St Joseph's Catholic Primary School, Worcester

'Following Jesus in all we do'

MATHEMATICS CURRICULUM

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ST JOSEPH'S CATHOLIC PRIMARY SCHOOL CURRICULUM

At St Joseph's it is our aim in the teaching and learning of mathematics to ensure:

- A positive attitude towards mathematics for both children and those who are engaged in the teaching of mathematics.
- An awareness of the fascination of mathematics.
- Competence and confidence in mathematical knowledge, skills and concepts.
- An understanding of mathematics through a process of enquiry and experiment.
- An ability to solve problems, to reason, to think logically and to work systematically and accurately.
- An ability to work both independently and in co-operation with others.
- An ability to communicate mathematics.
- An ability to use and apply mathematics across the curriculum and in real life situations.

The programme of study is set out year-by-year for Key Stages 1 and 2. Teachers in each year group will have the ability to develop the programme to ensure the schools aims are achieved and incorporate the programme of study in the cross curriculum topics for the year group. Teachers however must ensure that whilst incorporating units within their topic that all children are provided with challenging activities.

Our mathematics curriculum will follow the aims set out in the National Curriculum 'Mathematics programme of study for Key Stage one and two.'

New National Curriculum Purpose of Study

Mathematics is a creative and highly inter-connected discipline that has been developed over centuries, providing the solution to some of history's most intriguing problems. It is essential to everyday life, critical to science, technology and engineering, and necessary in most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, and a sense of enjoyment and curiosity about the subject.

Aims

The National Curriculum for mathematics aims to ensure that all pupils:

- become **fluent** in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils have conceptual understanding and are able to recall and apply their knowledge rapidly and accurately to problems
- **reason mathematically** by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument,

justification or proof using mathematical language
- can **solve problems** by applying their mathematics to a variety of routine and non- routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.

The programmes of study are organised in a distinct sequence and structured into separate domains. Pupils should make connections across mathematical ideas to develop fluency, mathematical reasoning and competence in solving increasingly sophisticated problems. They should also apply their mathematical knowledge to science and other subjects.

Information and communication technology

Calculators should not be used as a substitute for good written and mental arithmetic. They should therefore only be introduced near the end of Key Stage 2 to support pupils' conceptual understanding and exploration of more complex number problems, if written and mental arithmetic are secure. In both primary and secondary schools, teachers should use their judgement about when ICT tools should be used.

Spoken language

The National Curriculum for mathematics reflects the importance of spoken language in pupils' development across the whole curriculum – cognitively, socially and linguistically. The quality and variety of language that pupils hear and speak are key factors in developing their mathematical vocabulary and presenting a mathematical justification, argument or proof. They must be assisted in making their thinking clear to themselves as well as others and teachers should ensure that pupils build secure foundations by using discussion to probe and remedy their misconceptions.

Attainment targets
By the end of each key stage, pupils are expected to know, apply and understand the matters, skills and processes specified in the relevant programme of study.

(Department of Education 2014)

Key Stage 1

The principal focus of mathematics teaching in Key Stage 1 is to ensure that pupils develop confidence and mental fluency with whole numbers, counting and place value. This should involve working with numerals, words and the four operations, including with practical resources (e.g. concrete objects and measuring tools).

At this stage, pupils should develop their ability to recognise, describe, draw, compare and sort different shapes and use the related vocabulary. Teaching should also involve using a range of measures to describe and compare different quantities such as length, mass, capacity/volume, time and money.

By the end of Year 2, pupils should know the number bonds to 20 and be precise in using and understanding place value. An emphasis on practice at this early stage will aid fluency.

Pupils should read and spell mathematical vocabulary, at a level consistent with their increasing word reading and spelling knowledge at Key Stage 1.

(Department of Education 2014)

Year One (statutory requirements)

Number System

Place Value

count to and across 100, forwards and backwards, beginning with 0 or 1, or from any given number	Pupils should practice counting (1, 2, 3), ordering (e.g. first, second, third), or to indicate a quantity (e.g. 3 apples, 2 centimetres), including solving simple concrete problems, until they are fluent.
Count, read and write numbers to 100 in numerals,	
Count in different multiples including ones, twos, fives and tens.	
given a number, identify one more and one less	They should practice counting as reciting numbers and counting as enumerating objects, and counting in ones, twos, fives and tens from different multiples to develop their recognition of patterns in the number system (e.g. odd and even numbers). They connect these patterns with objects and with shapes, including through varied and frequent practice of increasingly complex questions.
identify and represent numbers using concrete objects and pictorial representations including the number line, and use the language of: equal to, more than, less than (fewer), most, least	
	Pupils begin to recognise place value in numbers beyond 20 by reading, writing, counting and comparing numbers up to 100, supported by concrete objects and pictorial representations.

Addition and Subtraction

read and write numbers from 1 to 20 in digits and words	Pupils should memories and reason with number bonds to 10 and 20 in several forms (e.g. 9 + 7 = 16; 16 – 7 = 9; 7 = 16 - 9). They should realise the effect of adding or subtracting zero.
read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs,	
represent and use number bonds and related subtraction facts within 20	Pupils should combine and increase numbers, counting forwards and backwards.
add and subtract one-digit and two-digit numbers to 20 (9 + 9, 18 - 9), including zero	They should discuss and solve problems in familiar practical contexts, including using quantities. Problems should include the terms put together, add, altogether, total, take away, difference between, more than and less than so that pupils develop the concept
solve simple one-step problems that involve addition and subtraction, using concrete objects	

and pictorial representations, and missing number problems.	of addition and subtraction and are enabled to use these operations flexibly.

Multiplication and Division

solve simple one-step problems involving multiplication and division, calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.	Through grouping and sharing small quantities, pupils should begin to understand multiplication and division; doubling numbers and quantities, and finding simple fractions of objects, numbers and quantities. They should make connections between arrays, number patterns, and counting in twos, fives and tens.

Fractions

recognise, find and name a half as one of two equal parts of an object, shape or quantity. recognise, find and name a quarter as one of four equal parts of an object, shape or quantity.	Pupils should be taught $^1/_2$ and $^1/_4$ as operators on discrete and continuous quantities by solving problems using shapes, objects and quantities. For example, they could recognise and find half a length, quantity, set of objects or shape. Pupils connect halves and quarters to the equal sharing and grouping of sets of objects and to measures, as well as recognising and combining halves and quarters as parts of a whole.

Measures

compare, describe and solve practical problems for: lengths and heights (e.g. long/short, longer/shorter, tall/short, double/half) compare, describe and solve practical problems for mass or weight (e.g. heavy/light, heavier than, lighter than) compare, describe and solve practical problems for capacity/volume (full/empty, more than, less than, quarter) time (quicker, slower, earlier, later) measure and begin to record the following: lengths and heights, measure and begin to record the following mass/weight Measure and begin to record capacity and volume recognise and know the value of different denominations of coins and notes sequence events in chronological order using language such as: before and after, next, first, today, yesterday, tomorrow, morning, afternoon and evening, recognise and use language relating to dates, including days of the week, weeks, months and years,	The terms mass and weight, volume and capacity are used interchangeably at this stage Pupils should move from using and comparing different types of quantities and measures using non-standard units, including discrete (e.g. counting) and continuous (e.g. liquid) measures, to using manageable common standard units. They should understand the difference between non-standard and standard units. In order to become familiar with standard measures, pupils begin to use measuring tools such as a ruler, weighing scales and containers. Pupils should use the language of time, including telling the time throughout the day, first using o'clock and then half past.

tell the time to the hour and half past the hour and draw the hands on a clock face to show these times.	
Geometry: properties of Shape Recognise and name common 2-D and 3-D shapes, including 2-D shapes [for example, rectangles (including squares), circles and triangles]. Recognise and name common 2-D and 3-D shapes, including 3-D shapes [for example, cuboids (including cubes), pyramids and spheres].**position, direction, motion** describe position, directions and movements, including half, quarter and three-quarter turns.	**Geometry: properties of Shape** Pupils should handle common 2-D and 3-D shapes, naming these and related everyday objects fluently. They should recognise these shapes in different orientations and sizes, and know that rectangles, triangles, cuboids and pyramids can be different shapes. Pupils should create copy, describe and reorganize patterns. They should use the language of position, direction and motion, including: left and right, top, middle and bottom, on top of, in front of, above, between, around, near, close and far, up and down, forwards and backwards, inside and outside. **Geometry: position, direction, motion** Pupils should make turns to show they understand half, quarter and three-quarter turns and routinely make these turns in a clockwise direction

Year Two

Number System

Number and Place Value

count in steps of 2, 3, and 5 from 0, and count in tens from any number, forward or backward recognise the place value of each digit in a two-digit number (tens, ones) identify, represent and estimate numbers using different representations, including the number line compare and order numbers from 0 up to 100; use greater than, less than and = signs read and write numbers to at least 100 in numerals and in words use place value and number facts to solve problems.	Using materials and a range of representations, pupils should practise counting, reading, writing and comparing numbers to at least 100 and solving a variety of related problems to develop fluency. They should count in multiples of three to support their later understanding of a third. As they become more confident with numbers up to 100, pupils should be introduced to larger numbers to develop further their recognition of patterns within the number system and represent them in different ways, including spatial representations. Pupils should partition numbers in different ways (e.g. 23 = 20 + 3 and 23 = 10 + 13) to support subtraction. They become fluent and apply their knowledge of numbers to reason with, discuss and solve problems that emphasise the value of each digit in two-digit numbers. They begin to understand zero as a place holder.

Addition and Subtraction

using concrete objects and pictorial representations, including those involving numbers, quantities and measures applying their increasing knowledge of mental and written methods recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100	Pupils should extend their understanding of the language of addition and subtraction to include sum and difference. Pupils should practise addition and subtraction to 20 to become increasingly fluent in deriving facts such as using 3 + 7 = 10, 10 - 7 = 3 and 7 = 10 - 3 to calculate 30 + 70 = 100, 100 - 70 = 30 and 70 = 100 - 30. They should check their calculations,

	adding numbers in a different order to check addition (e.g. 5 + 2 + 1 = 1 + 5 + 2 = 1 + 2 + 5).
add and subtract numbers using concrete objects, pictorial representations, and mentally, including: a two-digit number and ones Add and subtract numbers using concrete objects, pictorial representations, and mentally, including a two-digit number and tens. Add and subtract numbers using concrete objects, pictorial representations, and mentally, including two two-digit numbers Add and subtract numbers using concrete objects, pictorial representations, and mentally, including adding three one-digit numbers Show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot. Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems. .	Recording addition and subtraction in columns supports place value and prepares for efficient written methods with larger numbers.

Multiplication and Division

Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot Solve one-step problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.	Pupils should use a variety of language to describe multiplication and division. They are taught multiplication and division with larger numbers through equal grouping and sharing out quantities, relating multiplication tables to arrays and repeated addition and finding more complex fractions of objects, numbers and quantities. Pupils should be introduced to the multiplication tables. They should practise to become fluent in the 2, 5 and 10 multiplication tables and connect them to each other. They connect the 10 multiplication table to place value, and the 5 multiplication table to the divisions on the clock face. They begin to use other multiplication tables and recall multiplication facts, including using related division facts to perform written and mental calculations. Pupils should work with a range of materials and contexts in which multiplication and division relate to grouping and sharing discrete and continuous quantities, relating these to fractions and measures (e.g. 40 ÷ 2 = 20, 20 is a half of 40). They use commutativity and inverse relations to develop multiplicative reasoning (e.g. 4 × 5 = 20 and 20 ÷ 5 = 4).

Fractions

Recognise, find, name and write fractions $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{4}$ and /4 of a length, shape, set of objects or quantity.	Pupils should use additional fractions as operators on discrete and continuous quantities by solving problems using shapes, objects and quantities. They connect unit fractions to equal sharing and grouping, to numbers when they can be

Write simple fractions e.g. $^1/_2$ of 6 = 3 and recognise the equivalence of two quarters and one half.

calculated, and to measures, finding fractions of lengths, quantity, a set of objects or shapes. They meet $^3/_4$ as the first example of a non-unit fraction.

Pupils should count in fractions up to 10, starting from any number and using the $^1/_2$ and $^2/_4$ equivalence on the number line (e.g. $1^1/_4$, $1^2/_4$, (or $1^1/_2$), $1^3/_4$, 2). This reinforces the concept of fractions as numbers and that they can add up to more than one.

Measures

choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm); mass (kg/g); temperature (°C); capacity (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels

compare and order lengths, mass, volume/capacity and record the results using >, < and =

recognise and use symbols for pounds (£) and pence (p); combine amounts to make a particular value
Find different combinations of coins to equal the same amounts of money; add and subtract money of the same unit, including giving change

solve simple problems in a practical context involving addition and subtraction of money
compare and sequence intervals of time

tell and write the time to five minutes, including quarter past/to the hour and draw the hands on a clock face to show these times.
Know the number of minutes in an hour and the number of hours in a day.

Geometry: properties of shapes
identify and describe the properties of 2-D shapes, including the number of sides and symmetry in a vertical line
identify and describe the properties of 3-D shapes, including the number of edges, vertices and faces
identify 2-D shapes on the surface of 3-D shapes, for example a circle on a cylinder and a triangle on a pyramid
compare and sort common 2-D and 3-D shapes and everyday objects.
Geometry: position, direction, motion

Pupils should use standard units of measurement with increasing accuracy, using their knowledge of the number system. They should use the appropriate language and record using standard abbreviations.

They should become fluent in telling the time on analogue clocks and recording it.

Pupils should also become fluent in counting and recognising coins. They should use the symbols £ and p accurately and say the amounts of money confidently

Geometry: properties of shapes
Pupils should handle and name a wider variety of common 2-D and 3-D shapes including: quadrilaterals and cuboids, prisms, cones and polygons, and identify the properties of each shape (e.g. number of sides, number of faces). Pupils identify, compare and sort shapes on the basis of their properties and use vocabulary precisely, such as sides, edges, vertices and faces.
Pupils should read and write names for shapes that are appropriate for their word reading and spelling.
Pupils should draw lines and shapes using a straight edge.
Geometry: position, direction, motion

order and arrange combinations of mathematical objects in patterns use mathematical vocabulary to describe position, direction and movement, including distinguishing between rotation as a turn and in terms of right angles for quarter, half and three-quarter turns (clockwise and anti-clockwise), and movement in a straight line	Pupils should work with patterns ot shapes, including those in different orientations. Pupils should use the concept and language of angles to describe 'turn' by applying rotations, including in practical contexts (e.g. pupils themselves moving in turns, giving instructions to other pupils to do so, and programming robots using instructions given in right angles).

Statistics

interpret and construct simple pictograms, tally charts, block diagrams and simple tables ask and answer simple questions by counting the number of objects in each category and sorting the categories by quantity ask and answer questions about totalling and compare categorical data.	At this stage, pupils' recording and interpretation become more sophisticated as they collate, organise and compare information (e.g. using many-to-one correspondence in pictograms and using simple ratios 2, 5, 10).

KEY STAGE TWO Programme of Study

Lower Key Stage 2 – Years 3-4

The principal focus of mathematics teaching in lower Key Stage 2 is to ensure that pupils become increasingly fluent with whole numbers and the four operations, including number facts and the concept of place value. This should ensure that pupils develop efficient written and mental methods and perform calculations accurately with increasingly large whole numbers.

At this stage, pupils should develop their ability to solve a range of problems, including with simple fractions and decimal place value. Teaching should also ensure that pupils draw with increasing accuracy and develop mathematical reasoning so they can analyse shapes and their properties, and confidently describe the relationships between them. It should ensure that they can use measuring instruments with accuracy and make connections between measure and number.

By the end of Year 4, pupils should have memorised their multiplication tables up to and including the 12 multiplication table and show precision and fluency in their work.

Pupils should read and spell mathematical vocabulary correctly and confidently, using their growing word reading knowledge and their knowledge of spelling.

Upper Key Stage 2 – Years 5-6

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.

(Department of Education 2013)

Year Three

Number System

Number, place value and rounding

count from 0 in multiples of 4, 8, 50 and 100; Find 10 or 100 more or less than a given number	Pupils should work with larger numbers, applying partitioning related to place value using varied and increasingly complex problems, building on work in Year 2 (e.g. 46 = 40 and 6, 46 = 30 and 16).
recognise the place value of each digit in a three-digit number (hundreds, tens, ones)	

compare and order numbers up to 1000 identify, represent and estimate numbers using different representations	Using a variety of representations, including those related to measure, pupils should continue to count in ones, tens and hundreds, so that they become fluent in the order and place value of numbers to 1000.
read and write numbers to at least 1000 in numerals and in words solve number problems and practical problems involving working with and estimating numbers up to 1000 in a variety of units.	

Addition and Subtraction

add and subtract numbers mentally, including: a three-digit number and ones Add and subtract numbers mentally, including three-digit number and tens. Add and subtract numbers mentally, including three-digit number and hundreds.	Pupils should practise solving varied addition and subtraction questions. For mental calculations with two-digit numbers, the answers could exceed 100. Pupils should use their understanding of place value and partitioning, and practise using columnar addition and subtraction with increasingly large numbers up to three digits to become fluent
add and subtract numbers with up to three digits, using the efficient written methods of columnar addition and subtraction	
estimate the answer to a calculation and use inverse operations to check answers solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction.	

Multiplication and Division

recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables	Pupils should continue to practise their mental recall of multiplication tables when they are calculating mathematical statements in order to improve fluency. Through doubling, they connect the 2, 4 and 8 multiplication tables. Pupils should develop efficient mental methods, for example, using commutativity (e.g. $4 \times 12 \times 5 = 4 \times 5 \times 12 = 20 \times 12 = 240$) and multiplication and division facts (e.g. using $3 \times 2 = 6$, $6 \div 3 = 2$ and $2 = 6 \div 3$) to derive related facts ($30 \times 2 = 60$, $60 \div 3 = 20$ and $20 = 60 \div 3$). Pupils should develop reliable written methods for multiplication
write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to efficient written methods solve problems, including missing number problems, involving multiplication and division, including integer scaling problems and correspondence problems in which n objects	

Fractions:

count up and down in tenths; recognise that tenths arise from dividing an object into 10 equal parts and in dividing one-digit numbers or quantities by 10	Pupils should connect tenths to place value and decimal measures, not restricted to decimals between 0 and 1 inclusive and to division by 10. They should begin to understand unit and non-unit fractions as numbers on the number line, and deduce relations between them, such as size and equivalence. They should go beyond the [0, 1] interval, and $^1/4 + {}^3/4 = 1$ for example, relating this to measure.
recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators	
recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators	
recognise and show, using diagrams, equivalent fractions with small denominators add and subtract fractions with the same denominator within	Pupils should understand the relation between unit fractions as operators and division by integers. They should continue to recognise fractions in the

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one whole (e.g. $^5/7 + {}^1/7 = {}^6/7$) compare and order unit fractions with the same denominator solve problems that involve all understanding of fractions.	context of parts of a whole, numbers, measurements, a shape, or unit fractions as a division of a quantity. Pupils should practise adding and subtracting fractions with the same denominator through a variety of increasingly complex problems to improve fluency.

Measures

measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml) measure the perimeter of simple 2-D shapes add and subtract amounts of money to give change, using both £ and p in practical contexts tell and write the time from an analogue clock, including using Roman numerals from I to XII, and 12-hour and 24- hour clocks estimate and read time with increasing accuracy to the nearest minute; record and compare time in terms of seconds, minutes, hours and o'clock; use vocabulary such as a.m./p.m., morning, afternoon, noon and midnight know the number of seconds in a minute and the number of days in each month, year and leap year compare durations of events, for example to calculate the time taken by particular events or tasks **Geometry: properties of shapes** draw 2-D shapes and make 3-D shapes using modelling materials; recognise 3-D shapes in different orientations; and describe them with increasing accuracy recognise angles as a property of shape or description of a turn identify right angles, recognise that two right angles make a half-turn, three make three quarters of a turn and four a complete turn; identify whether angles are greater than or less than a right angle identify horizontal, vertical, perpendicular and parallel lines in relation to other lines. .	Pupils should continue to measure using the appropriate tools and units, progressing to using a wider range of measures, including comparing and using mixed units (e.g. 1 kg and 200g) and simple equivalents of mixed units (e.g. 5m = 500cm). The comparison of measures should also include simple scaling (e.g. a given quantity or measure is twice as long or five times as high) and connect this to multiplication. Pupils should continue to become fluent in recognising the value of coins, by adding and subtracting amounts, including mixed units, and giving change using manageable amounts. They should record £ and p separately. The decimal recording of money is introduced formally in Year 4. Pupils should use both analogue and digital 12-hour clocks and record their times. In this way they become fluent in and prepared for using digital 24-hour clocks in Year 4. **Geometry: properties of shapes** Pupils' knowledge of the properties of shapes is extended at this stage to symmetrical and non-symmetrical polygons and polyhedra. Pupils extend their use of the properties of shapes. They should be able to describe the properties of 2-D and 3-D shapes using accurate language, including lengths of lines and acute and obtuse for angles greater or lesser than a right angle. Pupils should draw and measure straight lines in centimetres.

Statistics

Interpret, construct and present data using bar charts, pictograms and tables solve one-step and two-step questions such as 'How many more?' and 'How many fewer?' using information presented in scaled bar charts and pictograms and tables.	Pupils should understand and use simple scales (e.g. 2, 5, 10 units per cm) in pictograms and bar charts with increasing accuracy. They should continue to interpret data presented in many contexts.

Number System

Number Place Vale

Count in multiples of 6, 7, 9, 25 and 1000. Find 1000 more or less than a given number. Count backwards through zero to include negative numbers. Recognise the place value of each digit in a four-digit number (thousands, hundreds, tens, and ones). Order and compare numbers beyond 1000. Identify, represent and estimate numbers using different representations. Round any number to the nearest 10, 100 or 1000. Solve number and practical problems that involve rounding, ordering and exploring negative numbers and with increasingly large positive numbers. Read Roman numerals to 100 (I to C) and know that over time, the numeral system changed to include the concept of zero and place value.	
add and subtract numbers with up to 4 digits using the efficient written methods of columnar addition and subtraction where appropriate estimate and use inverse operations to check answers to a calculation solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.	Pupils should continue to practise both mental methods and columnar addition and subtraction with increasingly large numbers to aid fluency.

Multiplication and Division

recall multiplication and division facts for multiplication tables up to 12 × 12 use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; use place value, known and derived facts to multiply and dividing by 1; use place value, known and derived facts to multiply and multiplying together three numbers recognise and use factor pairs and commutativity in mental calculations multiply two-digit and three-digit numbers by a one-digit number using formal written layout solve problems involving multiplying and adding, including using the distributive law and harder multiplication problems such as which n objects are connected to m objects.	Pupils should continue to practise recalling and using multiplication tables and related division facts to aid fluency. Pupils should practise mental methods and extend this to three- digit numbers to derive facts, for example 200 × 3 = 600 into 600 ÷ 3 = 200, to become fluent. Pupils should practise to become fluent in the efficient written method of short multiplication for multiplying using multi-digit numbers, and short division with exact answers when dividing by a one-digit number. Pupils should write statements about the equality of expressions (e.g. use the distributive law 39 × 7 = 30 × 7 + 9 × 7 and associative law (2 × 3) × 4 = 2 × (3 × 4)) Pupils should solve two-step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers. This should include

correspondence questions such as three cakes shared equally between 10 children.

Fractions

Recognise and show, using diagrams, families of common equivalent fractions. count up and down in hundredths; recognise that hundredths arise when dividing an object by a hundred and dividing tenths by ten solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities, including non-unit fractions where the answer is a whole number add and subtract fractions with the same denominator. Recognise and write decimal equivalents of any number of tenths or hundredths. Recognise and write decimal equivalents to 1/4, 1/2, 3/4. Find the effect of dividing a one- or two-digit number by 10 and 100, identifying the value of the digits in the answer as ones, tenths and hundredths. Round decimals with one decimal place to the nearest whole number. Compare numbers with the same number of decimal places up to two decimal places. Solve simple measure and money problems involving fractions and decimals to two decimal places.	Pupils should connect hundredths to tenths and place value and decimal measure. They should extend the use of the number line to connect fractions, numbers and measures. Pupils should understand the relation between non-unit fractions and multiplication and division of quantities, with particular emphasis on tenths and hundredths. Pupils should associate fractions of a length, of a shape and as a representation of one whole or set of quantities. Pupils should use factors and multiples to recognise equivalent fractions and simplify where appropriate (e.g. $^6/_9 = ^2/_3$ or $^1/_4 = ^2/_8$). Pupils should continue practice in adding and subtracting fractions with the same denominator, to become fluent through a variety of increasingly complex problems beyond one whole. They should practise counting using simple fractions and decimal fractions, both forwards and backwards.

Measures

convert between different units of measure (e.g. kilometre to metre; hour to minute) measure and calculate the perimeter of a rectilinear figure (including squares) in centimetres and metres find the area of rectilinear shapes by counting estimate, compare and calculate different measures, including money in pounds and pence read, write and convert time between analogue and digital 12 and 24-hour clocks solve problems involving converting from hours to minutes; minutes to seconds; years to months; weeks to days. **Geometry: properties of shapes** compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes identify acute and obtuse angles and compare and order angles up to two right angles by size identify lines of symmetry in 2-D shapes presented in different orientations	Pupils should use multiplication and their knowledge of place value to convert from larger to smaller units. They should relate area to arrays and multiplication. Pupils should build on their understanding of decimal notation to record measures. **Geometry: properties of shapes** Pupils should continue to classify shapes using geometrical properties, extending to classifying different triangles (e.g. isosceles, equilateral, scalene) and quadrilaterals (e.g. parallelogram, rhombus, trapezium). Pupils should compare and order angles in preparation for using a protractor and compare lengths and angles to decide if a polygon is regular or irregular. Pupils should draw symmetric patterns using a variety of media to become familiar with different

complete a simple symmetric figure with respect to a specific line of symmetry.

Geometry: position, direction, motion

describe positions on a 2-D grid as coordinates in the first quadrant

describe movements between positions as translations of a given unit to the left/right and up/down

plot specified points and draw sides to complete a given polygon.

orientations ot lines ot symmetry; and recognise line symmetry in a variety of diagrams.

Geometry: position, direction, motion

Pupils should draw a pair of axes in one quadrant, with equal scales and integer labels. They should read, write and use pairs of coordinates (2, 5), including using coordinate-plotting ICT tools.

Statistics

Interpret, construct and present discrete data using bar charts and continuous data using line graphs

solve comparison, sum and difference problems using information presented in bar charts, pictograms, tables and simple line graphs.

Pupils should understand and use a greater range of scales in their representations. Pupils should begin to relate the graphical representation of data to recording change over time.

Year Five

Number System

Number, place value, approximation and estimation

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 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 numbers up to 100000, negative numbers, rounding or jumping in steps.

read Roman numerals to 1000 (M) and recognise years written in Roman numerals

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 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

Addition and subtraction

add and subtract whole numbers with more than 4 digits, including using efficient 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.

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

They should practise mental calculations with increasingly large numbers to aid fluency (e.g. 12 462 – 2 300 = 10 162).

Multiplication and Division

identify multiples and factors, including finding all factor pairs of a number and common factors of two numbers.	Pupils should practise and extend their use of the efficient 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.
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	They should use and understand the terms factor, multiple and prime, square and cube numbers.
multiply numbers up to 4 digits by a one- or two-digit number using an efficient written method, including long multiplication for two-digit numbers	Pupils should 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 (e.g. $98 \div 4 = 24 \text{ r } 2 = 24^1/2 = 24.5 \approx 25$).
multiply and divide numbers mentally drawing upon known facts	
divide numbers up to 4 digits by a one-digit number using the efficient written method of short division and interpret remainders appropriately for the context	Pupils use multiplication and division as inverses to support the introduction of ratio in Year 6, for example, by multiplying and dividing by powers of 10 in scale drawings or by multiplying and dividing by powers of a 1000 in converting between units such as kilometres and metres.
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

compare and order fractions whose denominators are all multiples of the same number	Pupils should connect equivalent fractions >1 that simplify to integers with division and fractions >1 to division with remainders, using the number line and other models, and hence move from these to improper and mixed fractions.
Identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths.	
Recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements greater than 1 as a mixed number [for example, 2/5 + 4/5 = 6/5 = 1 1/5].	Pupils should connect multiplication by a fraction to using fractions as operators, and to division, building on work from previous years. This relates to scaling by simple fractions.
Add and subtract fractions with the same denominator and denominators that are multiples	They should extend their knowledge of fractions to thousandths and connect to decimals and measures. Pupils continue to develop their understanding of fractions as numbers, measures

Multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams.	and operators by finding fractions of numbers and quantities, writing remainders as a fraction.

Pupils should practise adding and subtracting fractions to become fluent through a variety of increasingly complex problems. They should extend their understanding of adding and subtracting fractions to calculations that exceed 1 as a mixed number.

Pupils should read and write proper fractions and mixed numbers accurately and continue to practise counting forwards and backwards with mixed fractions |

Decimals Fractions Percenatges

read and write decimal numbers as fractions (e.g. 0.71 = $^{71}/_{100}$)

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

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.

solve problems involving number up to three decimal places.

Solve problems which require knowing percentage and decimal equivalents of 1/2, 1/4, 1/5, 2/5, 4/5 and those fractions with a denominator of a multiple of 10 or 25. | Pupils extend counting from Year 4, using decimals and fractions including bridging zero, for example on a number line.

They should add and subtract decimals including a mix of whole numbers and decimals, decimals with different numbers of decimal places, and complements of 1 (e.g. 0.83 + 0.17 = 1).
They should mentally add and subtract tenths, and one-digit whole numbers and tenths.
Pupils should say, read and write decimal fractions and related tenths, hundredths and thousandths accurately and be confident in checking the reasonableness of their answers to problems. Pupils should go beyond the measurement and money models of
decimals, for example by solving puzzles involving decimals. |

Measures

convert between different units of measure (e.g. kilometre and metre; metre and centimetre; centimetre and millimetre; kilogram and gram; litre and millilitre)

understand and use basic equivalences between metric and common imperial units and express them in approximate terms
measure and calculate the perimeter of composite rectilinear shapes in centimetres and metres

 calculate and compare the area of squares and rectangles
including using standard units, square

centimetres (cm^2) and square metres (m^2) and | Pupils should use their knowledge of place value and multiplication and division to convert between standard units.

Pupils should calculate the perimeter of rectangles and related composite shapes, including using the relations of perimeter or area to find unknown lengths. Missing number questions such as these are the beginning of algebraic understanding. They should also calculate the area of scale drawings using given measurements.

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

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estimate the area of irregular shapes	
estimate volume (e.g. using 1 cm^3 blocks to build cubes and cuboids) and capacity (e.g. using water)	
solve problems involving converting between units of time	
solve problems involving addition and subtraction of units of measure (e.g. length, mass, volume, money) using decimal notation.	**Geometry: properties of shapes** Pupils should 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.
Use all four operations to solve problems involving measure [for example, length, mass, volume, money] using decimal notation, including scaling. **Geometry: properties of shapes** identify 3-D shapes, including cubes and cuboids, from 2-D representations	Pupils should use the term diagonal and make conjectures about the angles formed by diagonals and 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.
know angles are measured in degrees; estimate and compare acute, obtuse and reflex angles.	
Draw given angles, and measure them in degrees (°).	
Identify angles at a point and one whole turn (total 360°).	
Identify angles at a point on a straight line and a turn (total 180°).	
Identify other multiples of 90°.	
Use the properties of rectangles to deduce related facts and find missing lengths and angles.	**Geometry: position, direction, motion**
Distinguish between regular and irregular polygons based on reasoning about equal sides and angles.	Pupils should 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
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.	

Statistics

solve comparison, sum and difference problems using information presented in line graphs complete, read and interpret information in tables, including timetables.	Pupils should connect their work on coordinates and scales to their interpretation of time graphs using ICT tools, except where data are easily calculable. They should begin to decide which representations of data are most appropriate and why

Year Six

Number System

Number, place value and rounding

read, write, order and compare numbers up to 10 000 000 and determine the value of each digit	Pupils should use the whole number system, including saying, reading and writing numbers accurately.

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.

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 efficient 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, levels of accuracy.

Pupils should practise addition, subtraction, multiplication and division for larger numbers, using the efficient 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.

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.

Fractions

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 to calculate decimal fraction equivalents (e.g. 0.375) for a

simple fraction (e.g. $^3/_8$)

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. $^1/_4 \times ^1/_2 = ^1/_8$)

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 with simple fractions and decimal fraction equivalents to aid fluency, including listing equivalent fractions to identify fractions with common denominators. Denominators of given fractions should not exceed 12, with the exception of 100 and 1000.

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,

divide proper fractions by whole numbers (e.g. $1/3 \div 2 = 1/6$). Associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction [for example, 3/8].	pupils should learn about rounding the decimal to three decimal places. 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, as numbers, and as equal parts of objects, for example as parts of a rectangle.

Decimals and fractions

identify the value of each digit to three decimal places and multiply and divide numbers by 10, 100 and 1000 where the answers are 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.	Pupils should begin to 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 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. Pupils should understand that calculating a percentage of a quantity is the same as calculating a fraction of a quantity.

Percentages, decimals and fractions 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 of whole numbers or measures 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.	Pupils should consolidate their understanding of ratio when comparing quantities, sizes and scale drawings by solving a variety of problems. They may use the notation a:b to record their work. Pupils should recognise proportionality in contexts when the relations between quantities are in the same ratio (e.g. similar shapes, recipes).

Algebra

. Use simple formulae. Generate and describe linear number sequences.	Pupils should be introduced to the use of symbols and letters to represent variables and unknowns in

Express missing number problems algebraically.
Find pairs of numbers that satisfy an equation with two unknowns
Enumerate possibilities of combinations of two variables.

understand, such as:
missing numbers, lengths, coordinates and angles
formulae in mathematics and science
arithmetical rules (e.g. $a + b = b + a$)
generalisations of number patterns
number puzzles (e.g. what two numbers can add up to).

Measures

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
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 centimetre cubed (cm^3) and cubic metres (m^3) and extending to other units, such as mm^3 and km^3.

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

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

They should relate the area of rectangles to parallelograms and triangles, and be able to calculate their areas, understanding and using the formula 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
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
. 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.

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.

Geometry: position, direction, motion

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.

Statistics

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

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 measure to its graphical representation. Pupils should know when it is appropriate to find the mean of a data set.