appropriately choosing and using number facts, understanding of place value and mental and written methods. They can explain their decision making and justify their solutions and levels of accuracy.

*I can explain how a line graph I have drawn shows changes in temperature in the school greenhouse over a 24-hour period. I can find two points on the graph which show a change in temperature of  $7.5^{\circ}$  and I can calculate the time period over which the change took place, justifying my level of accuracy.*

### Learning objectives

Pupils should be taught to:

*Addition, subtraction, multiplication and division*

- perform mental calculations, including with mixed operations and large 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
- use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy

*Fractions (including decimals and percentages)*

- solve problems which require answers to be rounded to specified degrees of accuracy

*Algebra*

- use simple formulae
- generate and describe linear number sequences
- express missing number problems algebraically
- find pairs of numbers that satisfy an equation with two unknowns
- enumerate possibilities of combinations of two variables

*Measurement*

- 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 and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to three decimal places

*Statistics*

- interpret and construct pie charts and line graphs and use these to solve problems.

### Guidance

Pupils explore the order of operations using brackets; for example,  $2 + 1 \times 3 = 5$  and  $(2 + 1) \times 3 = 9$ .

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

equivalent expressions (for example,  $a + b = b + a$ )

number puzzles (for example, what two numbers can add up to).

For further guidance see appendix.

**Success criteria**

Pupils can solve problems involving multiplication and division and fractions and percentages in different contexts, appropriately choosing and using number facts, understanding of place value and mental and written methods. They can explain their decision making and justify their solutions.

*I can explain and represent different ways of solving  $2170 \text{ m} \div 70$  and  $2020 \text{ m} \times 15$ , give reasons for which would be the most efficient and suggest contexts where these calculations might be needed. I can explain and represent why the solution to  $345 \div 6$  is different in the following contexts: “£345 is won on the lottery by six people. How much do they each get?”, “345 people have bought tickets to the summer concert and the chairs are in blocks of 6. How many blocks are needed?”, “345 cup cakes have been baked for the summer fair and will be sold in bags of six. How many full bags can be sold?” and “345 m of bunting is available to use to decorate six rooms. How much do they each get if it is shared equally?”*

**Learning objectives**

Pupils should be taught to:

*Addition, subtraction, multiplication and division*

- multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
- divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context
- *perform mental calculations, including with mixed operations and large numbers*
- identify common factors, common multiples and prime numbers
- *use their knowledge of the order of operations to carry out calculations involving the four operations*
- *solve problems involving addition, subtraction, multiplication and division*
- *use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy*

*Fractions (including decimals and percentages)*

- 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

*Ratio and proportion*

- solve problems involving the calculation of percentages [for example, of measures, and such as 15% of 360] and the use of percentages for comparison

*Algebra*

- *use simple formulae*
- *generate and describe linear number sequences*
- *express missing number problems algebraically*
- *find pairs of numbers that satisfy an equation with two unknowns*
- *enumerate possibilities of combinations of two variables.*

*Measurement*

- *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 and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to three decimal places*

*Statistics*

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

**Guidance**

Pupils multiply decimals by whole numbers, starting with the simplest cases, such as  $0.4 \times 2 = 0.8$ , and in practical contexts, such as measures and money.

Pupils are introduced to the division of decimal numbers by one-digit whole numbers, initially, in practical contexts involving measures and money. They recognise division calculations as the inverse of multiplication.

Pupils know when it is appropriate to find the mean of a data set.

## 6.4 GEOMETRIC REASONING

2-week sequence

### Success criteria

Pupils can use their understanding of angle and properties of shapes to solve problems.

*I can explain and represent how I know that any parallelogram can be split into two congruent triangles and use this understanding to find the area of different parallelograms. I can create a net for a square-based pyramid, describe the properties of the triangles in the net and suggest other nets that would make the same pyramid.*

### Learning objectives

Pupils should be taught to:

*Geometry: properties of shapes*

- 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

*Algebra*

- use simple formulae
- express missing number problems algebraically
- find pairs of numbers that satisfy an equation with two unknowns
- enumerate possibilities of combinations of two variables

*Measurement*

- recognise that shapes with the same areas can have different perimeters and vice versa

- calculate the area of parallelograms and triangles
- recognise when it is possible to use the formulae for area and volume of shapes.

### Guidance

They relate the area of rectangles to parallelograms and triangles, for example, by dissection, and calculate their areas, understanding and using the formulae (in words or symbols) to do this.

Pupils draw shapes and nets accurately, using measuring tools and conventional markings and labels for lines and angles.

Pupils describe the properties of shapes and explain how unknown angles and lengths can be derived from known measurements.

These relationships might be expressed algebraically for example,  $d = 2 \times r$ ,  $a = 180 - (b + c)$ .

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.

## 6.5 NUMBER SENSE

2-week sequence

### Success criteria

Pupils can make appropriate decisions about when to use their understanding of counting (including counting below zero), place value and rounding for solving problems including adding and subtracting.

*I can explain and represent how I know how to order the numbers 21.061, 21.6 and 21.006 and explain why it is easy to subtract 6 tenths from 21.6. I can explain and represent how I know how to order the temperatures  $7^\circ$ ,  $-3^\circ$  and  $-7^\circ$  and calculate the difference between each pair of temperatures.*

### Learning objectives

Pupils should be taught to:

*Number and place value*

- 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

*Fractions (including decimals and percentages)*

- identify the value of each digit in numbers given to three decimal places and multiply and divide numbers by 10, 100 and 1000 given answers up to three decimal places

*Measurement*

- use, read, write and convert between standard units, converting measurements of length, mass and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to three decimal places.

### Guidance

Pupils use the whole number system, including saying, reading and writing numbers accurately.

They know approximate conversions and are able to tell if an answer is sensible.

Pupils connect conversion (e.g. from kilometres to miles) to a graphical representation as preparation for understanding linear/proportional graphs.

**Success criteria**

Pupils can solve addition and subtraction problems in different contexts, appropriately choosing and using number facts, understanding of place value and mental and written methods. They can explain their decision making and justify their solution and level of accuracy.

*I can explain and represent different ways of solving  $3.456 \text{ litres} + 729 \text{ ml}$  and  $8.315 \text{ litres} - 990 \text{ ml}$  and give reasons for which would be the most efficient. I can suggest contexts where these calculations might be necessary. I can explain and represent how I know how to calculate an increase in temperature of  $5^\circ$  from different starting numbers that I am using from a table of data, such as  $-7^\circ$  and  $-2^\circ$ .*

**Learning objectives**

Pupils should be taught to:

*Number and place value*

- use negative numbers in context, and calculate intervals across zero

*Addition, subtraction, multiplication and division*

- perform mental calculations, including with mixed operations and large 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
- use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy

*Fractions (including decimals and percentages)*

- solve problems which require answers to be rounded to specified degrees of accuracy

*Algebra*

- use simple formulae
- generate and describe linear number sequences

- express missing number problems algebraically
- find pairs of numbers that satisfy an equation with two unknowns
- enumerate possibilities of combinations of two variables

*Measurement*

- 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 and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to three decimal places

*Statistics*

- interpret and construct pie charts and line graphs and use these to solve problems.

**Guidance**

Using the number line, pupils use, add and subtract positive and negative integers for measures such as temperature.

For further guidance see 6.2 and appendix.

**Success criteria**

Pupils can represent and explain the relationship between decimals, fractions and percentages and equivalences within fractions. They use this understanding to solve problems.

*I can explain and represent how I know how to order the numbers  $\frac{9}{7}$ ,  $1\frac{1}{3}$ ,  $\frac{8}{6}$ ,  $\frac{10}{11}$ ,  $1\frac{1}{12}$ ,  $2\frac{1}{24}$  and mark them on a number line. I can convert the fractions to decimals and percentages and calculate how far each fraction is from 1.*

**Learning objectives**

Pupils should be taught to:

*Fractions (including decimals and percentages)*

- 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 and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction [for example,  $\frac{3}{8}$ ]
- recall and use equivalences between simple fractions, decimals and percentages, including in different context
- identify the value of each digit in numbers given to three decimal places and multiply and divide numbers by 10, 100 and 1000 giving answers up to three decimal places

*Algebra*

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

*Measurement*

- *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 and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to three decimal places*

*Statistics*

- *interpret and construct pie charts and line graphs and use these to solve problems.*

**Guidance**

Pupils can explore and make conjectures about converting a simple fraction to a decimal fraction (for example,  $3 \div 8 = 0.375$ ). For simple fractions with recurring decimal equivalents, pupils should learn about rounding the decimal to three decimal places or appropriate approximations depending on the context.

**Success criteria**

Pupils can explain the relationship between multiplication, division, ratio and proportion. They use this understanding to derive facts and solve problems.

*I can explain and represent how I know the ingredients I will need for a cake if the ratio is 4:2:1, flour: sugar: cocoa and I am using 250 g flour. I can identify data which would be best represented in a pie chart and explain how I constructed a pie chart from data showing the percentage of children that travel to school in different ways.*

**Learning objectives**

Pupils should be taught to:

*Addition, subtraction, multiplication and division*

- multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
- divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context
- perform mental calculations, including with mixed operations and large numbers
- identify common factors, common multiples and prime numbers
- use their knowledge of the order of operations to carry out calculations involving the four operations
- solve problems involving addition, subtraction, multiplication and division
- use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy

*Fractions (including decimals and percentages)*

- 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

*Ratio and proportion*

- 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 the relative sizes of two quantities, where missing values can be found by using integer multiplication and division facts
- solve problems involving unequal sharing and grouping using knowledge of fractions and multiples

*Algebra*

- use simple formulae
- generate and describe linear number sequences
- express missing number problems algebraically
- find pairs of numbers that satisfy an equation with two unknowns
- enumerate possibilities of combinations of two variables

*Measurement*

- 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 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

*Statistics*

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

**Guidance**

Pupils should consolidate their understanding of ratio when comparing quantities, sizes and scale drawings by solving a variety of problems. They might use the notation a:b to record their work.

Pupils recognise proportionality in contexts when the relations between quantities are in the same ratio (for example, similar shapes and recipes).

Pupils solve problems involving unequal quantities, for example, 'for every egg you need three spoonfuls of flour', ' $\frac{3}{5}$  of the class are boys'.

Pupils link percentages of  $360^\circ$  to calculating angles of pie charts.

Pupils connect their work on angles, fractions and percentages to the interpretation of pie charts.

**Success criteria**

Pupils can explain how to reflect and translate shapes on a grid with four quadrants and use this knowledge and understanding to solve problems. They can explain how to find the volume of cubes and cuboids and use this understanding to solve problems.

*I can draw a kite on a grid, identify the coordinates of the vertices and explain what happens to the coordinates if the kite is reflected in the  $x$  and  $y$  axes and how I know that the kites are congruent. I can explain, represent and record calculations showing how a box of staples with a volume of  $24 \text{ cm}^3$  can have different dimensions.*

**Learning objectives**

Pupils should be taught to:

*Geometry: properties of shapes*

- 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

*Geometry: position and direction*

- 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

*Algebra*

- use simple formulae
- express missing number problems algebraically
- find pairs of numbers that satisfy an equation with two unknowns
- enumerate possibilities of combinations of two variables

*Measurement*

- calculate the area of parallelograms and triangles
- recognise when it is possible to use the formulae for area and volume of shapes
- calculate, estimate and compare volume of cubes and cuboids using standard units, including cubic centimeters ( $\text{cm}^3$ ) and cubic metres ( $\text{m}^3$ ) and extending to other units, [for example,  $\text{mm}^3$  and  $\text{km}^3$ ]

*Ratio and proportion*

- Solve problems involving similar shapes where the scale factor is known or can be found.

**Guidance**

Pupils 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 draw and label rectangles (including squares), parallelograms and rhombuses, specified by coordinates in the four quadrants, predicting missing coordinates using the properties of shapes. These might be expressed algebraically, for example, translating vertex  $(a, b)$  to  $(a - 2, b + 3)$ ;  $(a, b)$  and  $(a + d, b + d)$  being opposite vertices of a square of side  $d$ .

**Success criteria**

Pupils can use their understanding of the multiplicative nature of the number system to convert between different units of measures, knowing when it is appropriate to use their understanding of how to multiply and divide by 10, 100 and 1000. Pupils make appropriate decisions about when to use their understanding of counting, place value and rounding for solving problems including adding and subtracting.

*I can explain and represent how I know how to convert from km to metres and km to miles. I can use this understanding to say which of these places in Paris is furthest from London: Eiffel Tower (452 km), Charles de Gaulle Airport (433 000 m), Disneyland (291 miles). I can explain and justify how I know and the level of accuracy used.*

**Learning objectives**

Pupils should be taught to:

*Number and place value*

- 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

*Fractions (including decimals and percentages)*

- use common factors to simplify fractions; use common multiples to express fractions in the same denomination
- compare and order fractions, including fractions  $>1$

- identify the value of each digit in numbers given to three decimal places and multiply and divide numbers by 10, 100 and 1000 giving answers up to three decimal places

*Measurement*

- use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation up to three decimal places
- convert between miles and kilometres.

**Guidance**

For guidance see 6.1, 6.7 and appendix.

**Success criteria**

Pupils can solve calculation problems in different contexts, appropriately choosing and using operations, number facts, understanding of place value and mental and written methods. They can explain their decision making and justify their solutions and levels of accuracy.

*I can use the data from the Diamond League athletics meetings to work out the average (mean) time run by the current Olympic champion for 100 m and compare this with the mean times of the other runners.*

**Learning objectives**

Pupils should be taught to:

*Addition, subtraction, multiplication and division*

- *perform mental calculations, including with mixed operations and large numbers*
- *use their knowledge of the order of operations to carry out calculations involving the four operations*
- *solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why*
- *solve problems involving addition, subtraction, multiplication and division*
- *use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy*

*Fractions (including decimal and percentages)*

- add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions
- *solve problems which require answers to be rounded to specified degrees of accuracy*

*Algebra*

- *use simple formulae*
- *generate and describe linear number sequences*
- *express missing number problems algebraically*
- *find pairs of numbers that satisfy an equation with two unknowns*
- *enumerate possibilities of combinations of two variables*

*Measurement*

- *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*

*Statistics*

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

**Guidance**

Pupils know when it is appropriate to find the mean of a data set.

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 (for example,  $\frac{1}{2} + \frac{1}{8} = \frac{5}{8}$ ) and progress to varied and increasingly complex problems.

For further guidance see 6.2.

**Success criteria**

Pupils can represent and explain the relationship between decimals, fractions and percentages and how decimals and fractions fit into the number system. They use this understanding to solve problems.

*I can explain how I know how to fill a range of measuring jugs (e.g. marked in 100 ml, 250 ml, 200 ml and  $\frac{1}{2}$  pints intervals) so that each contains 70 cl.*

**Learning objectives**

Pupils should be taught to:

*Fractions (including decimals and percentages)*

- 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 and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction [for example,  $\frac{3}{8}$ ]
- recall and use equivalences between simple fractions, decimals and percentages, including in different contexts
- identify the value of each digit in numbers given to three decimal places and multiply and divide numbers by 10, 100 and 1000 giving answers up to three decimal places

*Algebra*

- use simple formulae

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

*Measurement*

- 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 and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to three decimal places

*Statistics*

- interpret and construct pie charts and line graphs and use these to solve problems.

**Guidance**

For guidance see 6.7.

**Success criteria**

Pupils can solve calculation problems in different contexts, including those involving ratio and proportion, appropriately choosing and using operations, number facts, understanding of place value and mental and written methods. They can explain their decision making and justify their solutions and level of accuracy.

*I can explain and represent how I know whether Bradley Wiggins was cycling faster on average when he won Olympic gold in the individual pursuit, cycling 4000 m in 4 minutes 15.31 seconds, or when he cycled the last leg of the Tour de France, covering 120 km in 3 hours 8 minutes and 7 seconds, and justify my level of accuracy. I can explain and represent how I know that winning half of a quarter of a million pounds is the same as dividing a quarter of a million pounds by two and record matching number sentences.*

**Learning objectives**

Pupils should be taught to:

*Addition, subtraction, multiplication and division*

- 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 formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context
- perform mental calculations, including with mixed operations and large numbers
- identify common factors, common multiples and prime numbers
- use their knowledge of the order of operations to carry out calculations involving the four operations
- solve problems involving addition, subtraction, multiplication and division
- use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy

*Fractions (including decimals and percentages)*

- multiply simple pairs of proper fractions, writing the answer in its simplest form [for example,  $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$ ]
- divide proper fractions by whole numbers [for example,  $\frac{1}{3} \div 2 = \frac{1}{6}$ ]
- 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

*Ratio and proportion*

- 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 the relative sizes of two quantities, where missing values can be found by using multiplication and division facts
- solve problems involving unequal sharing and grouping using knowledge of fractions and multiples

*Algebra*

- use simple formulae
- generate and describe linear number sequences
- express missing number problems algebraically
- find pairs of numbers that satisfy an equation with two unknowns
- enumerate possibilities of combinations of two variables

*Measurement*

- 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 and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to three decimal places

*Statistics*

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

**Guidance**

Pupils 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 (for example, if  $\frac{1}{4}$  of a length is 36 cm, then the whole length is  $36 \times 4 = 144$  cm).

Pupils should use a variety of images to support their understanding of multiplication with fractions. This follows earlier work about fractions as operators (fractions of), as numbers, and as equal parts of objects, for example as parts of a rectangle.

**Success criteria**

Pupils can use their understanding of properties of shapes, area and volume to solve problems and make generalisations.

*I can explain, represent and record calculations to show how I know what happens to the area of the faces of a cuboid and the volume of a cuboid if the dimensions are all doubled, whatever the size of the original cuboid.*

**Learning objectives**

Pupils should be taught to:

*Geometry: properties of shapes*

- 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

*Geometry: position, direction, motion*

- 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

*Algebra*

- use simple formulae
- express missing number problems algebraically
- find pairs of numbers that satisfy an equation with two unknowns
- enumerate possibilities of combinations of two variables

*Measurement*

- recognise that shapes with the same areas can have different perimeters and vice versa
- 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 cubic centimeters ( $\text{cm}^3$ ) and cubic metres ( $\text{m}^3$ ) and extending to other units, [for example,  $\text{mm}^3$  and  $\text{km}^3$ ]

*Ratio and proportion*

- solve problems involving similar shapes where the scale factor is known or can be found.

**Guidance**

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

equivalent expressions (for example,  $a + b = b + a$ )

generalisations of number patterns.