Ryton Federation Mathematics Curriculum
Year 6

Understanding and investigating with numbers (whole numbers)

Place value, ordering and rounding
- *Continue to count forwards or backwards in steps of powers of 10 from any given number up to 10 000 000.*
- **Use,** *interpret and order,* **negative numbers in context, and calculate intervals across zero.**
- Using a number line add and subtract positive and negative integers for measures such as temperature**.**
- **Read, write,** say**, order and compare numbers up to 10 000 000 and determine the value of each digit.** *Continue to use numbers in contexts including measurement.*
- *Continue to extend and apply understanding of the number system to decimal numbers and fractions*
- *Use the vocabulary of comparing and ordering numbers including use of >, < symbols and = sign.*
- *Continue to read Roman numerals to 1 000 (M) and recognise years written in Roman numerals. Appreciate the difference between the Roman numeral system and our own number system from a place value viewpoint.*
- **Round any whole number to a required degree of accuracy**
- *Apply understanding of the number system to solve* **number problems and practical problems** *and puzzles involving numbers, money or measures. Explain methods and reasoning orally and in writing, including using diagrams and symbols.*

Properties of numbers and number sequences

- Continue to use all the multiplication tables to calculate mathematical statements in order to maintain fluency.
- **Identify common factors, common multiples, prime numbers,** *squared and cubed numbers.*
- Relate common factors to the finding of equivalent fractions.
- *Continue to recognise and describe linear number sequences, including those involving fractions and decimals and find the term to term rule.*
- *Apply understanding of number properties to solve routine and non-routine problems and puzzles involving numbers, money or measure.*
- *Explore and discuss patterns, properties and relationships that arise in the number system using appropriate mathematical vocabulary.*
- *Develop lines of enquiry through conjecturing relationships and generalisations and testing ideas. Identify examples for which a statement is true or false.*

Fractions, 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**
- **Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions.** Practise, use and understand 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 ½ + 1/8 = 5/8) and progress to varied and increasingly complex problems.
- **Multiply simple pairs of proper fractions, writing the answer in its simplest form (for example ¼ x ½ = 1/8).** Use a variety of images to support their understanding of multiplication with fractions. Make links with earlier work about fractions as operators (fractions of), as numbers, and as equal parts of objects, for example parts of a rectangle.
- Use 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 ¼ of a length is 36cm, then the whole length is 36 x 4 = 144cm).
- **Divide proper fractions by whole numbers (for example 1/3 ÷ 2 = 1/6)**
- **Associate a fraction with division and calculate decimal fraction equivalents (for example, 0.375) for a simple fraction (for example, 3/8)**
- Practise calculations with simple fractions and decimal fraction equivalents to aid fluency, including listing equivalent fractions to identify fractions with common denominators
- Explore and make conjectures about converting a simple fraction to a decimal fraction (for example, 3 ÷ 8 = 0.375). 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.
- **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**
- Start to multiply and divide decimals starting with simpler cases e.g. 0.4 x 2 = 0.8 or division of decimal numbers by one-digit whole numbers, in practical contexts involving measures or money. Recognise division calculations as the inverse of multiplication.
- **Multiply one-digit numbers with up to two decimal places by whole numbers** up to two digits**.**
- Divide numbers with up to two decimal places by whole numbers up to two digits.
- **Use written division methods in cases where the answer has up to two decimal places.**
- **Solve problems which require answers to be rounded to specified degrees of accuracy** and check reasonableness of answers.
- Develop skills of rounding and estimating as a means of predicting and checking the order of magnitude of answers to decimal calculations.
- **Recall and use equivalences between simple fractions, decimals and percentages, including in different contexts.**
- *Apply understanding of fractions, decimals up to three places and percentages to solve routine and non-routine problems and puzzles involving numbers, shapes, money or measures. Explain methods and reasoning orally and in writing, including using diagrams and symbols.*

Ratio and proportion

- **Solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts**
- **Solve problems involving the calculation of percentages [for example, of measures, and such as 15% of 360] and the use of percentages for comparison.** Link percentages of 360° to calculating angles of pie charts.
- **Solve problems involving similar shapes where the scale factor is known or can be found.**
- Recognise proportionality in contexts where the relations between quantities are in the same ratio (for example, similar shapes and recipes)
- Consolidate understanding of ratio when comparing quantities, sizes and scale drawings by solving a variety of problems. Use the notation a:b to record work *if appropriate.*
- Solve problems involving unequal quantities, for example 'for every egg you need three spoonfuls of flour', '3/5 of the class are boys'.
- **Solve problems involving unequal sharing and grouping using knowledge of fractions and multiples.**

Algebra

- Start to use symbols and letters to represent variables and unknowns in *familiar* mathematical situations e.g
  - Missing numbers, lengths, coordinates and angles
  - Equivalent expressions e.g. a + b = b + a
  - Generalisations of number patterns
  - Number puzzles e.g. what two numbers can add up to.
- **Use simple formulae** in maths and science
- **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.**

Developing and applying calculation

Addition and subtraction

- **Perform mental calculations, including with mixed operations,** *appropriate* **large numbers** *and decimals* and more complex calculations.
- *Use and explain a range of mental strategies appropriate to the numbers involved, sometimes supporting explanations with jottings or informal recording.*
- Practise addition and subtraction for larger numbers using the formal written methods of columnar addition and subtraction.
- Explore the order of operations using brackets; for example, 2 + 1 x 3 = 5 and (2 + 1) x 3 = 9.
- **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.**
- *Solve calculation problems using information from a range of table and charts.*
- *Apply understanding of number operations to solve number puzzles and non-routine problems and explain reasoning.*
- *Use and explain the equals sign to indicate equivalence, including in missing number problems (e.g. 13 + 24 = 12+ 25; 33 = 55 - Δ).*
- *Use a calculator to solve problems when the numbers involved are appropriate, including decimals, fractions and percentages, and interpret the display correctly for the context.*

Multiplication and division

- Continue to use all multiplication tables to calculate mathematical statements to maintain fluency. *Use these to* undertake **mental calculations** with increasingly **large (appropriate) numbers, mixed operations** and more complex calculations.
- *Continue to use knowledge of place value and multiplication facts to derive related multiplication and division facts involving decimals e.g. 0.8 x 7, 4.8 ÷ 6.*
- Explore the order of operations using brackets; for example, 2 + 1 x 3 = 5 and (2 + 1) x 3 = 9.
- **Use their knowledge of the order of operations to carry out calculations involving the four operations**
- **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**
- *Solve calculation problems using information from a range of table and charts.*

- *Apply understanding of number operations to solve number puzzles and non-routine problems and explain reasoning.*
- *Use and explain the equals sign to indicate equivalence, including in missing number problems (e.g. 13 + 24 = 12+ 25; 33 = 55 - Δ).*
- *Understand and use the relationships between the four operations and the principles of the arithmetic laws; commutative, associative and distributive.* **(**Distributivity can be expressed as a(b+c) = ab + ac).
- *Use rounding, estimation and inverse operations to check answers to calculations and determine, in the context of a problem, levels of accuracy.*
- *Use a calculator to solve problems when the numbers involved are appropriate, including decimals and fractions, and interpret the display correctly for the context.*

Measurement

- **Solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places where appropriate**
- **Use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to up to three decimal places**
- **Convert between miles and kilometres**
- Know approximate conversions and use to tell if an answer is sensible.
- Connect conversion e.g. from kilometres to miles to a graphical representation as preparation for understanding linear /proportional graphs.
- Begin to learn about compound units for speed, such as miles per hour, if appropriate and apply their knowledge in science and other subjects.
- **Recognise that shapes with the same areas can have different perimeters and vice versa**
- **Recognise when it is possible to use formulae for area and volume of shapes**
- **Calculate the area of parallelograms and triangles.** Relate area of rectangles to parallelograms and triangles e.g. by dissection, calculate their areas, understanding and using the formulae (in words or symbols) to do this.
- **Calculate, estimate and compare volume of cubes and cuboids using standard units, including cubic centimetres (cm3) and cubic metres (m3), and extending to other units [for example, mm3 and km3].**
- Use a number line to add and subtract positive and negative integers for measures such as temperature
- *Continue to read the time, interpret timetables and use units of time, including to* **solve problems involving converting between units of time.**
- **Use all four operations to solve problems involving measure (e.g. length, mass, volume, money) using decimal notation including scaling.** *Information required to solve a problem is often drawn from tables, including timetables, graphs and charts.*
- *Apply measuring skills to an appropriate degree of accuracy, alongside the skills of thinking mathematically to solve problems. These should include practical problems and might involve construction of shapes or artefacts, often in a cross curricular context.*
- *Make and explain connections between number, measures and shape.*

Geometry

Properties of shapes
- **Draw 2-D shapes** and nets accurately **using given dimensions and angles.** Use measuring tools and conventional markings and labels for lines 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.**
- Explain how unknown lengths and angles can be derived from known measurements.
- **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.**
- Express some relationships algebraically *e.g.* $d = 2 \times r$, $a = 180 - (b + c)$.
- *Solve problems, involving reasoning about shapes and their properties. Explain solutions orally or using writing, diagrams, practical materials or dynamic geometry ICT tools.*

Position and direction

- **Describe positions on the full coordinate grid (all four quadrants)**
- Draw and label a pair of axes in all four quadrants with equal scaling, extending knowledge of one quadrant to all four quadrants, including the use of negative numbers.
- Draw and label rectangles (including squares), parallelograms and rhombuses, specified by coordinates in the four quadrants, predicting missing coordinates, using the properties of the 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.
- **Draw and translate simple shapes on the coordinate plane, and reflect them in the axes.**
- *Recognise and use the eight compass directions*
- *Solve problems, involving reasoning about shapes and their properties. Explain solutions orally or using writing, diagrams, practical materials or dynamic geometry ICT tools.*

Statistics

Interpreting, constructing and presenting data

- **Interpret and construct pie charts and line graphs and use these to solve problems.**
- Connect work on angles, fractions and percentages to the interpretation of pie charts.
- Encounter and draw graphs relating to two variables, arising from their own enquiry and in other subjects
- Connect conversion from kilometres to miles in measurement to its graphical representation.
- **Calculate and interpret the mean as an average.** Know when it is appropriate to find the mean of a data set.

- *Pose questions that can be answered using information presented in different graphs charts and tables.*
- *Understand and use Venn and Carroll diagrams to support reasoning about numbers or shapes.*
- *Apply the skills of collecting, representing and interpreting statistical data across the curriculum within and beyond mathematic, sometimes in response to an enquiry of interest to and suggested by pupils.*