

## Upper Key Stage 2 – Years 5 and 6

The principal focus of mathematics teaching in upper key stage 2 is to ensure that pupils extend their understanding of the number system and place value to include larger integers. This should develop the connections that pupils make between multiplication and division with fractions, decimals, percentages and ratio.

At this stage, pupils should develop their ability to solve a wider range of problems, including increasingly complex properties of numbers and arithmetic, and problems demanding efficient written and mental methods of calculation. With this foundation in arithmetic, pupils are introduced to the language of algebra as a means for solving a variety of problems. Teaching in geometry and measures should consolidate and extend knowledge developed in number. Teaching should also ensure that pupils classify shapes with increasingly complex geometric properties and that they learn the vocabulary they need to describe them.

By the end of year 6, pupils should be fluent in written methods for all four operations, including long multiplication and division, and in working with fractions, decimals and percentages.

Pupils should read, spell and pronounce mathematical vocabulary correctly.

**This long term curriculum planning document includes:**

- **pgs 2 – 7: programmes of study for the year group including statutory requirements and accompanying notes and guidance (non-statutory). Key objectives for the year group are written in bold.**
- **pgs 8 – 9: appendix 1: table of key objectives for the year group taken from the National Curriculum and in a summarised form**
- **pgs 10 – 11: appendix 2: overview of progression for the year group**

## Year 6 programmes of study

The objectives highlighted in bold are considered by the school to be key objectives for the year group. The objectives have been selected either because they represent key content to be covered to allow access to the following year’s curriculum, or because it is the only or main time an objective is taught.

Year 6 programme of study (statutory requirements)	Notes and guidance (non-statutory)
<p><b>Number – number and place value</b></p> <p>Pupils should be taught to:</p> <ul style="list-style-type: none"> <li>▪ read, write, order and compare numbers up to 10 000 000 and determine the value of each digit</li> <li>▪ round any whole number to a required degree of accuracy</li> <li>▪ <b>use negative numbers in context, and calculate intervals across zero</b></li> <li>▪ solve number and practical problems that involve all of the above.</li> </ul>	<p>Pupils use the whole number system, including saying, reading and writing numbers accurately.</p>
<p><b>Number – Addition, subtraction, multiplication and division</b></p> <p>Pupils should be taught to:</p> <ul style="list-style-type: none"> <li>▪ multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication</li> <li>▪ <b>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</b></li> <li>▪ 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</li> <li>▪ perform mental calculations, including with mixed operations and large numbers</li> </ul>	<p>Pupils practise addition, subtraction, multiplication and division for larger numbers, using the formal written methods of columnar addition and subtraction, short and long multiplication, and short and long division (see calculation policy)</p> <p>They undertake mental calculations with increasingly large numbers and more complex calculations.</p> <p>Pupils continue to use all the multiplication tables to calculate mathematical statements in order to maintain their fluency.</p> <p>Pupils round answers to a specified degree of accuracy, for example, to the nearest 10, 20, 50 etc., but not to a specified number of significant figures.</p> <p>Pupils explore the order of operations using brackets; for example, <math>2 + 1 \times 3 = 5</math> and <math>(2 + 1) \times 3 = 9</math>.</p>

<ul style="list-style-type: none"> <li>▪ identify common factors, common multiples and prime numbers</li> <li>▪ <b>use their knowledge of the order of operations to carry out calculations involving the four operations</b></li> <li>▪ solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why</li> <li>▪ solve problems involving addition, subtraction, multiplication and division</li> <li>▪ use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.</li> </ul>	<p>Common factors can be related to finding equivalent fractions.</p>
<p><b>Number - Fractions (including decimals and percentages)</b></p> <p>Pupils should be taught to:</p> <ul style="list-style-type: none"> <li>□ <b>use common factors to simplify fractions;</b> use common multiples to express fractions in the same denomination</li> <li>□ <b>compare and order fractions, including fractions &gt; 1</b></li> <li>□ <b>add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions</b></li> <li>□ <b>multiply simple pairs of proper fractions, writing the answer in its simplest form</b> (for example <math>1/4 \times 1/2 = 1/8</math>)</li> <li>□ <b>divide proper fractions by whole numbers</b> (for example <math>1/3 \div 2 = 1/6</math>)</li> <li>□ <b>associate a fraction with division and calculate decimal fraction equivalents</b> [for example, 0.375] for a simple fraction [for example, <math>3/8</math> ]</li> <li>□ 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</li> </ul>	<p>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, <math>1/2 + 1/8 = 5/8</math> ) and progress to varied and increasingly complex problems.</p> <p>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.</p> <p>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 <math>1/4</math> of a length is 36cm, then the whole length is <math>36 \times 4 = 144\text{cm}</math>).</p> <p>They practise calculations with simple fractions and decimal fraction equivalents to aid fluency, including listing equivalent fractions to identify</p>

<ul style="list-style-type: none"> <li>□ <b>multiply one-digit numbers with up to two decimal places by whole numbers</b></li> <li>□ <b>use written division methods in cases where the answer has up to two decimal places</b></li> <li>□ solve problems which require answers to be rounded to specified degrees of accuracy</li> <li>□ <b>recall and use equivalences between simple fractions, decimals and percentages, including in different contexts.</b></li> </ul>	<p>fractions with common denominators.</p> <p>Pupils can explore and make conjectures about converting a simple fraction to a decimal fraction (for example, <math>3 \div 8 = 0.375</math>). For simple fractions with recurring decimal equivalents, pupils learn about rounding the decimal to three decimal places, or other appropriate approximations depending on the context. Pupils multiply and divide numbers with up to two decimal places by one-digit and two-digit whole numbers. Pupils multiply decimals by whole numbers, starting with the simplest cases, such as <math>0.4 \times 2 = 0.8</math>, and in practical contexts, such as measures and money.</p> <p>Pupils are introduced to the division of decimal numbers by one-digit whole number, initially, in practical contexts involving measures and money. They recognise division calculations as the inverse of multiplication.</p> <p>Pupils also develop their skills of rounding and estimating as a means of predicting and checking the order of magnitude of their answers to decimal calculations. This includes rounding answers to a specified degree of accuracy and checking the reasonableness of their answers.</p>
<p><b>Ratio and proportion</b></p> <p>Pupils should be taught to:</p> <ul style="list-style-type: none"> <li>▪ <b>solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts</b></li> <li>▪ <b>solve problems involving the calculation of percentages [for example, of measures, and such as 15% of 360] and the use of percentages for comparison</b></li> <li>▪ <b>solve problems involving similar shapes where the scale factor is known or can be found</b></li> <li>▪ <b>solve problems involving unequal sharing and grouping using knowledge of fractions and multiples.</b></li> </ul>	<p>Pupils recognise proportionality in contexts when the relations between quantities are in the same ratio (for example, similar shapes and recipes). Pupils link percentages or <math>360^\circ</math> to calculating angles of pie charts.</p> <p>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 <math>a:b</math> to record their work.</p> <p>Pupils solve problems involving unequal quantities, for example, ‘for every egg you need three spoonfuls of flour’, ‘<math>\frac{3}{5}</math> of the class are boys’. These problems are the foundation for later formal approaches to ratio and proportion.</p>

<p><b>Algebra</b></p> <p>Pupils should be taught to:</p> <ul style="list-style-type: none"> <li>▪ <b>use simple formulae</b></li> <li>▪ <b>generate and describe linear number sequences</b></li> <li>▪ <b>express missing number problems algebraically</b></li> <li>▪ find pairs of numbers that satisfy an equation with two unknowns</li> <li>▪ enumerate possibilities of combinations of two variables.</li> </ul>	<p>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:</p> <ul style="list-style-type: none"> <li>▪ missing numbers, lengths, coordinates and angles</li> <li>▪ formulae in mathematics and science</li> <li>▪ equivalent expressions (for example, <math>a + b = b + a</math>)</li> <li>▪ generalisations of number patterns</li> <li>▪ number puzzles (for example, what two numbers can add up to).</li> </ul>
<p><b>Measurement</b></p> <p>Pupils should be taught to:</p> <ul style="list-style-type: none"> <li>▪ solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places where appropriate</li> <li>▪ <b>use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to up to three decimal places</b></li> <li>▪ <b>convert between miles and kilometres</b></li> <li>▪ recognise that shapes with the same areas can have different perimeters and vice versa</li> <li>▪ recognise when it is possible to use formulae for area and volume of shapes</li> </ul>	<p>Pupils connect conversion (for example, from kilometres to miles) to a graphical representation as preparation for understanding linear/proportional graphs.</p> <p>They know approximate conversions and are able to tell if an answer is sensible.</p> <p>Using the number line, pupils use, add and subtract positive and negative integers for measures such as temperature.</p> <p>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.</p> <p>Pupils could be introduced to compound units for speed, such as miles per hour, and apply their knowledge in science or other subjects as appropriate.</p>

<ul style="list-style-type: none"> <li>▪ <b>calculate the area of parallelograms and triangles</b></li> <li>▪ <b>calculate, estimate and compare volume of cubes and cuboids using standard units</b>, including cubic centimetres (cm<sup>3</sup>) and cubic metres (m<sup>3</sup>), and extending to other units [for example, mm<sup>3</sup> and km<sup>3</sup>].</li> </ul>	
<p><b>Geometry - properties of shapes</b></p> <p>Pupils should be taught to:</p> <ul style="list-style-type: none"> <li>▪ draw 2-D shapes using given dimensions and angles</li> <li>▪ recognise, describe and build simple 3-D shapes, including making nets</li> <li>▪ compare and classify geometric shapes based on their properties and sizes and <b>find unknown angles in any triangles, quadrilaterals, and regular polygons</b></li> <li>▪ <b>illustrate and name parts of circles, including radius, diameter and circumference and know that the diameter is twice the radius</b></li> <li>▪ <b>recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles.</b></li> </ul>	<p>Pupils draw shapes and nets accurately, using measuring tools and conventional markings and labels for lines and angles.</p> <p>Pupils describe the properties of shapes and explain how unknown angles and lengths can be derived from known measurements.</p> <p>These relationships might be expressed algebraically for example, <math>d = 2 \times r</math>, <math>a = 180 - (b + c)</math>.</p>
<p><b>Geometry – position and direction</b></p> <p>Pupils should be taught to:</p> <ul style="list-style-type: none"> <li>▪ <b>describe positions on the full coordinate grid (all four quadrants)</b></li> <li>▪ <b>draw and translate simple shapes on the coordinate plane, and reflect them in the axes.</b></li> </ul>	<p>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.</p> <p>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 <math>(a, b)</math> to <math>(a - 2, b + 3)</math>; <math>(a, b)</math> and <math>(a + d, b + d)</math> being opposite vertices of a square of side <math>d</math>.</p>

## Statistics

Pupils should be taught to:

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

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

Pupils 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 measurement to its graphical representation.

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

**Appendix 1: Year 6 Key Objectives**

Taken from the National Curriculum	Summarised form
1. Use negative numbers in context, and calculate intervals across zero	1. Use negative numbers to calculate intervals across zero
2. 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	2. Divide numbers using long division, interpreting the remainders as appropriate
3. Use their knowledge of the order of operations to carry out calculations involving the four operations	3. Use order of operations to carry out calculations
4. Use common factors to simplify fractions	4. Use common factors to simplify fractions
5. Compare and order fractions, including fractions $> 1$	5. Compare and order fractions of any size
6. Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions	6. Add and subtract fractions with different denominators and mixed numbers
7. Multiply simple pairs of proper fractions, writing the answer in its simplest form	7. Multiply simple pairs of proper fractions
8. Divide proper fractions by whole numbers	8. Divide proper fractions by whole numbers
9. Associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction	9. Calculate decimal fraction equivalents for simple fractions
10. Multiply one-digit number with up to two decimal places by whole numbers	10. Multiply a number with up to two decimal places by whole numbers
11. Use written division methods in cases where the answer has up to two decimal places	11. Use written division with answers of up to two decimal places
12. Solve problems involving the calculation of percentages [for example, of measures, and such as 15% of 360] and the use of percentages for comparison	12. Solve problems involving the calculation of percentages
13. Recall and use equivalences between simple fractions, decimals and percentages, including in different contexts.	13. Recall and use equivalences between fractions, decimals and percentages
14. Solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts	14. Solve problems using ratio using multiplication and division facts
15. Solve problems involving similar shapes where the scale factor is known or can be found	15. Solve problems involving similar shapes where the scale factor is known
16. Solve problems involving unequal sharing and grouping using knowledge of fractions and multiples.	16. Solve problems involving proportion, using knowledge of fractions and multiples
17. Use simple formulae	17. Use simple formulae
18. Generate and describe linear number sequences	18. Generate and describe linear number sequences
19. Express missing number problems algebraically	19. Express missing number problems algebraically
20. Use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to up to three decimal places	20. Convert units of measure between smaller and larger units
21. Convert between miles and kilometres	21. Convert between miles and kilometres

22. Calculate the area of parallelograms and triangles	22. Calculate the area of parallelograms and triangles
23. Calculate, estimate and compare volume of cubes and cuboids using standard units	23. Calculate and compare volume of cubes and cuboids
24. Illustrate and name parts of circles, including radius, diameter and circumference and know that the diameter is twice the radius	24. Illustrate and name parts of a circle
25. Find unknown angles in any triangles, quadrilaterals, and regular polygons	25. Finding missing angles in triangles, quadrilaterals and regular polygons
26. Recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles	26. Recognise vertically opposite angles and find missing angles
27. Describe positions on the full coordinate grid (all four quadrants)	27. Describe positions on the full co-ordinate grid
28. Draw and translate simple shapes on the coordinate plane, and reflect them in the axes.	28. Translate shapes on a co-ordinate grid and reflect in the axes
29. Interpret and construct pie charts and line graphs	29. Construct and interpret pie charts
30. Calculate and interpret the mean as an average	30. Calculate the mean as an average

## Appendix 2: Overview of Progression in Year 6

### Number and place value

Children work with numbers up to 10,000,000, using knowledge of place value to work out the value of digits. They continue working with negative numbers in different contexts, and work out intervals across zero.

**Addition, subtraction, multiplication and division** Children continue to practise using efficient written and mental methods for all four operations, working with larger numbers and increasingly complex calculations, and confidently using number facts from the multiplication and division tables. They learn about the correct order of operations, understanding that (for example) to work out  $(7 + 8) \div 3$  they need to tackle the operation in brackets first.

### Fractions (including decimals and percentages)

Children begin to add and subtract fractions with different denominators. They multiply pairs of simple proper fractions together, and divide proper fractions by whole numbers.

Children begin to multiply and divide numbers with two decimal places by one-digit and two-digit whole numbers. They are introduced to this in practical contexts such as measures and money (for example, multiplying 1.80 metres by 2, or dividing £1.80 by 3).

Children extend their work on percentage and decimal equivalents of fractions, begun in Year 5. They work out simple percentages of whole numbers, and encounter equivalences between fractions, decimals and percentages in different contexts.

### Ratio and proportion

In Year 6, children are introduced to the concepts of ratio and proportion and use these to compare quantities and sizes; for example, understanding that mixing sugar and flour in a ratio of 1:2 means using 1 part of sugar for every 2 parts of flour, and that the proportion of sugar in the mixture is 1 out of 3 parts, which is  $\frac{1}{3}$ .

### Algebra

Children begin to form an understanding of algebra by encountering the use of symbols and letters to represent unknown elements, for example using letters to represent missing numbers in missing number problems. They also describe and generate number sequences and patterns. They begin to use simple formulae expressed in words, such as 'the perimeter of a rectangle is two times the length plus two times the width.'

### Measurement

Children extend their Year 5 work on calculating area and estimating volume and capacity to calculate the area of parallelograms and triangles, and work out the volume of cubes and cuboids using standard units. They convert measurements from miles to kilometres.

### Geometry: properties of shapes

This year, children make nets to build simple 3D shapes, and work out unknown angles in triangles, quadrilaterals and regular polygons. They draw and name the different parts of a circle (radius, diameter and circumference).

**Geometry: position and direction**

Extending their work with coordinate grids, children learn to describe positions on all four quadrants of the grid, including using negative numbers. They translate simple shapes on the coordinate plan, reflecting them in the axes.

**Statistics**

Children continue working with line graphs and also learn how to use pie charts, linking this with their work on angles, percentages and fractions. Children learn how to work out the mean of a set of data and understand when it might be appropriate to calculate the mean, and why.