

5.1 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 71.7 m is greater than 71.57 m, explain why it is easy to subtract 0.7 m from 71.7 m and why rounding both numbers to the nearest metre gives the same result, suggesting other numbers that would also round to 72 m. I can explain and represent the relationship between 71.7 and 717.

Learning objectives

Pupils should be taught to:

Number and place value

- read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit
- count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000
- round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000
- solve number problems and practical problems that involve all of the above

Multiplication and division

- multiply and divide whole numbers and those involving decimals by 10, 100 and 1000

Fractions (including decimals and percentages)

- read and write decimal numbers as fractions [for example, $0.71 = \frac{71}{100}$]
- recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
- round decimals with two decimal places to the nearest whole number and to one decimal place
- read, write, order and compare numbers with up to three decimal places
- solve problems involving number up to three decimal places

Measurement

- convert between different units of metric measure (for example, kilometre and metre; centimetre and metre; centimetre and millimetre; gram and kilogram; litre and millilitre)
- solve problems involving converting between units of time.

Guidance

Pupils extend counting from Year 4, using decimals and fractions including bridging zero, for example on a number line.

Pupils 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 extend their knowledge of fractions to thousandths and connect to decimals and measures.

Pupils should go beyond the measurement and money models of decimals, for example by solving puzzles involving decimals.

For further guidance see appendix.

5.2 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.

I can choose pairs of numbers from a table of data showing distances between major cities in the world and explain and justify my decisions for: pairs of numbers where I would use a mental method to find the difference or total; and pairs of numbers where I would use a written method to find the difference or total.

Learning objectives

Pupils should be taught to:

Addition and subtraction

- add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)
- add and subtract numbers mentally with increasingly large numbers
- use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why

Measurement

- use all four operations to solve problems involving measure [for example, length, mass, volume, money] using decimal notation including scaling

Statistics

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

Guidance

Pupils practise using the formal written methods of columnar addition and subtraction with increasingly large numbers to aid fluency.

They practise mental calculations with increasingly large numbers to aid fluency (for example, $12\,462 - 2\,300 = 10\,162$)

They practise adding and subtracting decimals including a mix of whole numbers and decimals, decimals with different numbers of decimal places, and complements of 1 [for example, $0.83 + 0.17 = 1$].

They mentally add and subtract tenths, and one-digit whole numbers and tenths.

Pupils connect their work on coordinates and scales to their interpretation of time graphs.

They begin to decide which representations of data are most appropriate and why.

5.3 MULTIPLICATIVE REASONING

3-week sequence

Success criteria

Pupils can solve problems involving multiplication and division 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 $216m \div 4$ and $220 m \times 5$, 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 $83 \div 6$ is different in the two contexts: "83 people need to travel in taxis that each carry 6 people, how many taxis do you need?" and "83 eggs have been collected, how many boxes of 6 can be filled?"

Learning objectives

Pupils should be taught to:

Multiplication and division

- identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers
- multiply numbers up to 4 digits by a one-digit number using a formal written method
- multiply and divide numbers mentally drawing upon known facts
- divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context
- multiply and divide whole numbers and those involving decimals by 10, 100 and 1000
- solve problems involving multiplication and division including using their knowledge of factors and multiples
- solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign

Measurement

- *use all four operations to solve problems involving measure [for example, length, mass, volume, money] using decimal notation including scaling.*

Guidance

Pupils practise and extend their use of the formal written methods of short multiplication and short division. They apply all the multiplication tables and related division facts frequently, commit them to memory and use them confidently to make larger calculations.

Pupils 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 (for example, $98 \div 4 = 98/4 = 24 \text{ r } 2 = 24\frac{1}{2} = 24.5 \approx 25$).

Pupils use all four operations in problems involving time and money, including conversions (for example, days to weeks, leaving the answer as weeks and days).

5.4 GEOMETRIC REASONING

2-week sequence

Success criteria

Pupils can explain angle as a measure of turn, draw and measure angles and use their understanding of angle to describe the properties of different shapes.

I can draw scalene, equilateral, isosceles and right-angled triangles. I can decide when I need to measure an angle in any triangle and when I can work out the size of an angle from the information I already have, explaining my thinking.

Learning objectives

Pupils should be taught to:

Geometry: properties of shapes

- 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 ($^{\circ}$)
- identify:
 - angles at a point and one whole turn (total 360°)
 - angles at a point on a straight line and $\frac{1}{2}$ a turn (total 180°)
 - other multiples of 90°
- use the properties of rectangles to deduce related facts and find missing lengths and angles
- distinguish between regular and irregular polygons based on reasoning about equal sides and angles.

Guidance

Pupils become accurate in drawing lines with a ruler to the nearest millimetre, and measuring with a protractor. They use conventional markings for parallel lines and right angles.

Pupils use the term diagonal and make conjectures about the angles formed between sides, and between diagonals and parallel sides, and other properties of quadrilaterals, for example using dynamic geometry ICT tools.

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

5.5 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. Pupils can explain the representation of three-digit positive numbers as Roman numerals.

I can explain and represent how I know that 206 is greater than -206 and explain why it is easier to subtract 6 from 206 than -206 . I can explain and represent the difference between the day time temperature in the desert, 53° , and a night time temperature of -7° . I can explain how to represent 206 in Roman numerals but why this is not possible for 20.6.

Learning objectives

Pupils should be taught to:

Number and place value

- read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit
- count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000
- interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers including through zero
- round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000
- solve number problems and practical problems that involve all of the above
- read Roman numerals to 1000 (M) and recognise years written in Roman numerals

Multiplication and division

- multiply and divide whole numbers and those involving decimals by 10, 100 and 1000

Fractions (including decimals and percentages)

- read and write decimal numbers as fractions [for example, $0.71 = \frac{71}{100}$]

- recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
- round decimals with two decimal places to the nearest whole number and to one decimal place
- read, write, order and compare numbers with up to three decimal places
- solve problems involving number up to three decimal places

Measurement

- convert between different units of measure (e.g. kilometre and metre; metre and centimetre; centimetre and millimetre; kilogram and gram; litre and millilitre)
- solve problems involving converting between units of time.

Guidance

Pupils use their knowledge of place value and multiplication and division to convert between standard units.

They should recognise and describe linear number sequences, including those involving fractions and decimals, and find the term-to-term rule.

For further guidance see 5.1 and appendix.

5.6 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.

I can explain and represent different ways of solving $45.37 \text{ kg} + 25.6 \text{ kg}$ and $80.45 \text{ kg} - 75.9 \text{ kg}$ and give reasons for which would be the most efficient. I can suggest contexts where these calculations might be necessary.

Learning objectives

Pupils should be taught to:

Addition and subtraction

- add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)
- add and subtract numbers mentally with increasingly large numbers
- use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why

Fractions (including decimals and percentages)

- solve problems involving number up to three decimal places

Measurement

- use all four operations to solve problems involving measure [for example, length, mass, volume, money] using decimal notation including scaling
- measure and calculate the perimeter

Statistics

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

Guidance

For guidance see 5.2

Success criteria

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

*I can explain and represent how I know how to order the fractions $15/10$, $5/10$, $15/20$, $1/2$, $1/5$ and $37/100$ and convert the fractions to decimals and percentages.
I can explain and represent how I know how close each fraction is to 1.*

Learning objectives

Pupils should be taught to:

Multiplication and division

- multiply and divide whole numbers and those involving decimals by 10, 100 and 1000

Fractions (including decimals and percentages)

- compare and order fractions whose denominators are all multiples of the same number
- recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements >1 as a mixed number [for example, $2/5 + 4/5 = 6/5 = 1\frac{1}{5}$]
- read and write decimal numbers as fractions [for example, $0.71 = 71/100$]
- recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
- 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
- identify, name and write equivalent fractions of a given fraction, represented visually including tenths and hundredths.

Guidance

Pupils should be taught throughout that percentages, decimals and fractions are different ways of expressing proportions.

Pupils connect equivalent fractions >1 that simplify to integers with division and other fractions >1 to division with remainders, using the number line and other models, and hence move from these to improper and mixed fractions.

Pupils 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.

For further guidance see 5.1 and appendix.

5.8 MULTIPLICATIVE REASONING

3-week sequence

Success criteria

Pupils can explain and show properties of prime, composite, square and cube numbers and explain factor pairs related to these sets of numbers. They understand and can explain the relationship between multiplication, division, fractions and percentages. They use this understanding to derive facts and solve problems.

I can explain and represent how I know 16 is a square number and 27 is a cube number and how I can identify a prime number and a composite number between 16 and 27. I can use my knowledge of factor pairs to organise a class of 32 children into teams. I can explain and represent which I would rather win: $\frac{1}{4}$ of £300 or 40% of £150.

Learning objectives

Pupils should be taught to:

Multiplication and division

- identify multiples and factors, including finding all factor pairs
- know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers
- solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates
- establish whether a number up to 100 is prime and recall prime numbers up to 19
- multiply numbers up to 4 digits by a one-digit number using a formal written method
- multiply and divide numbers mentally drawing upon known facts
- divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context
- multiply and divide whole numbers and those involving decimals by 10, 100 and 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

Fractions (including decimals and percentages)

- solve problems which require knowing percentage and decimal equivalents of $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{4}{5}$ and those with a denominator of a multiple of 10 or 25

Measurement

- use all four operations to solve problems involving measure [for example, length, mass, volume, money] using decimal notation including scaling.

Guidance

Pupils 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 including >1 .

Pupils make connections between percentages, fractions and decimals (for example, 100% represents a whole quantity and 1% is $\frac{1}{100}$, 50% is $\frac{50}{100}$, 25% is $\frac{25}{100}$) and relate this to finding 'fractions of'.

For further guidance see 5.3 and appendix.

5.9 GEOMETRIC REASONING

2-week sequence

Success criteria

Pupils can explain how to reflect and translate shapes on a grid in the first quadrant and use this knowledge and understanding to solve problems.

I can draw a right-angled triangle on a grid, identify the coordinates of the vertices and explain what happens to the coordinates if the triangle is reflected in a line parallel to the y-axis and how I know that the triangles are congruent.

Learning objectives

Pupils should be taught to:

Geometry: properties of shapes

- 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 ($^{\circ}$)
- Identify:
 - angles at a point and one whole turn (total 360°)
 - angles at a point on a straight line and $\frac{1}{2}$ a turn (total 180°)
 - other multiples of 90°
- use the properties of rectangles to deduce related facts and find missing lengths and angles

- distinguish between regular and irregular polygons based on reasoning about equal sides and angles

Geometry: position and direction

- identify, describe and represent the position of a shape following a reflection or translation, using the appropriate language, and know that the shape has not changed.

Guidance

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

For further guidance see 5.14.

Success criteria

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

I can explain and represent how I know which is a better deal: a 1.5 litre bottle of orange juice for £4.50 or a 500ml bottle of orange juice for £1.75. I can count in quarters from 73 and can explain and represent why I will not say 75.4.

Learning objectives

Pupils should be taught to:

Number and place value

- read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit
- count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000
- interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers including through zero
- round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000
- solve number problems and practical problems that involve all of the above

Multiplication and division

- multiply and divide whole numbers and those involving decimals by 10, 100 and 1000

Fractions (including decimals and percentages)

- compare and order fractions whose denominators are all multiples of the same number
- recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements > 1 as a mixed number [for example, $\frac{2}{5} + \frac{4}{5} = \frac{6}{5} = 1\frac{1}{5}$]
- read and write decimal numbers as fractions [for example, $0.71 = \frac{71}{100}$]

- recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
- round decimals with two decimal places to the nearest whole number and to one decimal place
- read, write, order and compare numbers with up to three decimal places
- solve problems involving number up to three decimal places

Measurement

- convert between different units of measure (e.g. kilometre and metre; metre and centimetre; centimetre and millimetre; kilogram and gram; litre and millilitre)
- solve problems involving converting between units of time.

Guidance

Pupils use their knowledge of place value and multiplication and division to convert between standard units.

They should recognise and describe linear number sequences, including those involving fractions and decimals, and find the term-to-term rule.

For further guidance see 5.1 and appendix.

5.11 ADDITIVE REASONING

3-week sequence

Success criteria

Pupils can solve addition and subtraction problems (including with fractions) 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 an efficient way of calculating whether it is quicker to travel from Plymouth to London by train or by coach using timetables. I can explain and represent how I know $£504.62 + £382.88$ is nearly $£900$ and that the difference between $£845$ and $£639$ is around $£200$ using rounding.

Learning objectives

Pupils should be taught to:

Addition and subtraction

- add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)
- add and subtract numbers mentally with increasingly large numbers
- use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why

Fractions (including decimals and percentages)

- recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements >1 as a mixed number [for example, $\frac{2}{5} + \frac{4}{5} = \frac{6}{5} = 1\frac{1}{5}$]
- add and subtract fractions with the same denominator and denominators that are multiples of the same number

- solve problems involving number up to three decimal places

Measurement

- use all four operations to solve problems involving measure [for example, length, mass, volume, money] using decimal notation including scaling
- solve problems involving converting between units of time

Statistics

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

Guidance

For guidance see 5.2.

5.12 NUMBER SENSE

2-week sequence

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 could use the same 1l measuring jug, marked in 100 ml intervals, to measure $\frac{2}{3}$ litre, 0.75 litre and 890 ml and explain why $\frac{2}{3}$ is difficult to represent as a decimal.

Learning objectives

Pupils should be taught to:

Multiplication and division

- multiply and divide whole numbers and those involving decimals by 10, 100 and 1000

Fractions (including decimals and percentages)

- compare and order fractions whose denominators are all multiples of the same number
- recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements >1 as a mixed number [for example, $\frac{2}{5} + \frac{4}{5} = \frac{6}{5} = 1\frac{1}{5}$]
- read and write decimal numbers as fractions [for example, $0.71 = \frac{71}{100}$]
- recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
- 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.

Measurement

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

Guidance

Pupils should be taught throughout that percentages, decimals and fractions are different ways of expressing proportions.

Pupils connect equivalent fractions >1 that simplify to integers with division and other fractions >1 to division with remainders, using the number line and other models, and hence move from these to improper and mixed fractions.

For further guidance see 5.1 and appendix.

Success criteria

Pupils can solve problems involving multiplication and division 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. They can explain and represent the connection between fractions and division.

*I can explain and represent different ways of solving “A school trip to Wimbledon costs £175 per pupil. 19 children are booked on the trip; how much money will be collected?” and “280 children are going to the county show and need to travel in mini buses which each hold nine children. How many mini buses need to be booked?”
I can represent and explain that $\frac{4}{5}$ is both four lots of $\frac{1}{5}$ and $4 \div 5$ and represent and explain why $\frac{8}{10}$ and $\frac{80}{100}$ are equivalent fractions.*

Learning objectives

Pupils should be taught to:

Multiplication and division

- identify multiples and factors, including finding all factor pairs, and common factors of two numbers
- know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers
- establish whether a number up to 100 is prime and recall prime numbers up to 19
- multiply numbers up to 4 digits by a one- or two-digit number using a formal written method including long multiplication for two-digit numbers
- multiply and divide numbers mentally drawing upon known facts
- divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context
- multiply and divide whole numbers and those involving decimals by 10, 100 and 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
- solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates.

Fractions (including decimals and percentages)

- identify, name and write equivalent fractions of a given fraction, represented visually including tenths and hundredths
- multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams
- solve problems which require knowing percentage and decimal equivalents of $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{3}{5}$ and those with a denominator of a multiple of 10 or 25

Measurement

- use all four operations to solve problems involving measure [for example, length, mass, volume, money] using decimal notation including scaling
- understand and use approximate equivalences between metric units and common imperial units such as inches, pounds and pints
- solve problems involving converting between units of time.

Guidance

Pupils practise and extend their use of the formal written methods of short multiplication and short division. They apply all the multiplication tables and related division facts frequently, commit them to memory and use them confidently to make larger calculations.

Distributivity can be expressed as $a(b+c) = ab + ac$.

For further guidance see 5.3, 5.8 and appendix.

5.14 GEOMETRIC REASONING

2-week sequence

Success criteria

Pupils can explain how to find the perimeter and area of different shapes, using this knowledge and understanding to solve problems.

I can explain which lengths I do not need to measure on a scale drawing of an L shaped garden but am still able to calculate the perimeter. I can explain and represent how rectangles with an area of 36 cm^2 can have different perimeters and explain how I know which one has the longest perimeter.

Learning objectives

Pupils should be taught to:

Geometry: properties of shapes

- *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*

Geometry: position and direction

- *identify, describe and represent the position of a shape following a reflection or translation, using the appropriate language, and know that the shape has not changed*

Measurement

- *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 (cm^2) and square metres (m^2) and estimate the area of irregular shapes

- estimate volume [for example, using 1 cm^3 blocks to build cuboids (including cubes)] and capacity [for example, using water].

Guidance

Pupils calculate the perimeter of rectangles and related composite shapes, including using the relations of perimeter or area to find unknown lengths. Missing measures questions such as these can be expressed algebraically for example, $4 + 2b = 20$ for a rectangle of sides 2 cm and b cm and perimeter of 20 cm.

Pupils calculate the area of scale drawings using given measurements.