Holy Trinity CE Academy

Mathematics

Year 6

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.

Year 6 Programme of Study	Notes and Guidance
Number – number and place value Pupils should be taught to: § 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 and practical problems that involve all of the above.	**Number – number and place value** Pupils should use the whole number system, including saying, reading and writing numbers accurately.
Number - addition, subtraction, multiplication and division Pupils should be taught to: § 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 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	**Number - addition, subtraction, multiplication and division** Pupils should 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. They should undertake mental calculations with increasingly large numbers and more complex calculations. Pupils should continue to use all the multiplication tables to calculate mathematical statements in order to maintain their fluency. Pupils should 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. Pupils explore the order of operations using brackets; for example, 2 + 1 x 3 = 5 and (2 + 1) x 3 = 9. Common factors can be related to finding equivalent fractions.

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degree of accuracy.	
Number – fractions (including decimals and percentages) Pupils should be taught to: § 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 § multiply simple pairs of proper fractions, writing the answer in its simplest form (e.g. $^1/_4 \times {}^1/_2 = {}^1/_8$) § divide proper fractions by whole numbers (e.g. $^1/_3 \div 2 = {}^1/_6$). § associate a fraction with division to calculate decimal fraction equivalents (e.g. 0.375) for a simple fraction (e.g. $^3/_8$) § 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 § 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 § solve problems which require answers to be rounded to specified degrees of accuracy. § recall and use equivalences between simple fractions, decimals and percentages, including in different contexts.	**Number – fractions (including decimals and percentages)** 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 (e.g. $^1/_2 + {}^1/_8 = {}^5/_8$) and progress to varied and increasingly complex problems. 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. Pupils should use their understanding of the relationship between unit fractions and division to work backwards by multiplying a quantity that represents a unit fraction to find the whole quantity (e.g. if ¼ of a length is 36cm, then the whole length is 36 × 4 = 144cm). They should practise calculations with simple fractions and decimal fraction equivalents to aid fluency, including listing equivalent fractions to identify fractions with common denominators. Pupils can explore and make conjectures about converting a simple fraction to a decimal fraction (e.g. 3 ÷ 8 = 0.375). For simple fractions with recurring decimal equivalents, pupils should learn about rounding the decimal to three decimal places, or other appropriate approximations depending on the context. Pupils multiply decimals by whole numbers, starting with the simplest cases, such as 0.4 × 2 = 0.8, and in practical contexts, such as measures and money. Pupils should also be introduced to the division of decimal numbers by one-digit whole numbers and, initially, in practical contexts involving measures and money. They should recognise division calculations as the inverse of multiplication. Pupils should 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.

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Ratio and proportion Pupils should be taught to: § 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 § solve problems involving similar shapes where the scale factor is known or can be found § solve problems involving unequal sharing and grouping using knowledge of fractions and multiples.	**Ratio and proportion** Pupils should recognise proportionality in contexts when the relations between quantities are in the same ratio (e.g. similar shapes, recipes). Pupils link percentages or 360° to calculating angles of pie charts. 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 solve problems involving unequal quantities, for example, 'for every egg you need three spoonfuls of flour', '$^{3}/_{5}$ of the class are boys'. These problems are the foundation for later formal approaches to ratio and proportion.
Algebra Pupils should be taught to: § 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	**Algebra** 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 (e.g. a + b = b + a) § generalisations of number patterns § number puzzles (e.g. what two numbers can add up to).
Measurement Pupils should be taught to: § 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 § convert between miles and kilometres § recognise that shapes with the same areas can have different perimeters and vice versa § recognise when it is necessary to use the formulae for area and volume of shapes § calculate the area of parallelograms and triangles § calculate, estimate and compare volume of cubes and cuboids using standard units, including centimetre cubed (cm^3) and cubic metres (m^3) and extending to other units, such as mm^3 and km^3.	**Measurement** Pupils connect conversion (for example, from kilometres to miles) to graphical representation as preparation for understanding linear/proportional graphs. They should know approximate conversions and be able to tell if an answer is sensible. Using the number line, pupils should use, add and subtract positive and negative integers for measures such as temperature. They should relate the area of rectangles to parallelograms and triangles, for example, by dissection, and be able to calculate their areas, understanding and using the formula (in words or symbols) to do this. Pupils could be introduced to other compound units for speed, such as miles per hour, and apply their knowledge in science or other subjects as appropriate.
Geometry - properties of shapes Pupils should be taught to: § 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,	**Geometry - properties of shapes** Pupils should draw shapes and nets accurately, using measuring tools and conventional markings and labels for lines and angles. Pupils should describe the properties of shapes and explain how unknown angles and lengths can be derived from known measurements. These relationships might be expressed algebraically for example, d=2 x r, a=180 – (b+c)

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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, and are vertically opposite, and find missing angles	
Geometry – position and direction Pupils should be taught to: § 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.	**Geometry – position and direction** Pupils should 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 should 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.
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.	**Statistics** Pupils should connect their work on angles, fractions and percentages to the interpretation of pie charts. Pupils should both encounter and draw graphs relating two variables, arising from their own enquiry and in other subjects. They should connect conversion from kilometres to miles in measurement to its graphical representation. Pupils should know when it is appropriate to find the mean of a data set.