

Curriculum Intent – Knowledge Builder

Mathematics- Primary Curriculum

Subject Intent Statement:

Our aim is to ensure our pupils are given the tools to become enthusiastic and confident mathematicians. By following this progressive curriculum, they will: -

- **become fluent** in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.
- **reason mathematically** by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language
- **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.

Year 1

Key knowledge

Pupils will know how to: -

- count to and across 100, forwards and backwards, beginning with 0 or 1, or from any given number
- count, read and write numbers to 100 in numerals; count in multiples of twos, fives and tens
- given a number, identify one more and one less
- identify and represent numbers using objects and pictorial representations including the number line, and use the language of: equal to, more than, less than (fewer), most, least
- read and write numbers from 1 to 20 in numerals and words.
- read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs
- represent and use number bonds and related subtraction facts within 20
- add and subtract one-digit and two-digit numbers to 20, including zero
- solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as $7 = \square - 9$.
- solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.
- 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.
- compare, describe and solve practical problems for:
 - lengths and heights [for example, long/short, longer/shorter, tall/short, double/half]
 - mass/weight [for example, heavy/light, heavier than, lighter than]
 - capacity and volume [for example, full/empty, more than, less than, half, half full, quarter]
 - time [for example, quicker, slower, earlier, later]
- measure and begin to record the following:
 - lengths and heights

Year 2

Key knowledge

Pupils will know how to: -

- count in steps of 2, 3, and 5 from 0, and in tens from any number, forward and 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 <, > and = signs
- read and write numbers to at least 100 in numerals and in words
- use place value and number facts to solve problems.
- solve problems with 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
- add and subtract numbers using concrete objects, pictorial representations, and mentally, including:
 - a two-digit number and ones
 - a two-digit number and tens
 - two two-digit numbers
 - 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.

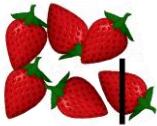
<ul style="list-style-type: none"> ▪ mass/weight ▪ capacity and volume ▪ time (hours, minutes, seconds) ▪ recognise and know the value of different denominations of coins and notes ▪ sequence events in chronological order using language [for example, before and after, next, first, today, yesterday, tomorrow, morning, afternoon and evening] ▪ recognise and use language relating to dates, including days of the week, weeks, months and years ▪ tell the time to the hour and half past the hour and draw the hands on a clock face to show these times. ▪ recognise and name common 2-D and 3-D shapes, including: <ul style="list-style-type: none"> ▪ 2-D shapes [for example, rectangles (including squares), circles and triangles] ▪ 3-D shapes [for example, cuboids (including cubes), pyramids and spheres]. ▪ describe position, direction and movement, including whole, half, quarter and three-quarter turns. 	<ul style="list-style-type: none"> ▪ 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 (\times), division (\div) 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 problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts. ▪ recognise, find, name and write fractions $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{4}$ and $\frac{3}{4}$ of a length, shape, set of objects or quantity ▪ write simple fractions for example, $\frac{1}{2}$ of 6 = 3 and recognise the equivalence of $\frac{2}{4}$ and $\frac{1}{2}$. ▪ choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm); mass (kg/g); temperature ($^{\circ}\text{C}$); 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 that equal the same amounts of money ▪ solve simple problems in a practical context involving addition and subtraction of money of the same unit, including giving change ▪ 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. ▪ identify and describe the properties of 2-D shapes, including the number of sides and line 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. ▪ order and arrange combinations of mathematical objects in patterns and sequences
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	<ul style="list-style-type: none"> ▪ use mathematical vocabulary to describe position, direction and movement, including movement in a straight line and distinguishing between rotation as a turn and in terms of right angles for quarter, half and three-quarter turns (clockwise and anti-clockwise). ▪ 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 comparing categorical data.
<p>Key skills</p> <p>Children will be able to count confidently to 100</p> <p>Children will be able to accurately write and form numbers to 100</p> <p>Children will be able to say what is 1 more or 1 less than a given number</p> <p>Children will be able to calculate and know simple number bonds</p> <p>Children understand how to complete simple addition sum, understanding that the answer will be a bigger number</p> <p>Children will be able to complete simple subtraction sums understanding that the answer will be a smaller number</p> <p>Children will be able to use objects and pictures to help them solve simple word problems</p> <p>Children will be able to complete simple multiplication sums using objects to help them</p> <p>Children will begin to understand how to measure length, height, weight and capacity</p> <p>Children will be able to read o'clock times</p> <p>Children will be able to name some 2D shapes</p> <p>Children will be able to identify the value of different coins</p> <p>Children will be able to use simple positional language</p> <p>Children will understand what half means</p> <p>children will be able to count in 1s from any number to 100 not just starting at 0 or 1</p> <p>Children can use a number line to represent numbers</p> <p>Children understand that they can share a number of objects between a different number of people</p> <p>Children can tell time to the half hour, reading o'clock and half past</p>	<p>Key skills</p> <p>Children will be able to count in different steps to ensure that they then make the link to multiplication</p> <p>Children will be able to complete of addition, subtraction and division sums using different strategies to ensure that all calculations are completed efficiently and effectively, giving children different options to choose from when calculating and solving problems.</p> <p>Pupils will become confident with mental methods to aid speed of calculation</p> <p>Pupils will begin to use more formal written methods to ensure they can approach more challenging calculations with confidence.</p> <p>Children will be equipped to solve problems and think mathematically when doing so.</p> <p>Understanding of fractions will enable children to make links with division calculations and to ensure that they develop their understanding of proportion.</p> <p>Understanding of measure – children will be able to use different equipment and apparatus to measure different objects, knowing which unit of measure and which equipment is appropriate to use.</p> <p>They will be able to read a variety of simple scales to ensure that they do not make errors when measuring and understand the importance of being able to know how long things are, how much weight they need, what capacity a cup or bottle needs to have and how the temperature affects their choice of clothing.</p> <p>Understanding of shape will ensure that the children know what shape an object needs to be for a particular purpose.</p> <p>Understanding of data will ensure that children can understand different charts and graphs and enable them to interpret these correctly and confidently.</p>
<p>Calculation strategies</p> <p><u>+ = signs and missing numbers</u></p> <p>Children need to understand the concept of equality before using the '=' sign. Calculations should be written either side of the equality sign so that the sign is not just interpreted as 'the answer'.</p> <p>2 = 1 + 1 2 + 3 = 4 + 1</p>	<p>Calculation strategies</p> <p><u>+ = signs and missing numbers</u></p> <p>Continue using a range of equations as in Year 1 but with appropriate, larger numbers to 100.</p> <p>Know and use number bonds to 20 fluently and related facts to 100.</p> <p>Add using concrete objects, pictorial representation and mentally.</p>

$$3 = 3$$

$$2 + 2 + 2 = 4 + 2$$

- Understand subtraction as 'take away'



- Find a 'difference' by counting up;

Multiplication is related to doubling and counting groups of the same size.



Looking at columns
 $2 + 2 + 2$
 3 groups of 2

Looking at rows
 $3 + 3$
 2 groups of 3

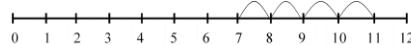
Counting using a variety of practical resources

Counting in 2s e.g. counting socks, shoes, animal's legs...
 Counting in 5s e.g. counting fingers, fingers in gloves, toes...
 Counting in 10s e.g. fingers, toes...

Addition

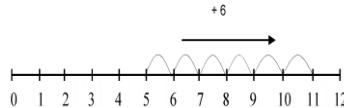
Children use a numbered line to count on in ones. Children use number lines and practical resources to support calculation and teachers demonstrate the use of the number line.

$$7 + 4$$



Subtraction

I have saved 5p. The socks that I want to buy cost 11p. How much more do I need in order to buy the socks?



Multiplication

There are 3 sweets in one bag.

How many sweets are there in 5 bags?

Arrays and repeated addition

- 4×2 or $4 + 4$
- 2×4 or $2 + 2 + 2 + 2$

Division - Sharing

Requires secure counting skills

Sharing – 6 sweets are shared between 2 people. How many do they have each?

$$6 + 7 = 7 + 6 \text{ (commutativity and associativity of addition)}$$

Extend to

$$14 + 5 = 10 + \square$$

$$24 + 30 =$$

$$23 + 32 =$$

$$3 + 6 + 7$$

and

$$32 + \square + \square = 100 \quad 35 = 1 + \square + 5$$

The steps in addition often bridge through a multiple of 10

e.g.

Children should be able to partition the 7 to relate adding the 2 and then the 5.

$$8 + 7 = 15$$

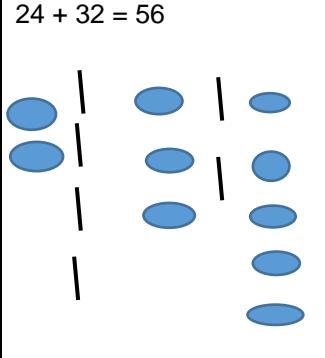
Partition into tens and ones and recombine

$$\begin{aligned} 12 + 23 &= 10 + 2 + 20 + 3 \\ &= 30 + 5 \\ &= 35 \end{aligned}$$

This method is used throughout the whole of year 2. Children are taught how to use place value counters to show the tens and ones in a number and use these to solve addition and subtraction problems. Children are shown a range of methods to solve various different calculations.

E.g.

$$24 + 32 = 56$$



- = signs and missing numbers

Continue using a range of equations as in Year 1 but with appropriate numbers.
 Recall and use number bonds to 20 fluently and related facts to 100.

$$10 - 3 = 7$$

$$100 - 30 = 70$$

Add using concrete objects, pictorial representation and mentally.

Recognise and use inverse relationship between addition and subtraction.

Find a small difference by counting up

$$42 - 39 = 3$$

Put 39 in your head, move your fingers as you count until you get to 42. You have moved 3 fingers so the difference is 3.

x = signs and missing numbers



Practical activities involving sharing, distributing cards when playing a game, putting objects onto plates, into cups, hoops etc.

Arrays and repeated addition

- $\square \quad \square \quad \square \quad 4 \times 2 \text{ or } 4 + 4$
- $\square \quad \square \quad \square \quad 2 \times 4 \text{ or } 2 + 2 + 2 + 2$

Count on in tens and ones

$$\begin{aligned} 23 + 12 &= 23 + 10 + 2 \\ &= 33 + 2 \\ &= 35 \end{aligned}$$

Partitioning and bridging through 10.

Language – sum of

Use known number facts and place value to subtract (partition second number only)

$$\begin{aligned} 37 - 12 &= 37 - 10 - 2 \\ &= 27 - 2 \\ &= 25 \end{aligned}$$

Bridge through 10 where necessary

$$32 - 17$$

Solve problems using concrete objects and pictorial representation, including those involving number, quantities and measures.

Recognise and use inverse relationship between addition and subtraction.

Extend to $14 + 5 = 20 - \square$

Language - difference

Recall and use multiplication facts for 2, 5 and 10 multiplication table.
Relate to odd and even numbers.

Children are taught to recognise the \times sign to mean 'lots of'. Children are shown how to create simple arrays (see Autumn term for repeated addition).

When confident, children move on to:

\times = signs and missing numbers

$$\begin{array}{ll} 7 \times 2 = \square & \square = 2 \times 7 \\ 7 \times \square = 14 & 14 = \square \times 7 \\ \square \times 2 = 14 & 14 = 2 \times \square \\ \square \times \square = 14 & 14 = \square \times \square \end{array}$$

$$3 \times 4 = 4 \times 3 \text{ (commutativity of multiplication)}$$

Use of inverse and relationship with division facts.

$$3 \times 4 = 12 \quad 12 \div 4 = 3$$

Doubling multiples of 5 up to 50

$$15 \times 2 = 30$$

Relate to inverse operation for halving.

\div = signs and missing numbers

$$\begin{array}{ll} 6 \div 2 = \square & \square = 6 \div 2 \\ 6 \div \square = 3 & 3 = 6 \div \square \\ \square \div 2 = 3 & 3 = \square \div 2 \\ \square \div \square = 3 & 3 = \square \div \square \end{array}$$

Use related facts from 2, 5 and 10 multiplication tables.

Grouping

Link to counting and understanding number strand

Count up to 100 objects by grouping them and counting in tens, fives or twos;
Find one half, one quarter and three quarters of shapes and sets of objects

Understand division as sharing and grouping

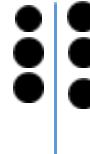
18 ÷ 3 can be modelled as:

Sharing – 18 shared between 3 (see Year 1 diagram)

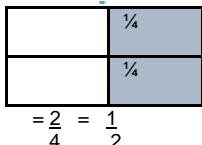
EQUIVALENCE

Write simple fractions

Eg $\frac{1}{2}$ of 6 = 3 so $6 \div 2 = 3$



Recognise the equivalence of $\frac{2}{4}$ and $\frac{1}{2}$



x = signs and missing numbers

Partition

Children need to be secure with partitioning numbers into 10s and 1s and partitioning in different ways: $6 = 5 + 1$
so
e.g. Double 6 is the same as double five add double one.

AND double 15
 $10 + 5$

OR
 $20 + 10 = 30$

$X 10 5$

$2 20 10 = 30$

Solve problems using multiplication, using materials, arrays, repeated addition, multiplication table facts, including problems in context.

÷ = signs and missing numbers

Solve problems involving division, using concrete materials, arrays, repeated subtraction, mental methods, and division facts Including problems in context – measures, money,

In the context of money count forwards and backwards using 2p, 5p and 10p coins

Practical grouping e.g. in PE 12 children get into teams of 4 to play a game. How many teams are there?

Count, number, equal to, more than, less than, most, least, subtract, add, problem, solve, measure, length, height, weight, hour, minute, days of the week, months of the year, left, right, turn, forward, backward, half, quarter, names of common 2D and 3D shapes	Place value, represent, estimate, number line, 1digit 2digit, inverse, multiplication, division, odd, even, array, repeated addition, fractions, equivalent, compare, total, metre, centimetre, kilogram, gram, litre, millilitre, Celsius, line of symmetry, edge, side, vertices, face, pictogram, block graph, table
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Key Stage 2

Lower Key Stage 2

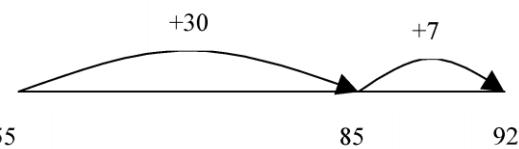
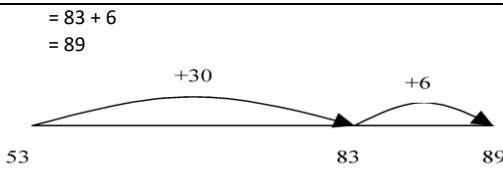
Year 3	Year 4
<p>Key Knowledge Pupils will know how to:</p> <ul style="list-style-type: none"> ▪ count from 0 in multiples of 4, 8, 50 and 100; find 10 or 100 more or less than a given number ▪ recognise the place value of each digit in a three-digit number (hundreds, tens, ones) ▪ compare and order numbers up to 1000 ▪ identify, represent and estimate numbers using different representations ▪ read and write numbers up to 1000 in numerals and in words ▪ solve number problems and practical problems involving these ideas. ▪ add and subtract numbers mentally, including: <ul style="list-style-type: none"> ▪ a three-digit number and ones ▪ a three-digit number and tens ▪ a three-digit number and hundreds ▪ add and subtract numbers with up to three digits, using formal 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 ▪ recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables ▪ 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 formal written methods ▪ solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects. ▪ 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 	<p>Key Knowledge Pupils will know how to:</p> <ul style="list-style-type: none"> ▪ 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 all of the above 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 formal 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. ▪ 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; dividing by 1; 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

<ul style="list-style-type: none"> ▪ 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 one whole [for example, $\frac{1}{4} + \frac{1}{4} = \frac{1}{2}$] ▪ compare and order unit fractions, and fractions with the same denominators ▪ solve problems that involve fractions. ▪ 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 and hours; use vocabulary such as o'clock, 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]. ▪ draw 2-D shapes and make 3-D shapes using modelling materials; recognise 3-D shapes in different orientations and describe them ▪ recognise angles as a property of shape or a 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 and vertical lines and pairs of perpendicular and parallel lines. ▪ interpret and present data using bar charts, pictograms and tables ▪ solve one-step and two-step questions [for example, 'How many more?' and 'How many fewer?'] using information presented in scaled bar charts and pictograms and tables. 	<ul style="list-style-type: none"> ▪ solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects. ▪ 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 one 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 $\frac{1}{4}, \frac{1}{2}, \frac{3}{4}$ ▪ 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. ▪ Convert between different units of measure [for example, 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 squares ▪ estimate, compare and calculate different measures, including money in pounds and pence ▪ 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 ▪ complete a simple symmetric figure with respect to a specific line of symmetry. ▪ 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.
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Key Skills

Key Skills

<p>Overarching Problem solving, justifying answer</p> <p>Subject specific</p> <p>Children can confidently count in steps of 4, 8, 50 and 100.</p> <p>Children can use their understanding of place value to find 10 or 100 more or less than any given number</p> <p>Children can order numbers to 1000 and represent them using their understanding of place value</p> <p>Children can complete calculations using 3-digit numbers across mathematical operations</p> <p>Children can use these calculation strategies and their mathematical understanding to solve word problems</p> <p>Children can compare different units of measure based on comparative size and their understanding of units of measure</p> <p>Children can draw 2D shapes accurately and understand and apply the term perimeter</p> <p>Children can read, understand and use Roman numerals</p> <p>Children can tell the time at 5 minute intervals</p> <p>Children can answer questions about data which has been presented in different forms</p> <p>Children can use more formal written methods to record their maths work including using the inverse operation and finding missing numbers to solve problems</p> <p>Children will confidently find change when calculating with money</p> <p>Children can identify right angles and apply them when describing turns</p> <p>Children will develop their understanding of fractions by counting in tenths and understanding that this comes from dividing an object into ten equal parts; finding fractions of objects and numbers</p>	<p>Key Skills: Overarching Problem solving demonstrating how problem was solved</p> <p>Subject specific</p> <p>Children can add and subtract fractions with the same denominator</p> <p>Children can count in hundredths</p> <p>Children can understand simple decimals and order numbers with 2 decimal places</p> <p>Children can compare and convert different units of measure and use different units of measure to solve problems.</p> <p>Children can use pounds and pence confidently</p> <p>Children can understand how to read a 24-hour clock and convert between that and a 12 hour clock</p> <p>Children can read and interpret different types of data which is displayed in different ways, drawing conclusions about what the data is showing them</p> <p>Children can spot factor pairs and use these and commutativity in mental calculations</p> <p>Children can demonstrate their understanding of equivalent fractions</p> <p>Children can find decimal equivalents of simple fractions</p> <p>Children can identify acute and obtuse angles</p> <p>Children can develop their understanding of geometric shapes and identify lines of symmetry in different orientations</p> <p>Children will be able to understand and use coordinates</p> <p>Children can count negative numbers</p> <p>Children can calculate area</p> <p>Children can understand movements as translations</p>
<p>Calculation Strategies</p> <p>Addition + = signs and missing numbers</p> <p>Continue using a range of equations as in Year 1 and 2 but with appropriate, larger numbers up to 3 digits.</p> <p>Mentally</p> <p>3 digit numbers and ones 234 + 7</p> <p>3 digit numbers and tens 234 + 20</p> <p>3 digit numbers and hundreds. 234 + 300</p> <p>Partition into tens and ones</p> <ul style="list-style-type: none"> Partition both numbers and recombine. Count on by partitioning the second number only e.g. $36 + 53 = 53 + 30 + 6$ 	<p>Calculation Strategies</p> <p>Addition and subtraction + = signs and missing numbers</p> <p>Continue using a range of equations as in previous years but with appropriate numbers up to 4 digits.</p> <p>Mental Strategies.</p> <p>Partition into hundreds, tens and ones and recombine</p> <p>Either partition both numbers and recombine or partition the second number only e.g. $\begin{aligned} 358 + 73 &= 358 + 70 + 3 \\ &= 428 + 3 \\ &= 431 \end{aligned}$</p>



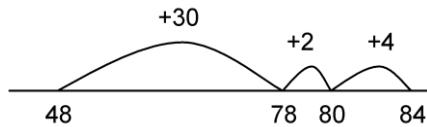
Add a near multiple of 10 to a two-digit number

Secure mental methods by using a number line to model the method. Continue as in Year 2 but with appropriate numbers

e.g. $35 + 19$ is the same as $35 + 20 - 1$.

Children need to be secure adding multiples of 10 to any two-digit number including those that are not multiples of 10.

$$48 + 36 = 84$$



Vertical expansion

$$\begin{array}{r} 83 \\ + 42 \\ \hline 125 \end{array} \quad \begin{array}{r} 83 \\ + 42 \\ \hline 125 \end{array} \quad \begin{array}{r} 83 \\ + 42 \\ \hline 1 \end{array}$$

3 digit example

$$\begin{array}{r} 235 \\ + 456 \\ \hline 691 \end{array}$$

Subtraction

- signs and missing numbers

Continue using a range of equations as in Year 1 and 2 but with appropriate, larger numbers up to 3 digits.

Mentally

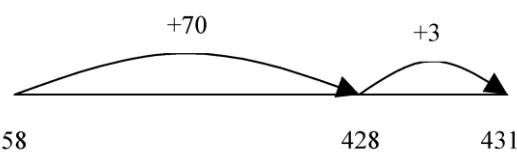
3 digit numbers and ones

$$234 - 7$$

3 digit numbers and tens

$$234 - 20$$

3 digit numbers and hundreds.



Add or subtract the nearest multiple of 10 or 100, then adjust

Continue as in Year 2, 3 and 4 but with appropriate numbers e.g. $458 + 79$ is the same as $458 + 80 - 1$

Pencil and paper procedures

$$367 + 185 = 431$$

either or

$$\begin{array}{r} 367 \\ + 185 \\ \hline 12 \\ 140 \\ 400 \\ 552 \end{array} \quad \begin{array}{r} 300 + 60 + 7 \\ 100 + 80 + 5 \\ 400 + 140 + 12 = 552 \end{array}$$

leading to

$$\begin{array}{r} 367 \\ + 185 \\ \hline 552 \\ 11 \end{array}$$

Extend to decimals in the context of money.

Find a small difference by counting up

$$\text{e.g. } 5003 - 4996 = 7$$

This can be modelled on an empty number line (see complementary addition below). Children should be encouraged to use known number facts to reduce the number of steps.

Subtract the nearest multiple of 10 or 100, then adjust.

Continue as in Year 2 and 3 but with appropriate numbers. To 4 digits

Use known number facts and place value to subtract

$$92 - 25 = 67$$



PENCIL AND PAPER PROCEDURES:

Formal Written methods – start with partitioning

$$\begin{array}{r} 800 \\ 70 \\ 4 \\ \hline 874 \end{array}$$

534 – 300

Find a small difference by counting up

Continue as in Year 2 but with appropriate numbers e.g. $102 - 97 = 5$

Subtract mentally a 'near multiple of 10' to or from a two-digit number

Continue as in Year 2 but with appropriate numbers e.g. $78 - 49$ is the same as $78 - 50 + 1$

Use known number facts and place value to subtract

e.g. $97 - 15 = 72$

Formal Written method (Not needing decomposition) Use partitioning.

$$\begin{array}{r} 500 \ 60 \ 7 \\ - \underline{200} \ 30 \ 4 \\ \hline 300 \ 30 \ 3 \end{array}$$

$$\begin{array}{r} 567 \\ - \underline{234} \\ \hline 333 \end{array}$$

Multiplication

Recall and use multiplication facts for 3, 6, and 8

x = signs and missing numbers

Continue using a range of equations as in Year 2 but with appropriate numbers.

Use commutativity and associativity

$$4 \times 12 \times 5 = 4 \times 5 \times 12 = 20 \times 12 = 240$$

Arrays and repeated addition

Continue to understand multiplication as repeated addition and continue to use arrays (as in Year 2).

Doubling multiples of 5 up to 50

$$35 \times 2 = 70$$

Partition

Use known facts and place value to carry out simple multiplications

Use the same method as above (partitioning),

$$32 \times 3 = 96$$

$$\begin{array}{r} & 30 & 2 \\ \times & 3 & \\ \hline 90 & 6 \end{array}$$

$$= 96$$

$$\begin{array}{r} - 500 \ 20 \ 3 \\ 300 \ 50 \ 1 \\ \hline = 351 \end{array}$$

$$\begin{array}{r} 30 \ 15 \\ 245 - 126 \quad 200 \ 40 \ 5 \\ - \underline{100} \ 20 \ 6 \\ \hline 100 \ 10 \ 9 = 119 \end{array}$$

If able to cope with simple decomposition

$$\begin{array}{r} 3 \ 1 \\ - \underline{2} \ 4 \ 5 \\ \hline 1 \ 2 \ 6 \\ \hline 1 \ 1 \ 9 \end{array}$$

Two step problems in context

Make decisions about which operation and method to use.

Multiplication

x = signs and missing numbers

Continue using a range of equations as in previous years but with appropriate numbers

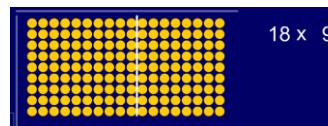
Recall and use multiplication facts to 12×12

Including understanding of multiplying by 0 and 1

Use knowledge of table facts to find factor pairs to 144.

Partition

Continue to use arrays:



$$18 \times 9 = 162$$

$$18 \times 9 = (10 \times 9) + (8 \times 9) = 162$$

or

$$47 \times 6 = 282$$

$$47 \times 6 = (40 \times 6) + (7 \times 6) = 282$$

OR

Use the grid method of multiplication (as below)

Progress to formal written method

2digit by 1 digit

$$\begin{array}{r} 24 \\ \times 6 \\ \hline 144 \\ 2 \end{array}$$

Division

÷ = signs and missing numbers

Continue using a range of equations as in Year 2 but with appropriate numbers and **using related multiplication facts from 3, 4, and 8 multiplication tables.**

Mental Calculation- Continue from year 2

Derive related facts for division

$$20 \times 3 = 60$$

$$60 \div 3 = 20$$

Remainders

$$16 \div 3 = 5 \text{ r}1$$

Sharing – 16 shared between 3, how many left over?

Grouping – How many 3's make 16, how many left over?

e.g



Formal Method

Progressing to introduce the layout of short division

$$\begin{array}{r} 22 \\ 4) 88 \\ \hline \end{array}$$

Key vocabulary

Multiple, 3 digit, ones, tens, hundreds, columnar, positive integer, tenth, denominator, diagram, chart, millimetre, volume, capacity, perimeter, analogue, digital, Roman numeral, a.m. p.m., seconds, leap year orientation, property, horizontal, vertical, perpendicular, parallel

Pencil and paper procedures

Grid method

123×7 is approximately $120 \times 10 = 1200$

X 100	20	3	
7 700	140	21	= 861

Solve problems using multiplication including problems in context.

A box of sweets holds 124 sweets, I buy 4 boxes, how many sweets will I have.

A cake weighs 250g, how much will 6 cakes weigh?

Expanded Column Multiplication

Leading to formal method

3digit by 1 digit

Children should describe what they do by referring to the actual values of the digits in the columns. For example, the first step in 38×7 is ‘thirty multiplied by seven’, not ‘three times seven’, although the relationship 3×7 should be stressed.

$$\begin{array}{r} 30 + 8 & 38 \\ \times 7 & \times 7 \\ 56 & (8 \times 7 = 56) & 56 \\ 210 & (30 \times 7 = 210) & 210 \\ 266 & & 266 \end{array}$$

$$123$$

$$\times 8$$

$$984$$

$$12$$

Key vocabulary

Negative numbers, 4 digit, operation, method, factor pairs, correspondence, equivalent fractions, hundredths, quantity, non-unit fraction, decimal, convert, rectilinear figure/shape, quadrilateral, acute, obtuse, angle, right angle, co-ordinate, quadrant, 2-D grid, polygon

Upper Key Stage 2

Year 5	Year 6
<p>Key Knowledge Pupils will know how to:</p> <p>Number and Place Value</p> <ul style="list-style-type: none">• read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit• count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000• interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers, including through zero• round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000• solve number problems and practical problems that involve all of the above• read Roman numerals to 1000 (M) and recognise years written in Roman numerals. <p>Addition and Subtraction</p> <ul style="list-style-type: none">• add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)• add and subtract numbers mentally with increasingly large numbers• use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy• solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why <p>Multiplication and Division</p> <ul style="list-style-type: none">• identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers• know and use the vocabulary of prime numbers, prime factors and composite (nonprime) numbers• establish whether a number up to 100 is prime and recall prime numbers up to 19• multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers• multiply and divide numbers mentally drawing upon known facts• divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context• multiply and divide whole numbers and those involving decimals by 10, 100 and 1000	<p>Key Knowledge Pupils will know how to:</p> <p>Number and Place Value</p> <ul style="list-style-type: none">• 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. <p>Addition, Subtraction, Multiplication and Division</p> <ul style="list-style-type: none">• 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 degree of accuracy. <p>Fractions</p> <ul style="list-style-type: none">• 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 [for example, $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$]• divide proper fractions by whole numbers [for example, $\frac{1}{3} \div 2 = \frac{1}{6}$]

Fractions

- compare and order fractions whose denominators are all multiples of the same number
- 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 > 1 as a mixed number
- add and subtract fractions with the same denominator and denominators that are multiples of the same number
- multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams
- read and write decimal numbers as fractions [for example, $0.71 = 71/100$]
- recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
- round decimals with two decimal places to the nearest whole number and to one decimal place
- read, write, order and compare numbers with up to three decimal places
- solve problems involving number up to three decimal places
- 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 which require knowing percentage and decimal equivalents of $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{4}{5}$ and those fractions with a denominator of a multiple of 10 or 25.

Measurement

- convert between different units of metric measure (for example, kilometre and metre; centimetre and metre; centimetre and millimetre; gram and kilogram; litre and millilitre)
- understand and use approximate equivalences between metric units and common imperial units such as inches, pounds and pints
- measure and calculate the perimeter of composite rectilinear shapes in centimetres and metres
- calculate and compare the area of rectangles (including squares), and including using standard units, square centimetres (cm^2) and square metres (m^2) and estimate the area of irregular shapes
- estimate volume [for example, using 1 cm^3 blocks to build cuboids (including cubes)] and capacity [for example, using water]
- solve problems involving converting between units of time
- use all four operations to solve problems involving measure [for example, length, mass, volume, money] using decimal notation, including scaling.

Geometry

- identify 3-D shapes, including cubes and other cuboids, from 2-D representations
- know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles

- associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction [for example, $3/8$]
- 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.

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
- 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.

Algebra

- 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.

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
- 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

- draw given angles, and measure them in degrees ($^{\circ}$)
- identify:
 - angles at a point and one whole turn (total 360°)
 - angles at a point on a straight line and $\frac{1}{2}$ a turn (total 180°)
 - other multiples of 90°
- use the properties of rectangles to deduce related facts and find missing lengths and angles
- distinguish between regular and irregular polygons based on reasoning about equal sides and angles.
- 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 a line graph
- complete, read and interpret information in tables, including timetables.

- calculate, estimate and compare volume of cubes and cuboids using standard units, including cubic centimetres (cm^3) and cubic metres (m^3), and extending to other units [for example, mm^3 and km^3].

Geometry

- 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 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.
- 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.

Statistics

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

Key Skills

Mental strategies:

Partition into thousands, hundreds, tens and units, then recombine. (Extend to decimals)

$$\text{E.G. } 2567 + 1189 = 3756$$

$$2000 + 1000 = 3000$$

$$500 + 100 = 600$$

$$60 + 80 = 140 +$$

$$7 + 9 = \underline{16}$$

$$3756$$

Key skills

Mental strategies:

Partition into ten thousands, thousands, hundreds, tens and units, then recombine. (Extend to decimals)

$$\text{E.G. } 62567 + 21189 = 83756$$

$$60000 + 20000 = 80000$$

$$2000 + 1000 = 3000$$

$$500 + 100 = 600$$

$$60 + 80 = 140 +$$

$$7 + 9 = \underline{16}$$

$$83756$$

Written Method:

Use column method for addition.

E.G. 2567 +

1189

11

3756

*Denotes carried digits

Use column method (decomposition) for subtraction.

2⁴5¹⁵6¹7 -

11 89

13 78

*denotes cancelled digits and carrying.

Times tables: children should know times tables up to X12, and related division facts.

Written Method:

Use column method for addition.

E.G. 62567 +

21189

11

83756

*Denotes carried digits

Use column method (decomposition) for subtraction.

6 2⁴5¹⁵6¹7 -

211 89

413 78

*denotes cancelled digits and carrying.

Times tables: children should know times tables up to X12, and related division facts.

Written method: Column (long)

Multiply 3-digit numbers by a 2-digit numbers (Extend to 4-digit by 2-digit)

$$\begin{array}{r}
 326 \times \\
 27 \\
 \hline
 14 \\
 2282 \\
 \hline
 1 \\
 6520 + \\
 \hline
 8802
 \end{array}$$

*denotes carried digits

Written method: Bus-stop (short & long).

In year 5 – divide a 3-digit number by a 2-digit number (extend by dividing a 4-digit number by a 2-digit number).

$$\begin{array}{r}
 13 \quad \text{WIK} \\
 \hline
 22 \overline{)286} \quad 22 \\
 22 \quad \downarrow \\
 \underline{66} \quad 66 \\
 \underline{66} \quad 88 \\
 1 \quad 110 \\
 \hline
 132
 \end{array}$$

Written method: Column (Short for decimals, otherwise long)

Multiply 4-digit numbers by 2-digit numbers and extend to 3-digit numbers by 3-digit numbers. Also multiply decimal numbers by single digit numbers.

$$\begin{array}{r}
 326 \times \quad 2.4 \times \\
 127 \quad 6 \\
 \hline
 14 \\
 2282 \quad 14.4 \\
 \hline
 1 \\
 6520 \\
 \hline
 32600 + \\
 \hline
 111 \\
 \hline
 41402
 \end{array}$$

*denotes carried digits

Written method: Bus-stop (short & long).

In year 6 – divide 3 & 4-digit numbers by 2 – digits numbers, including those with a remainder (extend by dividing 5-digit numbers by 2-digit numbers)

$$\begin{array}{r}
 443 \text{ r } 17 \quad \text{WIK} \\
 \hline
 22 \overline{)891763} \quad 22 \\
 88 \quad \downarrow \\
 08916 \quad 66 \\
 88 \quad \downarrow \\
 07813 \quad 110 \\
 66 \quad \downarrow \\
 17
 \end{array}$$