Year 4

Year 4 - Autumn 1

Milestone LO (National Curriculum)

PLACE VALUE

Children should be taught to:

- count in multiples of 6, 7, 9, 25 and 1,000
- find 1,000 more or less than a given number
- count backwards through 0 to include negative numbers
- recognise the place value of each digit in a four-digit number (1,000s, 100s, 10s, and 1s)
- order and compare numbers beyond 1,000
- identify, represent and estimate numbers using different representations
- round any number to the nearest 10, 100 or 1,000
- 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 0 and place value

ADDITION

Children should be taught to:

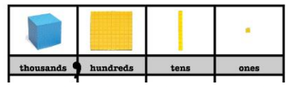
- add numbers with up to 4 digits using the formal written methods of columnar addition where appropriate
- estimate and use inverse operations to check answers to a calculation
- solve addition and two-step problems in contexts, deciding which operations and methods to use and why

Revisited Knowledge

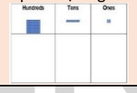
New knowledge

Domains	**Declarative knowledge** (substantive knowledge)	**Procedural knowledge** (disciplinary knowledge)	**Conditional knowledge** (knowing the when and the why)

Place value	**Counting**
	Children need to know that…
	• *We can count in multiples (adding the same amount each time) (Year 1)*
	• *When we count in multiples of 2, we add 2 each time and we only say even numbers. We know the multiples of 2 up to 100. (Year 1) We know the divisibility rules for multiples of 2 (Year 3)*
	• *When we count in multiples of 3, we add 3 each time. We know the pattern this makes on a hundred square and know the multiples of 3 up to 36 (Year 2). We know the divisibility rules for multiples of 3 (Year 3)*
	• *When we count in multiples of 5, we add five each time. Multiples of 5 always end in 0 or 5. We know the multiples of 5 up to 100. (Year 1) We know the divisibility rules for multiples of 5 (Year 3)*
	• *When we count in multiples of 10, we add 10 each time. We know multiples of 10 always end in 0 and are always even. We know the multiples of 10 up to 100. (Year 1) We know the divisibility rules for multiples of 10 (Year 3)*
	• *When we count in multiples of 4, we add 4 each time. We know the divisibility rules for multiples of 4 and know the multiples of 4 up to 48. (Year 3)*
	• *When we count in multiples of 8, we add 8 each time. We know the multiples of 8 up to 96. We know the divisibility rules for multiples of 8 (Year 3)*
	• *When we count in multiples of 50, we add 50 each time. We know the multiples of 50 up to 1000. (Year 3)*
	• *When we count in multiples of 100, we add 100 each time. We know the multiples of 100 up to 1000 (Year 3)*
	• When we count in multiples of 6,
	  ○ We add 6 each time.
	  ○ We say the numbers 0,6,12,18,24,30,36,42,48,54,60,66 and 72
	• When we count in multiples of 7,
	  ○ We add 7 each time.
	  ○ We say the numbers 0,7,14,21,28,35,42,49,56,63,70,77 and 84
	• When we count in multiples of 9,
	  ○ We add 9 each time.
	  ○ We say the numbers 0,9,18,27,36,45,54,63,72,81,90,99 and 108
	• When we count in multiples of 25,
	  ○ We add 25 each time.
		Counting
		Children need to know how…
		• *To count in ones to and across 100 from a given number (Year 1)*
		• *To count in multiples of 2, 3, 5 and 10 to 100. (KS1)*
		• *To find one more and one less than a given number (Year 1)*
		• *To count in multiples or 4, 8, 50 and 100. (Year 3)*
		• *To find 10 or 100 more or less than a given number, by applying their knowledge of what 10 is and what 100 is. (Year 3)*
		• To count in multiples of 6, 7, 9, 25 and 1,000
			Children need to know…
			• *Where a digit is placed shows the value of the digit, based on its position (place value column) in a number. Example: in the number 347, understanding that the digit 4 represents 4 tens because it is in the tens place. (Year 3)*
			• *When we compare numbers, we need to look at the columns in order from largest to smallest to determine which number is greater. Example: 3 in the tens column is worth 30 but 3 in the hundreds column is worth 300. (Year 3)*
			• *When we order a set of numbers from least to greatest, we compare the digits in each place value column in order starting from the hundreds. (Year 3)*
			• *When we partition numbers, we break the numbers down into their expanded form to show the value of each digit in its columnar place. Example: the number 347 as 300 + 40 + 7 to demonstrate its place value composition. (Year 3)*
			• *When to use place value knowledge to solve word problems involving quantities, such as identifying the place value of different items or amounts. Example: solving a word problem that asks how many tens are in a group of 230 marbles. (Year 3)*
			• When to use subtractive notation for Roman numerals, based on the placement of symbols.
			• When to round up and when to round down.
			• When rounding may be an effective strategy to support our calculation.

	○ We say the numbers 0,25,50,75,100,125,150,175,200 etc. • When we count in multiples of 1000, ○ We add 1000 each time. ○ Only the thousands column changes ○ We say the numbers 0,1000,2000,3000,4000…		
	Representing Number Children need to know that… • *All numbers have meaning. A number is a value that represents quantity. Each number has a name. Numbers can be represented in digits/numerals or words (KS1).* • *A digit is a single symbol used to represent a value within a number (KS1).* • *The position of this digit tells us its value (Year 1,2,3):*  • *Zero can be a place holder. It means there is no value in a place. (Year 3)* • *Numbers can be represented in different ways, e.g. using resources, pictorial representations and abstract representations (including objects, pictures, money and number lines). (Year 2)* • *Partitioning means to split a number into smaller parts. (KS1)* • *Hundreds numbers can be partitioned into hundreds, tens and ones, but also in a range of other ways. (Year 3)* • *Estimate means to make a 'sensible guess' using your knowledge of number. (Year 2)* • *There are 10 ones in one ten. (Year 1)* • *There are 10 tens in a hundred; there are 100 ones in one hundred. (Year 2)* • *There are 10 hundreds in one thousand; there are 100 tens in one thousand; there are 1,000 ones in one thousand (Year 3).* • A comma is used to separate the digits in the thousands and hundreds columns. • This is because this helps us to read the number out loud.	**Representing Number** Children need to know how… • *To read, and write numbers up to 100 in numerals and words (Year 2)* • *To represent numbers up to 100 in a range of different ways (Year 2)* • *To partition numbers up to 100 in different ways (Year 2)* • *To estimate amounts within 100 using their knowledge of place value and counting (Year 2)* • *To read and write numbers up to 1000 as numerals and words.* • *To identify the value of a number, up to 1000. (Year 3)* • *To represent numbers to 1000 in different ways (concrete, pictorial, abstract) (Year 3)* • *To partition numbers up to 1000 in different ways. (Year 3)* • *To estimate numbers, using their knowledge of place value, calculations and the number system. (Year 3)* • To recognise the place value of each digit in a four-digit number (1,000s, 100s, 10s, and 1s) • To identify, represent and estimate numbers using different representations, including partitioning numbers in different ways.	Children need to know why… • ***We use place value charts and squared paper for representing number in maths.*** *Our maths system has a base 10 structure. Each column represents a different place value. Using columns to lay out our digits allows us to represent numbers efficiently. (Year 2)* • ***The < = and > are written the way they are.*** *The wide side of the symbol represents a greater quantity (you could physically fit more counters on that side of the sign). An equals sign consists of two parallel lines because you can fit the same quantity either side. (Year 2)*  • ***We start from the left-most column when we are comparing numbers.*** *The place value column a digit is in determines its quantitative value. The left-most column is the largest column. Example: A 1 in the thousands column has a greater value than a 9 in the hundreds column. (Year 3)* • **We round up when the next smallest column is greater than or equal to 5. '**5' is considered to be halfway between the two values. Rounding this up is a universal convention. • **Roman numerals are still learned today.** We see them in the world around us (for example on statues, for dates and on clocks) so it is important for us to be familiar with them.
	Comparison Children need to know that… • *Numbers increase as they go up in the number system and decrease as we count back. (Year 1)* • *To compare has two different meanings:* ○ *to say how something is like or unlike something else.* ○ *To describe which is larger and which is smaller (and by how many) (Year 2)* • *Order means to arrange numbers by their numerical value. (Year 2)* • *We can arrange numbers in ascending order (from smallest to largest) (Year 2)* • *We can arrange numbers in descending order (from largest to smallest) (Year 2)* • *< is a mathematical symbol which means less than (Year 2)* • *> is a mathematical symbol which means more than. (Year 2)* • *= is a mathematical symbol which means equal to (Year R)* • *Equal means the same (Year R)* • *When comparing and ordering numbers, we have to look at the largest place value column first. (Year 3)* • *It is important to organise our numbers so it is easy to compare place value columns, e.g. using the squares in our books. (Year 3)* • When we find 10 more, the tens column increases by 1. • When we find 10 less, the tens column decreases by 1. • When we find 100 more, the hundreds column increases by 1. • When we find 100 less, the hundreds column decreases by 1. • When we find 1000 more, the hundreds column increases by 1. • When we find 1000 less, the hundreds column decreases by 1. • When we are finding a power of 10 more, if this causes 'overflow' we will need to regroup (like in column addition) • When we are finding a power of 10 less, if there is not a sufficient amount in the column in the minuend, we will need to exchange (like in column subtraction).	**Comparison** Children need to know how… • *To compare numbers to 100.* • *To order numbers to 100 in ascending and descending order.* • *To use the mathematical symbols <, > and* • *To compare numbers to 1,000. (Year 3)* • *To order numbers to 1,000. (Year 3)* • *To find 10 or 100 more or less than a given number (Year 3)* • To find 1,000 more or less than a given number. • To order numbers beyond 1,000 • To compare numbers beyond 1,000 using <, > and =	

<table>
<tr>
<td></td>
<td>Rounding
Children need to know that…
• Rounding numbers makes them ‘easier’ to use or understand whilst keeping the number close to its original value.
• Rounding is a mathematical way of estimating number.
• We can round to any place value column.
• When rounding, you need to find the place value you are rounding to. This is called your target digit.
• You then need to look at the next smallest column. If this is 5 or more, you round up. If this is 0-4 you round down.
• When you round up, the target digit increases by one; the digits in larger place value columns stay the same; the digits in smaller place value columns become 0.
• When you round down, the target digit stays the same; the digits in larger place value columns stay the same; the digits in smaller place value columns become 0.</td>
<td>Rounding
Children need to know how…
• To round any number to the nearest 10, 100 or 1,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Negative Numbers
Children need to know that…
• A negative number is a number less than 0.
• Numbers below 0 are shown as minus numbers with the minus symbol (-) e.g. – 8</td>
<td>Negative Numbers
Children need to know how…
• To count backwards through 0 to include negative numbers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Roman Numerals
Children need to know that…
• Roman numerals are an ancient number system. Over time, this changed and England adopted the Arabic numeral system, which includes the Base 10 concept and the idea of 0.
• Roman numerals are still seen in many places in the world for specific purposes.
• In Roman numerals, alphabetic symbols are used as the digits which represent fixed positive numbers
○ In Roman numerals, I means 1
○ In Roman numerals, V means 5
○ In Roman numerals, X means 10
○ In Roman numerals, L means 50
○ In Roman numerals, C means 100
• To write numbers between these fixed amounts, symbols are listed in succession.
• Symbols should be arranged from highest to lowest value, except in subtractive combinations.
• A symbol can only be repeated up to three times in succession (e.g., III = 3).
• When large symbols are followed by small symbols, the value is calculated by adding. (e.g. XI is 11 because it shows 10 + 1)
• If four symbols would be required to make the number, a subtractive combination is used instead. This is where the symbol with the smaller value (subtrahend) is placed before the symbol with the larger value (minuend) to show it needs to be subtracted (e.g. IX is 9 because it shows 10 – 1).
• Only certain pairings are allowed for subtractive combinations. Between 1 and 100, these are (e.g., IV = 4, IX = 9, XL = 40, XC = 90).</td>
<td>Roman Numerals
Children need to know how…
• To read roman numerals to 100 (i to c)
• To write numbers in Roman Numerals up to 100.

To solve number and practical problems that involve all of the above and with increasingly large positive numbers</td>
<td></td>
</tr>
<tr>
<td>Vocabulary</td>
<td colspan="6">
<table>
<tr>
<td>NUMBER</td><td>An abstract way of representing a quantity (e.g. 2, 26, fifty-nine, $\frac{1}{2}$, 0.322)</td><td>NUMERAL</td><td>Words or symbols used to represent numbers, made up of digits.</td><td>DIGIT</td><td>The ten single symbols 0-9, used to represent numbers when placed in sequence.</td>
</tr>
<tr>
<td>VALUE</td><td>How much something is worth. In representation of number, the position of a digit in a numeral determines its value.</td><td>PLACE VALUE CHART</td><td>A picture/diagram used to help represent the value of digits in numbers.
  </td><td>ESTIMATE</td><td>To make a ‘sensible guess’ based on your knowledge of and experience with number.</td>
</tr>
</table>
</td>
</tr>
</table>

	ONE DIGIT NUMBER	A numeral which only contains one digit.	**TWO DIGIT NUMBER**	A numeral which contains two digits. The first digit has a value of tens.	**THREE DIGIT NUMBER**	A numeral which contains three digits. The first numeral has a value of hundreds.
	FOUR DIGIT NUMBER	A numeral which contains four digits. The first numeral has a value of thousands.	**ONES**	Where the digit represents the quantity exactly.	**TENS**	A digit value where the digit represents ten-times the quantity. There are 10 ones in a ten.
	HUNDREDS	A digit value where the digit represents one-hundred-times the quantity. There are 10 tens in a hundred; there are 100 ones in a hundred.	**THOUSANDS**	A digit value where the digit represents one-thousand-times the quantity. There are 10 hundreds in a thousand. There are 100 tens in a thousand; there are 1,000 ones in a thousand.	**PLACE HOLDER ZERO**	Where a zero is placed in a place value column to show there are 0 of that value within the number. This is important to ensure that digits are seen in the correct place value column.
	COMPARE	Two meanings: a) to say what is the same or what is different. b) to identify the mathematical difference between numbers.	**EQUAL**	The same as.	**MANIPULATIVE**	A physical object used to help represent mathematics (e.g. beadstring, Base 10).
	GREATER THAN >	When the first number is more than the second number. Can be shown by the greater than symbol >	**LESS THAN <**	When the first number is less than the second number. Can be shown by the less than symbol.	**ORDER**	To arrange numbers by their numerical value.
	ASCENDING ORDER	Arranging numbers from smallest to largest.	**DESCENDING ORDER**	Arranging numbers from largest to smallest.	**PARTITION**	To split a whole into parts.
	PART	A section of the whole.	**WHOLE**	A total amount. This is always the sum of the parts.	**REPRESENTATION**	A way of showing a mathematical idea using objects, pictures or numerals.
	CONCRETE	A representation of a mathematical idea using manipulatives or real-life objects.	**PICTORIAL**	A representation of a mathematical idea using pictures.	**ABSTRACT**	A representation of a mathematical idea using symbols (e.g. numerals)
	NUMBER LINE	A picture used to represent numbers and calculations where numbers are shown on a regular scale.	**PART-PART WHOLE MODEL**	A pictorial representation of number showing the relationship between parts and wholes.	**BAR MODEL**	A form of part-part whole model where the parts are represented by adjacent bars.
	EXPANDED FORM	a way of writing numbers to show the value of each digit (e.g., 325 written as 300 + 20 + 5)	**ROUNDING**	To alter a number to be less exact by taking it to the nearest 'one' of a specified place value column. This makes it more convenient for calculating with.	**NEGATIVE NUMBER**	A number less than 0. This is shown by the minus symbol.
	MINUS SYMBOL/SIGN	A mathematical symbol used to indicate either subtraction (when it is placed between the minuend and the subtrahend) or a negative number (when it is placed directly before a number)	**ROMAN NUMERAL**	A number system used by the Roman Empire which used letters to represent numbers.	**I**	One in Roman Numerals.
	V	Five in Roman Numerals.	**X**	Ten in Roman Numerals.	**L**	Fifty in Roman Numerals.
	C	One hundred in Roman Numerals.	**ADDITIVE COMBINATION**	When a combination of values are added together to create a sum.	**SUBTRACTIVE COMBINATION**	Where a combination of values is interpreted by subtracting the value of one from the value of the other.

Addition

Children need to know that…

- *Addition (adding) is when you put two or more numbers together to find a total amount (part + part = whole) (Year R)*
- *+ means add (Year 1)*
- *Addition is commutative. (Year 1)*
- *Commutative means you can do it in any order. (Year 1)*
- *Number bonds refer to pairs of numbers that add together to total a given amount. (Year 1)*

- *The vocabulary of addition: (Year 1)*
- *When we know both parts (addends) but not the whole (sum) we are being asked to do addition. (Year 2)*
- *Inverse is the opposite calculation. Addition is the inverse to subtraction. (Year 2)*
- *We lay our digits out in columns, one digit per square to make the place value of these numbers obvious. (Year 3)*
- *In columnar addition, digits with the same place value must always be placed in the same column. (Year 3)*
- *In columnar addition, we begin our calculation with the smallest place value column. (Year 3)*
- *Regrouping means rearranging numbers into groups by place value to make it easier to carry out operations. (Year 3)*
- *We can regroup 10 ones to create 1 ten. (Year 3)*
- *We can regroup 10 tens to create 1 hundred. (Year 3)*
- *Estimate means to make a 'sensible guess' using your knowledge of number. This can be based on logical reasoning and rounding (Year 2)*
- *To recognise the place value of each digit in a four-digit number (1,000s, 100s, 10s, and 1s) (Year 4 Place Value)*
- *To identify, represent and estimate numbers using different representations, including partitioning numbers in different ways. (Year 4 Place Value)*
- We can regroup 10 hundreds to create 1 thousand.
- We can estimate by rounding numbers to make them easier to add. This allows us to check whether the answer to our calculation is reasonable.

Children need to know how…

- *To identify whether a problem is asking them to add or subtract using their knowledge of parts and wholes (addends and sum; minuend, subtrahend and difference). (KS1)*
- *To add three digit numbers and ones/tens/hundreds mentally by applying knowledge of number bonds (KS1/Year 3)*
- *To accurately lay out 3 digit numbers to support the formal written method of columnar addition. (Year 3)*
- *To add numbers with up to three digits using the formal written method of columnar addition where no regrouping is required. (Year 3)*
- *To add numbers using the formal written method of columnar addition, regrouping tens when the total of the ones column exceeds 9 and regrouping hundreds when the total of the tens column exceeds 90/9tens. (Year 3)*
- To add numbers mentally (supported by jottings if required) by applying their knowledge of counting forwards in 1s, 10s, 100s and 1,000s.
- To add numbers with up to four digits using the formal written method of columnar addition.
- To regroup ten hundreds in the thousands column when the sum in the hundreds column exceeds 9 hundreds (900)
- To solve two-step problems using their knowledge of addition.
- To check the reasonableness of an addition calculation by estimating using rounding.
- To check their calculations using the inverse relationship.

Children need to know when …

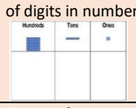
- *regrouping is required in formal columnar addition. This is necessary when the sum of digits in a column exceeds nine.. (Year 3)*
- *it is appropriate to check addition by adding the numbers in reverse order, using the inverse or using a different method to verify the sum. (Year 3)*
- *to estimate the sum of numbers to determine if the calculated result is reasonable. Example: estimating the sum of 84 + 29 as approximately 100 + 30 = 130 to verify that the calculated sum is within a reasonable range. (Year 3)*
- Rounding may be an appropriate strategy for estimating the sum to check the reasonableness of an answer.

Children need to know why

- ***Regrouping is necessary.*** *We can never have more than 9 in a single place value column as, for example, 10 ones are equivalent to 1 ten. (Year 3)*
- ***Using estimation to check a calculation is sensible.*** *Anyone can make calculation errors. Estimation is an efficient way of checking whether this has occurred. (Year 3)*
- **The process of regrouping is the same even when the place value gets larger.** We have a B10 number system, which means every column is 10 times bigger than the one on its right.
- **We begin column addition with the smallest column.** It is possible that we will have to regroup if the sum of a single place value column exceeds 9 of that value. When we have to regroup, this changes the sum of the next biggest column.

Vocabulary

	PARTITION	To split a whole into parts.	**EQUAL**	The same as.	**PART**	A section of the whole.
	WHOLE	A total amount. This is always the sum of the parts.	**REPRESENTATION**	A way of showing a mathematical idea using objects, pictures or numerals.	**MANIPULATIVE**	A physical object used to help represent mathematics (e.g. beadstring, Base 10).
	CONCRETE	A representation of a mathematical idea using manipulatives or real life objects.	**PICTORIAL**	A representation of a mathematical idea using pictures.	**ABSTRACT**	A representation of a mathematical idea using symbols (e.g. numerals)
	PART-PART WHOLE MODEL	A pictorial representation of number showing the relationship between parts and wholes.	**BAR MODEL**	A form of part-part whole model where the parts are represented by adjacent bars.	**BEADSTRING**	A manipulative where coloured beads are placed on a string in alternating colours (10 red, 10 white, 10 red…) to support counting in ones and tens.
	BASE 10	A manipulative used to show the value of a digit based on the column in which it is placed.	**NUMBER LINE**	A picture used to represent numbers and calculations where numbers are shown on a regular scale.	**NUMBER BOND**	Addition and subtraction number facts which we memorise to support efficient calculation

	PLACE VALUE CHART	A picture/diagram used to help represent the value of digits in numbers. 	**ADDITION**	Combining parts.	**COMMUTATIVE**	A calculation which will give the same answer, regardless of the order in which it is performed. Addition and multiplication are commutative.
	COUNTING ON	Starting from a number and counting forwards in the number system. This can be used as a strategy to solve addition and subtraction problems.	**SYMBOL**	An abstract image used to represent an idea (e.g. digits, +, =)	**NUMBER SENTENCE**	A way of representing a mathematical operation using symbols (+,-,x,÷,= etc)
	ADDEND	The numbers which are being added. These are parts of the whole.	**SUM**	The answer to an addition. This is the whole.	**FACT FAMILIES**	A set of mathematical facts which are closely related. Knowing on means you know all. For example 2 + 3 = 5, 3 + 2 = 5, 5-3 = 2, 5-2 = 3
	COLUMNAR ADDITION	The formal written method of column addition	**EXPANDED FORM**	a way of writing numbers to show the value of each digit (e.g., 325 written as 300 + 20 + 5)	**REGROUP**	In column addition: Regrouping 10 from one column to make one from the next largest place value column.
	REGROUPED DIGIT	Recording the regroup on the formal written method.	**OVERFLOW**	When the sum of the addends in a column is greater than 9. This indicates that you need to regroup before solving.	**VERTICAL ADDITION**	Adding by arranging addends in columns, organised by their place value. Formal column method is an example of vertical addition.
	PARTIAL SUM	The sum to the addends in each column (not the whole number sentence)	**ESTIMATE**	To make a 'sensible guess' based on your knowledge of and experience with number.	**ROUNDING**	To alter a number to be less exact by taking it to the nearest 'one' of a specified place value column. This makes it more convenient for calculating with.

Enrichment & wider development	

Year 4 - Autumn 2

Milestone LO (National Curriculum)

MULTIPLICATION
Children should be taught to:
- recall multiplication facts for multiplication tables up to 12 × 12
- use place value, known and derived facts to multiply mentally, including: multiplying by 0 and 1; multiplying together 3 numbers
- recognise and use factor pairs and commutativity in mental calculations

LENGTH, PERIMETER AND AREA:
Children should be taught to:
- Measure and calculate the perimeter of a rectilinear figure (including squares) in centimetres and metres
- Find the area of rectilinear shapes by counting squares

GEOMETRY: ANGLES
- Identify acute and obtuse angles and compare and order angles up to two right angles by size

Geometry: POSITION AND DIRECTION
- 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.

Revisited Knowledge
New knowledge

Domains	**Declarative knowledge** (substantive knowledge)	**Procedural knowledge** (disciplinary knowledge)	**Conditional knowledge** (knowing the when and the why)
Multiplication	Children need to know that… • *Multiplication is a commutative mathematical operation that indicates how many times a number is added to itself and is represented by the symbol 'x'. (Year 1)* • *Commutative means it can be done in any order (Year 1)* • *An array is a way of showing multiplication by arranging dots or counters into rows and columns (Year 1)* • *An even number is a number that is divisible by 2 (Year 2)* • *An odd number is a number that is not divisible by 2. (Year 2)* • *The formal language of multiplication (multiplicand, multiplier, product) (Year 1)* • *The 0,1,2,5 and 10 times tables. (Year 2). The 3, 4 and 8 times table (Year 3)* • *The patterns we see in the 2,5,10 and 3 number sequences. (Year 2) The patterns we see in the 4 and 8 number sequences (Year 3)* • *The connections between different times tables we have learned (Year 3)* • *The multiplication facts we are expected to learn are called times tables. (Year 3)* • *A multiple of a number can be divided by that number without a remainder (e.g. 25 is a multiple of 5 because 25 can be divided by 5 without a remainder).* • *Related facts are those which are linked. We can use related facts to help us find the answer to mathematical questions quickly. The related facts we can use are our place value (e.g. 2 x 20 solved using 2 x 2) and fact families. (Year 3)* • *Inverse means the opposite. Division is the inverse of multiplication. (Year 3)* • When any number is multiplied by 0, the product is 0. • When any number is multiplied by 1, it remains the same. • 6 times table ○ The 6 times table sequence: 0,6,12,18,24,30,36,42,48,54,60,66,72	Children need to know how… • *To count in multiples of 2, 5, 10, 3, 4, 8 (Year 2 & 3)* • *To write multiplication number sentences (Year 1)* • *To identify whether a problem requires multiplication or division using more advanced mathematical language and reasoning (e.g. part, whole, multiplier, multiplicand, product, dividend, divisor, quotient) (Year 2)* • *To solve missing number questions using the inverse.(Year2)* • *To use a range of strategies to solve multiplication problems (See calculation policy - Year 3)* • *To choose the most efficient method (Year 2)* • *To identify fact families (Year 3)* • *To use knowledge of place value to multiply.* • *To write and calculate mathematical statements for 2s x 1d multiplication statements using the related facts of tables they know (e.g. 2 x 20 as linked to 2 x 2)* • *To use the expanded column method as a way of recording and solving multiplication problems using their knowledge of related facts.* • *To solve problems including missing number problems and inverse operations.* • To multiply by 0 and 1 mentally, explaining mathematically why the product is derived. • To recall and use multiplication facts for the multiplication tables up to 12 x 12 when solving problems.	Children need to know when… • *to use a times table based on the factors in the problem. (Year 3)* • *patterns within the times tables can help solve a problem. (Year 3)* • *it is appropriate to use known multiplication facts to find related products. (Year 3)* • *to apply the commutative property of multiplication to reorder factors for easier calculation. (Year 3)* • *to use times tables knowledge to check the accuracy of multiplication answers. (Year 3)* • *A problem requires multiplication based on reasoning about wholes, parts and groups (Year 3)* • *When to use expanded short multiplication to solve a problem.(Year 3)* • *When accurate use of place value columns is important to ensure accurate calculation. (Year 3)* • When a known fact can be used to derive a new fact.

<table>
<tr>
<td></td>
<td>

The 6 times table is every other number from the 3 times table. This is because 6 is double 3.
The 6 times table is every three number from the 2 times table. This is because 6 is 3 times bigger than 2.
Multiples of 6 are all even numbers.

7 times table

The 7 times table sequence: 0,7,14,21,28,35,42,49,56,63,70,77,84
The 7 times table is the most complex times table because it is a prime number (its only factors are 7 and 1).

9 times table

The 9 times table sequence: 0,9,18,27,36,45,54,63,72,81,90,99,108
The 9 times table is every third number from the 3 times table. This is because 9 is 3 times bigger than 3.
Multiples of 9 have an odd, even, odd, even pattern.
The tens number increases by 1, the ones number decreases by one.

11 times table

The 11 times table sequence: 0,11,22,33,44,55,66,77,88,99,110,121,132
11 is also a prime number, so the other tables cannot easily be used to derive the facts by doubling.
The 11 times table (up to 9 x 11) has a very simple pattern of repeated digits.

12 times table

The 12 times table sequence: 0,12,24,36,48,60,72,84,96,108,120,132,144
The 12 times table is every other number from the 6 times table. This is because 12 is double 6.
The 12 times table is every third number from the 4 times table. This is because 12 is 3 times bigger than 4.
The 12 times table is every fourth number from the 3 times table. This is because 12 is 4 times bigger than 3.
The 12 times table is every sixth number from the 2 times table. This is because 12 is 6 times bigger than 2.
Multiples of 12 are all even numbers.

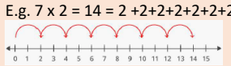
A derived fact is a fact worked out using facts you already know (e.g. the relationship between the times tables, known facts and place value, using a known fact and adding a multiple or fact families).
A factor is a number that a multiple can be divided by without a remainder (it gives an integer quotient).
An integer is a whole number.
Factors come in pairs, which multiply together to create a multiple.

</td>
<td>

To use known facts and place value to multiply mentally when the product is less than or equal to 9,999.
To derive multiplication facts using knowledge of fact families, commutativity and factor pairs.

</td>
<td>
Children need to know why

We need to develop rapid recall of key multiplication and division number facts. Having fluent and automatic recall of number facts allows us to ‘know’ the answer rather than working it out each time. This makes it easier for our brains (reducing cognitive load) which helps us to solve trickier problems. (Year 2)
We develop a range of strategies to help simplify and check the products to multiplication calculations. Developing efficiency will allow us to work with numbers quickly and flexibly. (Year 3)
You need to multiply each digit from the multiplier by the multiplicand before adding to find the product. The expanded column method works by partitioning the multiplier into tens and ones and completing two smaller multiplications which can be assisted by knowing our number facts. (Year 3)
Regrouping is also important in formal written multiplication. Often, the products of your multiplications will be greater than 9. Therefore, because 10 ones are equivalent to one 10, it is important to exchange to know how many are in each column. (Year 3)
The product of any number multiplied by 0 is 0. When we multiply by 0, we either have 0 groups of an amount (0) or we have lots of groups with 0 in (0). In either case, the quantity we have is 0.
The product of any number multiplied by 1 is the same as the original number. When we multiply by 1, we either have 1 groups with an exact amount (itself) or we have an exact number of groups with 1 in (itself). In either case, the quantity we have is the same as the factor we know.

</td>
</tr>
<tr>
<td>Vocabulary</td>
<td colspan="3">
<table>
<tr><td>EQUAL</td><td>The same as.</td><td>EQUAL GROUPS</td><td>The same quantity in each group.</td><td>MULTIPLICATION</td><td>When you have lots of copies of the same group or number.</td></tr>
<tr><td>MULTIPLIER</td><td>The number you are multiplying by.</td><td>MULTIPLICAND</td><td>The number which is being multiplied</td><td>PRODUCT</td><td>A result of multiplying two or more numbers together.</td></tr>
<tr><td>COMMUTATIVE</td><td>A calculation which will give the same answer, regardless of the order in which it is performed. Addition and multiplication are commutative.</td><td>REPEATED ADDITION</td><td>A way of solving multiplication problems where the multiplicand is added repeatedly using a number line or number sentences.
E.g. 7 x 2 = 14 = 2 +2+2+2+2+2+2
  </td><td>ARRAY</td><td>A way of showing (and solving) multiplication problems where groups are arranged systematically in rows and columns.
Multiplier = rows.
Multiplicand = columns.
e.g.  </td></tr>
<tr><td>INVERSE</td><td>The opposite calculation. This undoes what was done by the previous calculation. Multiplication and division are inverse operations.</td><td>TIMES TABLES</td><td>A list of multiplication facts for a particular number which need to be memorised and quickly recalled.</td><td>DERIVED FACT</td><td>A fact worked out using facts you already know.</td></tr>
</table>
</td>
</tr>
</table>

	EVEN NUMBER	Multiples of 2. These can be divided by 2 without leaving a remainder. Even numbers end in 0,2,4,6,8.	**ODD NUMBER**	Numbers which are not multiples of 2. These leave a remainder when divided by 2. Odd numbers end in 1,3,5,7,9	**FACT FAMILIES**	A set of mathematical facts which are closely related. Knowing on means you know all. For example 2 x 3 = 6, 3 x 2 = 6, 6 ÷ 3 = 2, 6 ÷2 = 3
	MULTIPLE	The products which are created from a specific multiplier. E.g. multiples of 2 are 2,4,6,8,10…	**FACTOR**	A number which a multiple can be divided by without a remainder (giving an integer quotient)	**INTEGER**	A whole number.
	PRIME NUMBER	A number which only has 2 factors: one and itself.				

Length, perimeter and area

Children need to know that…

- *Measurement is a precise way to describe the quantity of something (e.g. length, height, weight, capacity). (Year 1)*
- *A ruler is a tool used to measure length and draw straight lines (Year 1) A metre stick is a type of large ruler used for measuring longer distances. It is 1m long. There is sometimes space before the 0. (Year 2)*
- *Many rulers have two scales (one on either side). One scale is divided into cm. The other scale is divided into mm. (Year 3)*
- *Millimetre is a unit of measure used to measure very short distances. (Year 3)*
- *Distances measured in millimetres are written as _mm. (Year 3)*
- *There are 10 millimetres in 1 centimetre (Year 3)*
- *There are 1,000millimeters in 1m (Year 3)*
- *There are 100cm in 1m. (Year 1)*
- *Perimeter is the distance around the outside of a shape (Year 3)*
- *An array is a way of showing multiplication by arranging dots or counters into rows and columns (Year 1)*
- Area is a measure of the amount of space within the perimeter of a 2D shape.
- Area is measured in square units (e.g. mm^2, cm^2, m^2)
- Square units work by dividing a space into many small squares. In a square unit, each side of a tiny square measures one of that unit. (e.g. when measuring in cm^2, each side of each tiny square within the space would be 1cm long.)
- A rectilinear shape is a 2D shape made up of squares and rectangles.
- We can find the area by counting squares within a rectilinear shape. This works very much like an array in multiplication.

Children need to know how…

- *To describe distance using the language long and short.*
- *To compare lengths using comparative language: longer and shorter, longest and shortest. (Year 1)*
- *To measure distance accurately using non-standard units of measure and standard units of measure (to half a cm). (Year 1)*
- *To identify the most appropriate unit of measure (cm or m) (Year 1)*
- *To estimate lengths using non-standard measuring tools and their knowledge of measuring (Year 2)*
- *To compare lengths using <,> = and order them. (Year 2)*
- *To use a ruler to measure precisely by: (Year 3)*
  - *identifying the correct unit of measure on the ruler*
  - *holding the ruler the right way up*
  - *positioning the ruler at the edge of the line/object, starting from the '0'*
  - *reading the scale accurately*
  - *Recording the measurement with the appropriate units.*
  - *To draw a straight line of a specified length by using the ruler to guide the pencil, starting the line at the correct side of the ruler and at the 0 and ending the line at the correct point on the scale.*
- *To convert to find equivalent units of measure by multiplying (Year 3)*
- *To find the perimeter of a shape by measuring each side and adding them together (Year 3)*
- To measure the perimeter of more complex rectilinear shapes by measuring each side and adding them together.
- To calculate the perimeter of more complex rectilinear shapes not draw to scale by adding the lengths together.
- To begin to efficiently calculate the perimeter of squares and rectangles using basic algebraic reasoning based on well-established knowledge of the properties of 2D shapes (e.g. square = 4 x length; rectangle = 2 x height + 2 x length)
- To find the area of rectilinear shapes (not drawn to scale) by counting squares.
- To give the area of rectilinear shapes using the correct unit (cm^2 or m^2)

Children need to know when…

- *They may need to convert a unit of measure to be able to calculate with it. (Year 3)*
- *When they need to measure all sides of a shape to find the perimeter and when they can use their knowledge of calculation and properties of shapes. (Year 3).*
- *When to apply knowledge of addition and subtraction to solve perimeter problems (including finding the length of missing sides) (Year 3).*
- A simple algebraic formula (expanded) can help them calculate the perimeter of a shape.
- A problem is asking us to calculate area: how much space is available on a surface, how much material is needed to cover a surface, to compare the size of different shapes.
- To use different units of measure based on the size of the space/distance being measured.

Children need to know why…

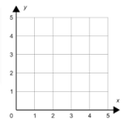
- ***Careful, accurate measurement is important.*** *To ensure that we use exactly the right amount of something. Getting this wrong can have significant consequences (e.g. baking, medicine, sports). (Year 1)*
- ***We have different units of measure.*** *Things can vary in size hugely. If we didn't have units of measure, we would have to measure very large numbers, which would be very difficult. (Year 1)*
- ***Rulers have two different scales.*** *Both mm and cm are common units of measure. Having both on a ruler lets us measure in both. (Year 3)*
- ***We need to find the perimeter of a shape****. This can both help us in real life contexts (e.g. knowing how much fence to buy) but is also important to be able to calculate area later on in Mathematics (Year 3)*
- **We need to be able to calculate the area.** The area gives us a measure of the size of a space. This can help us work out how much material we need to cover it, or whether things will fit in this space.

Vocabulary

	DESCRIBE	To say what something is like.	**MEASUREMENT**	A way of precisely describing the quantity of something. It is a process that uses numbers to make these descriptions.	**UNIT OF MEASURE**	Measurements are made by working out 'how many' of something are the same size. A unit of measure tells us what the 'something' is.
	STANDARD UNIT OF MEASURE	A formally recognised and widely used unit of measure which has a consistent size and has measurement tools available (e.g. cm)	**NON-STANDARD UNIT OF MEASURE**	When other objects in the world are chosen to measure the size of something.	**DISTANCE**	How far something is. Length and height are examples of distance.
	HEIGHT	Vertical distance	**LENGTH**	Horizontal distance	**PERIMETER**	The distance around the outline of a 2D shape.
	METRE	A large measure of distance, recorded with the unit notation m.	**CENTIMETRE**	A small measure of distance, recorded with the unit notation cm. There are 100cm in 1m.	**MILLIMETRE**	A tiny measure of distance, recorded with the unit notation mm. There are 1,000mm in 1m. There are 10mm in 1cm
	SCALE	A type of number line, often found on measuring tools. The type of scale depends on the interval between each mark. For example, most rules have a 1cm scale as there is 1cm between each mark.	**AREA**	A measure of the space within a 2D shape.	**SQUARE CENTIMETRE cm^2** **SQUARE METRE m^2**	Units of measure for area.

<table>
<tr>
<td>Position and direction</td>
<td>
Children need to know that…

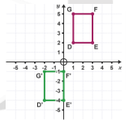
Position describes where something or someone is. (Year 1)
Direction means the line along which something moves, lies or points. (Year 1)
Movement means a change of position or direction. (Year 1)
Rotation is when something turns or spins around a point. Sometimes, this point is located at the centre. (Year 2)
Clockwise is the direction in which the hands of a clock turn. It is a turn to the right. (Year 2)
Anti-clockwise is a turn to the left, opposite to the direction of the clock hands. (Year 2)
A polygon is a shape with three or more straight sides (Year 3).
A coordinate grid is a way of organising space.
Coordinate grids have two axes: a horizontal (x) axis and a vertical (y) axis.
In a one-quadrant coordinate grid the x and y axes meet at the origin (0) and only have positive values.



Most coordinate grids have narrow or faint horizontal and vertical lines connecting the numbers on each axis.
Coordinate grids allow us to describe exact locations precisely: coordinates are the way of describing this location.
Coordinates consist of 2 numbers separated by a comma. The coordinates are contained within a pair of brackets.

The first number shows the position on the x axis and describes an imaginary vertical line originating from this point on the x axis.
The second number shows the position on the y axis and describes an imaginary line originating from this point on the y axis.
The position where these two lines intersect is the position described by the coordinate pair.

When we put a dot at a location on a coordinate grid described by a pair of coordinates, this is called plotting.
Translation is a type of transformation, where a shape or point on a coordinate grid is changed in some way.
Translation is when a point or shape is moved (either horizontally or vertically) from one position to another. Every point in a translated shape moves the same amount in the same direction.



A translation can be described using positional language (e.g. 3 right, 2 down).
A translation can also be given in coordinate terms (e.g. +3, -2)
We always describe movement on the x axis first.

</td>
<td>
Children need to know how…

To describe the position of a point or shape shown on a grid showing the first quadrant using coordinates.
To plot specified points on a coordinate grid in the first quadrant from given coordinates. When these points create a polygon, join these with a ruler to create the final polygon.
To describe the translation of a point or shape on a coordinate grid using positional language (e.g. to the left/right and up/down) and with coordinates (e.g. 2,-1)
To translate a shape within the first quadrant of a coordinate grid from directions given in positional language and with coordinates.

</td>
<td>
Children need to know when…

A number in a coordinate is referring to the x axis and when it is referring to the y axis.
A translation has occurred.
Jottings may help them to describe or complete a translation.

Children need to know why…

The x axis is always given first. This is a mathematical convention.
Completed polygons must be drawn with a ruler. Geometric shapes are shapes with straight sides. Therefore, these must be drawn carefully.

</td>
</tr>
<tr>
<td>Vocabulary</td>
<td colspan="3">
<table>
<tr><td>COORDINATE GRID</td><td>A type of mathematical diagram where a horizontal and vertical axis (line) meet at a right angle. Each axis has a scale. Divisions on the axis have faint vertical/horizontal lines emerging from them, which create a regular grid pattern.</td><td>X AXIS</td><td>The horizontal axis (fixed reference line with a scale on a grid).</td><td>Y AXIS</td><td>The vertical axis (fixed reference line with a scale on a grid).</td></tr>
<tr><td>COORDINATE</td><td>A way of mathematically describing an exact position on a coordinate grid. Coordinates are given in the following format: (#,#). The first number (#) shows the position on the x axis. The second number shows the position on the y axis.</td><td>TRANSFORMATION</td><td>A change to the size or position of a geometric shape (such as a reflection, translation, rotation or enlargement)</td><td>TRANSLATION</td><td>The movement of a shape from one position to another vertically/horizontally.</td></tr>
<tr><td>FIRST QUADRANT</td><td>The first of four parts created when an x and y axis cross. The first quadrant contains the positive scales for both the x and the y axis and is located on the top right of a four-quadrant coordinate grid.</td><td>ORIGIN</td><td>The point where the x and y axis meet.</td><td></td><td></td></tr>
</table>
</td>
</tr>
<tr>
<td>Enrichment & wider development</td>
<td colspan="3"></td>
</tr>
</table>

Year 4 - Spring 1

Milestone LO (National Curriculum)

SUBTRACTION

Children should be taught to:

- subtract numbers with up to 4 digits using the formal written methods of columnar subtraction where appropriate
- estimate and use inverse operations to check answers to a calculation
- solve subtraction two-step problems in contexts, deciding which operations and methods to use and why

DIVISION

Children should be taught to:

- Recall division facts for multiplication tables up to 12 × 12
- Use place value, known and derived facts to divide mentally, including dividing by 1
- Solve problems involving division

FRACTIONS

- Count up and down in hundredths; recognise that hundredths arise when dividing an object by one hundred and dividing tenths by ten.
- Recognise and show, using diagrams, families of common equivalent fractions
- Add and subtract fractions with the same denominator
- 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
- Solve simple measure problems involving fractions

Revisited Knowledge

New knowledge

Domains	**Declarative knowledge** (substantive knowledge)	**Procedural knowledge** (disciplinary knowledge)	**Conditional knowledge** (knowing the when and the why)
Subtraction	Children need to know that… • *Subtraction is when you take one number away from another number and is represented by the symbol '-' (Year R)* • *The formal language of subtraction (minuend, subtrahend, difference) (Year 1)* • *When we know one part (subtrahend) and the whole (minuend) but not the other part (difference), we are being asked to do subtraction. (Year 2)* • *In mathematics, difference means the 'gap' between two numbers. This is also the answer to a subtraction question. (Year 2)* • *Inverse is the opposite. Addition is the inverse to subtraction. (Year 2)* • *We lay our digits out in columns, one digit per square, to make the place value of these numbers obvious. (Year 2)* • *In the formal written method of columnar subtraction, digits with the same place value must always be placed in the same column. (Year 3)* • *In the formal written method of columnar subtraction, we begin our calculation with the smallest place value column. (Year 3)* • *Exchanging is when you substitute 1 unit from a larger place value for 10 units from the next smallest place value. (Year 3)* • *We can exchange 1 ten for 10 ones (Year 3)* • *We can exchange 1 hundred for 10 tens (Year 3)* • We can exchange 1 thousand for 10 hundreds. • If the minuend is smaller than the subtrahend, the difference will be a negative number. • We can estimate by rounding numbers to make them easier to subtract. This allows us to check whether the answer to our calculation is reasonable.	Children need to know how… • *To know when a question is asking them to do subtraction based on their knowledge of parts and wholes. (KS1)* • *To subtract a one-digit number from a number up to three digits using their knowledge of counting back in ones, number bonds and written strategies. (Year 2)* • *To subtract ones and tens from a two-digit number within 100. (Year 2)* • *To subtract a two-digit number from a two-digit number. (Year 2)* • *To solve missing number problems using the inverse relationship. (Year 2) and check calculations using this (Year 3)* • *To subtract ones, tens and hundreds from a three-digit number mentally and supported by jottings by using their knowledge of counting backwards. (Year 3)* • *To subtract numbers with up to three digits using the formal written method of columnar subtraction. (Year 3)* • *To exchange one ten for ten ones when the ones digit in the minuend is smaller than the ones digit in the subtrahend. (Year 3)* • *To exchange a hundred for ten tens when the tens digit in the minuend is smaller than the tens digit in the subtrahend. (Year 3)* • *To check their answer using estimation (based on their knowledge of place value. (Year 3)* • *To identify fact families and inverse calculations. (Year 3)* • To subtract mentally (supported by jottings if needed) by applying knowledge of counting back in 1s, 10s, 100s and 1,000s. • To subtract numbers with up to four digits using the formal written method of columnar subtraction. • To exchange from the next largest column when the minuend in a column is smaller than the subtrahend (thousands→ hundreds, hundreds → tens, tens → ones). • To check the reasonableness of an answer by rounding. • To check calculations using the inverse relationship. • To solve two-step problems using their knowledge of subtraction.	Children need to know when… • *A specific calculation strategy may be most useful (e.g. number line, mental strategies, use of manipulatives, pictorial representations, formal written subtraction)* • *When exchanging from the next largest column will be necessary. (Year 3)* • *When to use addition or subtraction to work out a missing number problem (based on reasoning about parts and wholes) (Year 3)* • *When different checking strategies will be most useful (e.g. inverse, estimation, recalculation) (Year 3)* • *When we need to use reasoning language to explain our confidence in our calculations or to justify the approach we have taken. (Year 3)* • When a problem involves more than one step. Children need to know why… • ***We need to know whether we are looking at a part or a whole.*** *Knowing whether we are looking at a part or a whole helps us to know whether we need addition or subtraction.* • ***We learn to manipulate numbers mentally first.*** *It is often most efficient to use a mental method. The best mathematicians use the most efficient method to solve a problem.* • ***Subtraction is important.*** *We need to subtract so that we are able to establish 'how much of something is left' in real life contexts. (Year 3)* • ***We cannot simply switch the digits in the minuend and subtrahend around.*** *Subtraction is not commutative as the minuend is the whole, not a part. (Year 3)* • ***We can exchange from the next largest column.*** *10 ones are equivalent to 1 ten. 10 tens are equivalent to 1 hundred. Therefore exchanging them does not change the overall value. (Year 3)*

Vocabulary

PARTITION	To split a whole into parts.	**EQUAL**	The same as.	**PART**	A section of the whole.
WHOLE	A total amount. This is always the sum of the parts.	**REPRESENTATION**	A way of showing a mathematical idea using objects, pictures or numerals.	**MANIPULATIVE**	A physical object used to help represent mathematics (e.g. beadstring, Base 10).
CONCRETE	A representation of a mathematical idea using manipulatives or real-life objects.	**PICTORIAL**	A representation of a mathematical idea using pictures.	**ABSTRACT**	A representation of a mathematical idea using symbols (e.g. numerals)
PART-PART WHOLE MODEL	A pictorial representation of number showing the relationship between parts and wholes.	**BAR MODEL**	A form of part-part whole model where the parts are represented by adjacent bars.	**NUMBER LINE**	A picture used to represent numbers and calculations where numbers are shown on a regular scale.
BASE 10	A manipulative used to show the value of a digit based on the column in which it is placed.	**PLACE VALUE CHART**	A picture/diagram used to help represent the value of digits in numbers.	**SYMBOL**	An abstract image used to represent an idea (e.g. digits, +, =)
COUNTING ON	Starting from a number and counting forwards in the number system. This can be used as a strategy to solve subtraction problems (starting at the subtrahend or difference and counting on to the minuend).	**COUNTING BACK**	Starting from a number and counting backwards. This can be used as a strategy for solving subtraction problems (starting at the minuend and counting back to the subtrahend or difference).	**NUMBER SENTENCE**	A way of representing a mathematical operation using symbols (+,-,x,÷,= etc)
SUBTRATION	Removing a part from the whole.	**FACT FAMILIES**	A set of mathematical facts which are closely related. Knowing on means you know all. For example 2 + 3 = 5, 3 + 2 = 5, 5-3 = 2, 5-2 = 3		
MINUEND	The whole in a subtraction problem. This is the amount you subtract from and must always come first.	**SUBTRAHEND**	The part which you are taking away from the whole. This always comes after the minuend.	**DIFFERENCE**	The answer to a subtraction question. This shows the remaining part (the gap between the part and the whole)
INVERSE	The opposite calculation. This undoes what was done by the previous calculation. Addition and subtraction are inverse.	**EXCHANGING**	Using your knowledge of the relationship between different place value columns to 'exchange' from a larger column when the digit in the minuend is smaller than the digit in the subtrahend.		

Division

Children need to know that…

- *Equal means the same and is shown by the symbol = (Year 1)*
- *'Equal groups' means you have the same number of objects in each group. (Year 1)*
- *Division can be seen in two ways: (Year 1)*
  - ***Division as sharing:** sharing the dividend into a specific number of groups (e.g. 12 ÷ 2 → share 12 equally between two groups. How many counters are in each group?).*
  - ***Division as grouping:** is sharing the dividend into equal size groups. (e.g. 12 ÷ 2 → group the 12 counters into lots of groups of two. How many groups are there?)*
- *÷ is a symbol that means division. (Year 1)*
- *The formal language of division (dividend, divisor, quotient) (Year 1)*
- *Half means dividing something by 2 (Year 1)*
- *Division is not commutative. (Year 2)*
- *In division, the whole (dividend) must always be before the divisor (Year 2)*
- *Multiplication is the inverse of division (Year 2)*
- *A multiple of a number can be divided by that number without a remainder (e.g. 25 is a multiple of 5 because 25 can be divided by 5 without a remainder). (Year 3)*
- *Relationships between the times tables they know (all) (Year 4 Autumn 1).*
- *A remainder is the amount left over when something cannot be shared or grouped equally. (Year 3)*
- *Dividend is the whole. The number which is to be divided. (Year 3)*
- *Divisor is the number the dividend is going to be divided by. This could tell us the number of groups to create (dividing by sharing) or the number in each group (dividing by grouping). (Year 3)*
- *Quotient is the answer to a division question. This could mean the number of groups created or the quantity in each group, depending on whether we are dividing by grouping or by sharing. (Year 3)*
- *Divisibility Rules for 1, 2, 3, 4, 5, 8 and 10. (Year 3)*
- *A derived fact is a fact worked out using facts you already know (e.g. the relationship between the times tables, known facts and place value, using a known fact and adding a multiple or fact families). (Year 3)*
- *A factor is a number that a multiple can be divided by without a remainder (it gives an integer quotient). (Year 3)*
- *An integer is a whole number. (Year 3)*
- *Factors come in pairs, which multiply together to create a multiple. (Year 3)*
- Any number divided by 1 remains the same.
- The divisibility rules for
  - 6: Is it even? And is the sum of the digits divisible by 3?
  - 7: Double the last digit and subtract from a number made by the other digits. Is the result divisible by 7?
  - 9: Is the sum of the digits divisible by 9?
  - 11: Add and subtract the digits in an alternating pattern (i.e. add digit 1, subtract digit 2, add digit 3, subtract digit 4). Is the answer divisible by 11?

Children need to know how…

- *To identify equal groups (Year 1)*
- *To justify how they know a group is equal. (Year 1)*
- *To write division number sentences using the ÷ symbol and =. (Year 1)*
- *To represent division as sharing and grouping (Year 1)*
- *To solve division problems using an appropriate method (mentally by recalling the number facts they have learned, practically or repeated subtraction on a number line) (Year 1)*
- *To identify whether a problem requires multiplication or division using more advanced mathematical language and reasoning (e.g. part, whole, multiplier, multiplicand, product, dividend, divisor, quotient) (Year 2)*
- *To use the inverse relationship between multiplication and division. (Year 2)*
- *To solve missing number problems using the inverse relationship. (Year 2)*
- *To check their calculations using the inverse relationship. (Year 2)*
- *To count forwards and backwards in 1,2,3,4,5,8 and 10. (Year 3)*
- *To recall and find multiplication facts for the 2,3,4,5,8, 10 times tables (Year 3)*
- *To find the associated division facts for the times tables that they already know (2,3,4,5,8,10) (Year 3)*
- *To represent division problems confidently using bar models, part-part whole models, arrays and open arrays. (Year 3)*
- To divide any number by 1.
- To use divisibility rules to suggest whether a division will be possible without a remainder before calculating.
- To recall division facts for multiplication tables up to 12 x 12.
- To use place value and knowledge of fact families to mentally solve division problems.

Children need to know…

- *When a question requires multiplication or division based on their knowledge of the underlying structures of these calculations. (Year 2)*
- *When a strategy is useful and appropriate for solving a division problem (Year 2)*
- *When a problem can be solved mentally using a known fact (Year 2)*
- *Which multiplication fact they have learned will help them solve a division problem. (Year 3)*
- *When we are looking at missing number problems, we need to work out which part of the problem we are missing. (Year 3)*
- *When to use the inverse to check an answer. (Year 3)*
- *Where patterns can be used to help solve more complex division problems efficiently (e.g. repeatedly dividing by 2). (Year 3)*
- When a problem can be solved mentally using a derived fact.

Children need to know why…

- ***There are a range of ways of solving multiplication and division problems.** Different problems may be visualised better using different representations. (Year 1)*
- ***You get the same quotient regardless of whether you solve a division problem by grouping or sharing.** We can rotate our array to show the commutative nature of multiplication. (Year 1)*
- ***We need to develop rapid recall of key multiplication and division number facts.** Having fluent and automatic recall of number facts allows us to 'know' the answer rather than working it out each time. This makes it easier for our brains (reducing cognitive load) which helps us to solve trickier problems. (Year 2)*
- ***An open array is a useful way of visualising division problems.** Open arrays can help us when we are multiplying and dividing much larger numbers. They also help us to solve area problems later on.*

	○ 12: Does it pass the divisibility rules for both 3 and 4? (3: Is the sum of the digits divisible by 3? 4: Are the last 2 digits divisible by 4?) • We can derive division facts using known facts (e.g. fact families, place value)		

Vocabulary						
	EQUAL	The same as.	**EQUAL GROUPS**	The same quantity in each group.	**INVERSE**	The opposite calculation. This undoes what was done by the previous calculation. Multiplication and division are inverse operations.
	DIVISION	Where a whole is split into two or more equal groups.	**DIVISION AS SHARING (PARTITIVE DIVISION)**	The divisor tells you the number of groups to share the dividend between. E.g. 10÷2=5 	**DIVISION AS GROUPING (QUOTIVE DIVISION)**	The divisor tells you the number in each group. E.g. 10÷2=5 
	DIVIDEND	A number to be divided by another number (the whole)	**DIVISOR**	The number which the dividend is being divided by. Tells you either the number of parts or the size of each part.	**QUOTIENT**	A result of dividing one number by another. Depending on the role of the divisor, this either tells you the number of parts or the size of each equal part.
	FACT FAMILIES	A set of mathematical facts which are closely related. Knowing on means you know all. For example, 2 x 3 = 6, 3 x 2 = 6, 6 ÷ 3 = 2, 6 ÷2 = 3	**REMAINDER**	The amount left over when you divide a dividend by a divisor which cannot divide perfectly.	**REPEATED SUBTRACTION**	A strategy for solving division problems where you count back in multiples, sometimes supported by a number line.
	SHORT DIVISION	A formal written method used to solve some larger division problems. This is sometimes colloquially called bus stop method.				

Fractions

Representing Fractions

Children need to know that…

- *A fraction represents part of a whole. A whole is your total amount/shape. A part is an **equal** section of your total amount/ shape. (Year 1)*
- *The number 1 represents 1 whole. (Year 2)*
- *When we write a fraction, the bottom number describes the total number of **equal** parts that the whole has been split into. This is called the denominator (Year 2)*
- *When we write a fraction, the top number describes the number of parts you have. This is called the numerator. (Year 2)*
- *The straight line between the numerator and the denominator is called the dividing line. (Year 2)*
- *Why the following fractions are written the way they are: $\frac{1}{2}, \frac{1}{4}, \frac{2}{4}, \frac{3}{4}, \frac{1}{3}$, (Year 2)*
- *A unit fraction is any fraction with 1 as its numerator and an integer for the denominator (e.g. $\frac{1}{2}$) (Year 3)*
- *A non-unit fraction is a fraction where the numerator is greater than 1 (e.g. $\frac{3}{4}$). (Year 3)*
- *A tenth is 1 part out of 10. Tenths arise from dividing an object into 10 equal parts. (Year 3)*
- *To find a fraction of a quantity, we need to first divide by the denominator and then multiply by the numerator. (Year 3)*
- A hundredth is 1 part out of 100.
- Hundredths arise from dividing a whole into 100 equal parts.
- Hundredths arise from dividing a tenth into 10 equal parts.

Representing Fractions

Pupils need to know how…

- *To identify when you have equal parts/groups (Year 1)*
- *To identify a half, a quarter, a third, two quarters and three quarters of a shape, object or quantity (KS1)*
- *To write number sentences to describe fractions of quantities (including lengths) – e.g. $\frac{1}{2}$ of 6 = 3. (Year 2)*
- *To find a tenth of a quantity or shape by diving the whole by 10 (Year 3)*
- *To count up and down in tenths e.g. 1/10, 2/10, 3/10… (Year 3)*
- *To recognise, find and write unit fractions of a discrete set of objects by counting the objects to find the denominator (Year 3)*
- *To recognise, find and write non-unit fractions of a discrete set of objects by counting all the objects to find the denominator and counting the taken part to find the numerator (Year 3)*
- *To recognise, find and write unit fractions of a quantity (Year 3)*
- *To recognise, find and write non-unit fractions of a quantity (Year 3)*
- To count up and down in hundredths.
- To find a hundredth of a quantity or shape by dividing the whole by 10.
- To find a hundredth of a quantity or shape by dividing a tenth by 10.
- To calculate increasingly large unit and non-unit fractions of an amount by dividing by the denominator and multiplying by the numerator where the answer is a whole number.

Children need to know when …

- *To use the language of half and quarter. (Year 1)*
- *A part is equal or unequal. (Year 1)*
- *Fractions which look different are describing the same thing (equivalent fractions $\frac{2}{4}$ and $\frac{1}{2}$) (Year 2)*
- *To use visual models and when to use calculation to solve fractions problems. (Year 3)*
- *Multiplication and division facts can be used to help solve fractions problems. (Year 3)*
- *We can just add/subtract the numerators (when the denominators are the same) (Year 3)*
- *To use fraction knowledge to help us solve real-life problems (e.g. sharing an object equally between friends, making a recipe work for less people). (Year 3)*

Children need to know why…

- ***Recognising equal parts is so important.** Recognising equality of parts is the fundamental knowledge required for multiplication, division and fractional reasoning. (Year 1)*
- ***Fractions may look different but be describing the same amount.** Some fractions are equivalent. This means that they describe the same amount. They have been split into a different number of parts. (Year 2)*
- ***We can only add/subtract numerators without doing anything else to the fractions when denominators are the same.** The parts must be the same size in order to be added together. (Year 3)*
- ***When the numerator is the same, a larger denominator means a smaller fraction.** The denominator tells us how many parts it is split into. More parts means the parts will be smaller. (Year 3)*
- ***We use a fraction wall to help us solve equivalence problems.** A fraction wall shows fractions side by side so it is very easy for us to draw a line and see which ones are bigger and which ones are smaller. (Year 3)*
- **A hundredth is a tenth divided by 10.** Tenths and hundredths also follow our base 10 system. There are ten hundredths in a tenth.

Vocabulary						
	FRACTION	A way of representing mathematically how many equal parts of a whole you have.	**PART**	A section of the whole. In fractions, parts must always be equal.	**WHOLE**	A total amount. This is the sum of all the parts. In fractions, the number 1 represents 1 whole.
	DENOMINATOR	The bottom number in a fraction. This describes the number of equal parts the whole has been split into.	**DIVIDING LINE**	The horizontal line which separates the numerator from the denominator.	**NUMERATOR**	The top number in a fraction. This describes the number of parts you have.
	HALF	When a whole has been split into two equal parts.	**QUARTER**	When a whole has been split into four equal parts.	**THIRD**	When a whole has been split into three equal parts.
	QUANTITY	A numerical amount.	**COMPARE**	Two meanings: a) to say what is the same or what is different. b) to identify the mathematical difference between numbers.	**EQUAL/ EQUIVALENT**	The same as.
	EQUIVALENT FRACTION	Fractions that represent the same amount/number but which look different.	**FRACTION WALL**	A pictorial representation of small fractions. This helps to find equivalent fractions.	**LIKE DENOMINATORS**	Denominators are the same
	LIKE NUMERATORS	Numerators are the same.	**UNIT FRACTION**	A fraction with a numerator of 1	**NON-UNIT FRACTION**	A fraction with a numerator larger than 1.
	TENTH	One part when a whole has been divided by 10	**HUNDREDTH**	One part when a whole has been divided by 100	**FRACTION FAMILY**	A group of equivalent fractions.
Enrichment & wider development						

Year 4 - Spring 2

Milestone LO (National Curriculum)

FRACTIONS

- Count up and down in hundredths; recognise that hundredths arise when dividing an object by one hundred and dividing tenths by ten.
- Recognise and show, using diagrams, families of common equivalent fractions
- Add and subtract fractions with the same denominator
- 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
- Solve simple measure problems involving fractions

DECIMALS

- Count up and down in hundredths; recognise that hundredths arise when dividing an object by one hundred and dividing tenths by ten.
- Recognise and write decimal equivalents of any number of tenths or hundredths
- Recognise and write decimal equivalents to ¼, ½, ¾
- 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

GEOMETRY:

Properties of shape

- Compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes
- 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.

Revisited Knowledge

New knowledge

Domains	**Declarative knowledge** (substantive knowledge)	**Procedural knowledge** (disciplinary knowledge)	**Conditional knowledge** (knowing the when and the why)
Fractions	**Adding and Subtracting Fractions** Children need to know that… • *When we add/subtract fractions with the same denominator, we add/subtract the numerator but the denominator stays the same.* **Equivalence** Children need to know that… • *Equivalent means equal to (Year 2)* • *$\frac{2}{4}$ is equivalent to $\frac{1}{2}$ (Year 2)* • *Equivalent fractions are fractions that describe the same fraction of an amount/number but which look different (Year 3)* • *We can find equivalent fractions by drawing bar models/pictures and using a fraction wall. (Year 3)* • A group of equivalent fractions is called a 'fraction family' **Comparing and Ordering Fractions** Children need to know that… • *< means is greater than (more than) (Year 2)* • *> means is fewer than (less than) (Year 2)* • *= means is equal to (Year 2)*	**Adding and Subtracting Fractions** Pupils need to know how… • *To add two fractions with the same denominator, by adding the numerators of both addends together (Year 3)* • *To subtract fractions with the same denominator by subtracting the numerator of the subtrahend from the numerator of the minuend. (Year 3)* • To confidently add and subtract increasingly large unit and non-unit fractions with the same denominator (including adding three or more fractions). **Equivalence** Pupils need to know how… • *To show that $\frac{2}{4}$ is equivalent to $\frac{1}{2}$. (Year 2)* • *To recognise and show pairs of equivalent fractions by writing and drawing diagrams (Year 3)* • To show families of equivalent fractions using diagrams. **Comparing and Ordering Fractions** Pupils need to know how… • *To compare unit fractions by using <, > and = (Year 3)* • *To compare fractions with the same denominator by using <, > and = (Year 3)* • To compare fractions with the same numerator using <,> and = • To compare and order increasingly complex fractions.	Children need to know when … • *To use the language of half and quarter. (Year 1)* • *A part is equal or unequal. (Year 1)* • *Fractions which look different can be describing the same thing (Year 2)* • *To use the simpler fraction to solve the problem (e.g. finding $\frac{1}{2}$ rather than $\frac{2}{4}$) (Year 2)* • *To use visual models (e.g. equivalence) and when to use calculation (e.g. simple fractions of quantities) to solve fractions problems. (Year 3)* • *Multiplication and division facts can be used to help solve fractions problems. (Year 3)* • *We can just add/subtract the numerators) (Year 3)* • *To use fraction knowledge to help us solve real-life problems (e.g. sharing an object equally between friends, making a recipe work for less people). (Year 3)* Children need to know why… • ***Recognising equal parts is so important.*** *Recognising equality of parts is the fundamental knowledge required for multiplication, division and fractional reasoning. (Year 1)* • ***Fractions may look different but be describing the same amount.*** *Some fractions are equivalent. This means that they describe the same amount. They have been split into a different number of parts.* ***(Year 2)*** • ***We can only add/subtract numerators without doing anything else to the fractions when denominators are the same.*** *The parts must be the same size in order to be added together. (Year 3)* • ***When the numerator is the same, a larger denominator means a smaller fraction.*** *The denominator tells us how many parts it is split into. More parts means the parts will be smaller. (Year 3)* • ***We use a fraction wall to help us solve equivalence problems.*** *A fraction wall shows fractions side by side so it is very easy for us to draw a line and see which ones are bigger and which ones are smaller. (Year 3)*

	• *We can compare fractions with the same denominator by looking at the numerator. The larger the numerator, the larger the fraction.* • *We can compare fractions with the same numerator by looking at the denominator. The larger the denominator, the smaller the fraction.* • *We can compare fractions with different numerators and denominators using pictorial representations, such as a fraction wall or bar model.*	To solve problems (including measure) using knowledge of fractions	• **A hundredth is a tenth divided by 10.** Tenths and hundredths also follow our base 10 system. There are ten hundredths in a tenth.

Vocabulary

FRACTION	A way of representing mathematically how many equal parts of a whole you have.	**PART**	A section of the whole. In fractions, parts must always be equal.	**WHOLE**	A total amount. This is the sum of all the parts. In fractions, the number 1 represents 1 whole.
DENOMINATOR	The bottom number in a fraction. This describes the number of equal parts the whole has been split into.	**DIVIDING LINE**	The horizontal line which separates the numerator from the denominator.	**NUMERATOR**	The top number in a fraction. This describes the number of parts you have.
HALF	When a whole has been split into two equal parts.	**QUARTER**	When a whole has been split into four equal parts.	**THIRD**	When a whole has been split into three equal parts.
QUANTITY	A numerical amount.	**COMPARE**	Two meanings: a) to say what is the same or what is different. b) to identify the mathematical difference between numbers.	**EQUAL/ EQUIVALENT**	The same as.
EQUIVALENT FRACTION	Fractions that represent the same amount/number but which look different.	**FRACTION WALL**	A pictorial representation of small fractions. This helps to find equivalent fractions.	**LIKE DENOMINATORS**	Denominators are the same
LIKE NUMERATORS	Numerators are the same.	**UNIT FRACTION**	A fraction with a numerator of 1	**NON-UNIT FRACTION**	A fraction with a numerator larger than 1.
TENTH	One part when a whole has been divided by 10	**HUNDREDTH**	One part when a whole has been divided by 100	**FRACTION FAMILY**	A group of equivalent fractions.

Decimals

Recognising Decimals

Children need to know that…

- *A unit fraction is any fraction with 1 as its numerator, and a whole number for the denominator eg $\frac{1}{2}$) (Year 3)*
- *A non-unit fraction is a fraction where the numerator is greater than 1 (eg $\frac{3}{4}$) (Year 3)*
- *A tenth is 1 part out of 10. (Year 3)*
- *Tenths arise from dividing an object into 10 equal parts. (Year 3)*
- *A hundredth is 1 part out of 100. (Year 4 Spring 1)*
- *Hundredths arise from dividing a whole into 100 equal parts. (Year 4 Spring 1)*
- *Hundredths arise from dividing a tenth into 10 equal parts. (Year 4 Spring 1)*
- Decimal numbers are another way of showing fractions of a whole.
- Decimal numbers use the Base 10 number system to do this.
- With decimal numbers, our place value grid extends to the right, past the ones – see below.

- To show that the digits are now decimals (parts of a whole), a decimal point is placed between the ones column and the tenths column.
- The number of digits after the decimal point is called decimal places. We can describe decimal numbers by saying how many dps (decimal places) they have. For example, 2.12 is a number with 2dps.
- The decimal point should be written on the line between the squares in your book, to show it is just a visual placeholder, not a column with numerical value.
- 0.1 = $\frac{1}{10}$
- Tenths are shown in the tenths column.
- 0.01 =$\frac{1}{100}$
- There are key fraction/decimal equivalents we need to learn:
  - $\frac{1}{4}$ = 0.25
  - $\frac{1}{2}$ = 0.5
  - $\frac{3}{4}$ = 0.75
- Hundredths are shown in the hundredths column.
- Both fractions and decimals can be used to express fractional numbers greater than one whole.

Recognising Decimals

Children need to know how…

- *To find a tenth of a quantity or shape by diving the whole by 10 (Year 3)*
- *To count up and down in tenths e.g. 1/10, 2/10, 3/10…(Year 3)*
- *To count up and down in hundredths. (Year 4 Spring 1)*
- *To find a hundredth of a quantity or shape by dividing the whole by 10. (Year 4 Spring 1)*
- *To find a hundredth of a quantity or shape by dividing a tenth by 10. (Year 4 Spring 1)*
- To convert between fractions and decimals by recognising and writing decimal equivalents of any number of tenths and hundreds.
- To write fractional numbers (with tenths/hundredths) greater than one whole as mixed numbers and decimals.
- To convert between fractions and decimals by recognising and writing key fraction/decimal equivalences $\frac{1}{4}$ = 0.25, $\frac{1}{2}$ = 0.5, $\frac{3}{4}$ = 0.75

Children need to know when…

- It is easier to present a fractional amount as a fraction or a decimal.
- They are likely to see/use decimal numbers in real life.

Children need to know why…

- **Many measures use decimal rather than fraction notation.** Many measurement units use Base 10 equivalences which are easier to show and calculate with in decimal form.

	○ Decimal numbers: The fractional parts are shown in the place value columns (e.g. 3 wholes, 1 tenth and 7 hundredths would be written 3.17) ○ Fractions: a fraction with wholes and parts is called a mixed number. The integer (whole number) is written with a large digit and the fractional part is shown as a fraction and written much smaller. (e.g. 3 wholes, 1 tenth and 7 hundredths would be written as $3\frac{17}{100}$) • Decimal equivalents are decimal numbers that have the same value (e.g. 0.5 and 0.50) **Comparing and Ordering Decimals** Children need to know that… • *< is a mathematical symbol which means less than (Year 2)* • *> is a mathematical symbol which means more than. (Year 2)* • *= is a mathematical symbol which means equal to (Year R)* • *Equal means the same (Year R)* • *When comparing and ordering numbers, we have to look at the largest place value column first. (Year 3)* • *It is important to organise our numbers so it is easy to compare place value columns, for example using the squares in our books. (Year 3)* **Rounding Decimals** Children need to know that… • *Rounding numbers makes them 'easier' to use or understand whilst keeping the number close to its original value.* • *Rounding is a mathematical way of estimating number. (Year 4)* • *We can round to any place value column. (Year 4)* • *When rounding, you need to find the place value you are rounding to. This is called your target digit. (Year 4)* • *You then need to look at the next smallest column. If this is 5 or more, you round up. If this is 0-4 you round down. (Year 4)* • *When you round up, the target digit increases by one; the digits in larger place value columns stay the same; the digits in smaller place value columns become 0. (Year 4)* • *When you round down, the target digit stays the same; the digits in larger place value columns stay the same; the digits in smaller place value columns become 0. (Year 4)* **Dividing to create decimal numbers** Children need to know that… • When we divide a number by 10, the digits move one column to the right, becoming ten times smaller. • When we divide a number by 100, the digits move two columns to the right, becoming one hundred times smaller.	**Comparing and Ordering Decimals** Children need to know how… • *To compare (using <,>,=) and order numbers beyond 1000 (Year 4 Autumn 1)* • To compare decimal numbers with the same number of decimal places (up to 2 dp) using <,>, = • To order decimal numbers with the same number of decimal places (up to 2 dp) in ascending or descending order. **Rounding Decimals** Children need to know how… • To round decimal numbers with 1dp to the nearest one whole. **Dividing to create decimal numbers** Children need to know how… • *To round any number to the nearest 10, 100 or 1,000 (Year 4 Autumn 1)* • To divide a one or two digit number by 10 and 100, identifying the value of the digits in the quotient as ones, tenths and hundredths.	

Vocabulary

NUMBER	An abstract way of representing a quantity (e.g. 2,26, fifty-nine, $\frac{1}{2}$, 0.322)	**NUMERAL**	Words or symbols used to represent numbers, made up of digits.	**DIGIT**	The ten single symbols 0-9, used to represent numbers when placed in sequence.
VALUE	How much something is worth. In representation of number, the position of a digit in a numeral determines its value.	**PLACE VALUE CHART**	A picture/diagram used to help represent the value of digits in numbers.	**ESTIMATE**	To make a 'sensible guess' based on your knowledge of and experience with number.
ONE DIGIT NUMBER	A numeral which only contains one digit.	**TWO DIGIT NUMBER**	A numeral which contains two digits. The first digit has a value of tens.	**THREE DIGIT NUMBER**	A numeral which contains three digits. The first numeral has a value of hundreds.
FOUR DIGIT NUMBER	A numeral which contains four digits. The first numeral has a value of thousands.	**DECIMAL POINT**	The 'dot' placed between the ones and tenths column to show the shift from integer to fractional amounts.	**DECIMAL PLACES**	The number of digits after the decimal point in a given numeral.
THOUSANDS	A digit value where the digit represents one-thousand-times the quantity. There are 10 hundreds in a thousand. There are 100 tens in a hundred; there are 1,000 ones in a hundred.	**HUNDREDS**	A digit value where the digit represents one-hundred-times the quantity. There are 10 tens in a hundred; there are 100 ones in a hundred.	**TENS**	A digit value where the digit represents ten-times the quantity. There are 10 ones in a ten.
ONES	Where the digit represents the quantity exactly.	**TENTH**	One part when a whole has been divided by 10.	**HUNDREDTH**	One part when a whole has been divided by 100
PLACE HOLDER ZERO	Where a zero is placed in a place value column to show there are 0 of that value within the number. This is important to ensure that digits are seen in the correct place value column.	**COMPARE**	Two meanings: a) to say what is the same or what is different. b) to identify the mathematical difference between numbers.	**EQUAL**	The same as.

	GREATER THAN >	When the first number is more than the second number. Can be shown by the greater than symbol >	**LESS THAN <**	When the first number is less than the second number. Can be shown by the less than symbol.	**ORDER**	To arrange numbers by their numerical value.
	ASCENDING ORDER	Arranging numbers from smallest to largest.	**DESCENDING ORDER**	Arranging numbers from largest to smallest.	**PART**	A section of the whole.
	WHOLE	A total amount. This is always the sum of the parts.	**ROUNDING**	To alter a number to be less exact by taking it to the nearest 'one' of a specified place value column. This makes it more convenient for calculating with.	**EQUAL/ EQUIVALENT**	The same as.

Properties of shape

2D Shape

Children need to know that…

- *A 2D shape is a shape that has 2 dimensions (width/height). It is flat and can only ever be drawn. (Year 1)*
- *2D shapes have sides and vertices (Year 1)*
- *The properties of a range of different 2D shapes: circle, triangle, quadrilateral, pentagon, hexagon and octagon (Year 1)*
- *A semicircle is exactly half of a circle. (Year 3)*
- *A polygon is a word for a multiple sided shape. (Year 3)*
- *Quadrilateral is the name for a four-sided shape. (Year 3)*
- *The names and properties of a range of quadrilaterals. (Year 3)*

Name	***Number of sides/vertices***	***Unique properties***
Square	*4*	*All sides are equal lengths.* *All angles are right angles.* *2 pairs of parallel lines.*
Rectangle	*4*	*All angles are right angles.* *2 pairs of parallel lines.* *Parallel sides are equal lengths.*
Trapezium	*4*	*Not all trapeziums look the same.* *1 pair of parallel lines.* *2 pairs of equal angles.* *2 lines of equal length; 2 lines that are different lengths.* *2 obtuse angles and 2 acute angles.*
Rhombus	*4*	*All sides are equal lengths* *2 pairs of parallel lines* *Opposite angles are equal.*
Parallelogram	*4*	*2 pairs of parallel lines.* *2 acute and 2 obtuse angles.* *2 pairs of sides that are equal lengths.*

- *Symmetry means when something is exactly the same on either side. Lines of symmetry can be diagonal, horizontal or vertical. (Year 2)*
- The names and properties of a range of triangles:

Name	**Number of sides/vertices**	**Unique properties**
Equilateral	3	All sides are equal lengths. All angles are the same size (60^o)
Isosceles	3	2 sides are the same length. 2 angles are the same size.
Scalene	3	All sides are different lengths. All angles are different sizes.
Right Angled	3	One angle is a right angle. Could be either an isosceles or scalene triangle.

- 'Classify' means to arrange a group of things into classes or categories according to shared characteristics.
- Geometrical properties are the specific characteristics of geometric shapes (e.g. type of line, vertices, angles, faces etc.)

3D Shape

Children need to know that…

2D Shape

Children need to know how…

- *To recognise and identify 2D shapes, based on their properties. (Year 1)*
- *To recognise 2D shapes in different orientations and sizes. (Year 1)*
- *To recognise 2D shapes in everyday life. (Year 1)*
- *To identify a line of symmetry in a shape. (Year 2)*
- *To recognise and describe a 2D shape by its lines of symmetry (Year 2)*
- *To describe 2D shapes using the terms 'side' and 'vertex'/'vertices' (Year 3)*
- *To accurately identify and describe types of quadrilateral.*
- *To draw 2D shapes with accuracy (Year 3)*
- *To complete a drawing of a 2D shape which is symmetrical when given one side of the line of symmetry. (Year 3)*
- To compare and classify 2D shapes using geometrical properties (including grouping different types of triangle and different types of quadrilateral.)
- To choose an appropriate geometrical property to compare/classify a group of 2D shapes.
- To recognise lines of symmetry in 2D shapes presented in different orientations.
- To complete simple symmetrical figures with respect to a specific line of symmetry (including horizontal, diagonal and vertical lines of symmetry)

3D Shape

Children need to know how…

Children need to know when…

- *We see a shape, we can identify it by its properties. (Year 1)*
- *We see symmetry in real life. (Year 2)*
- *We draw shapes with straight sides, we use a ruler. (Year 3)*
- *we draw a symmetrical shape, it can be divided into two parts which are mirror images of one another. (Year 3)*
- *comparing shapes, we can choose to compare them based on their properties such as the number of sides, angles, or symmetry. (Year 3)*
- *we make 3D shapes, all sides must connect to each other with no gaps. (Year 3)*
- a shape is symmetrical.
- a geometrical property would be a useful way of comparing and classifying shapes.

Children need to know why…

- ***We identify shapes.*** *We identify shapes because we can use 3D shapes to build. Different shapes have different properties so are useful for different things. (Year 1)*
- ***There is no gap between the sides in 3D shapes.*** *3D shapes describe complete, enclosed shapes. (Year 3)*
- **A specific property may not always be a useful way of comparing and classifying shapes.** If the property is shared across all shapes, you will not create meaningful groups. Similarly, if a property is different for all shapes, you will not be able to create meaningful groups.

- *A 3-d shape is a solid figure or an object or shape that has three dimensions— length, width, and height (Year 1)*
- *3D shapes have edges, vertices and faces. (Year 1)*
- *A face is a surface of a 3D shape. (Year 1)*
- *An edge is the straight line where 2 edges meet. (Year 1)*
- *A vertex is the point where at least 3 edges meet (Year 1)*
- *The properties of a range of 3D shapes (Year 1)*

Name	*Number of edges*	*Number of Vertices*	*Number of faces*
Sphere	*0*	*0*	*1 continuous, curved*
Pyramid	*6*	*4*	*Triangular base: 4 flat triangles (inc. base)*
	8	*5*	*Square base: 1 flat square 4 flat triangles*
Cone	*1*	*1*	*1 flat, circle 1 curved*
Cylinder	*2*	*0*	*2 flat circles 1 curved rectangle*
Triangular prism	*9*	*6*	*2 flat triangles 3 flat squares*
Cube	*12 (equal length)*	*8*	*6 flat squares*
Cuboid	*12 (parallel are equal length)*	*8*	*6 flat faces - some squares, some rectangles*

- *Orientation is the angle at which an object or shape is presented from. (Year 3)*

- *To recognise and identify 3D shapes, based on their properties. (Year 1)*
- *To recognise 3D shapes in different orientations and sizes. (Year 1)*
- *To recognise 3D shapes in everyday life (Year 1)*
- *To identify the 2-D shapes on the surface of 3D shapes (faces) by their properties. (Year 2)*
- *To compare 2D and 3D shapes using everyday objects. (Year 2)*
- *Describe 3D shapes using the terms face, edge, curved surface, flat surface and vertex/vertices. (Year 3)*
- *Recognise 3-d shapes in different orientations. (Year 3)*
- *Construct 3-d shapes using a variety of equipment. (Year 3)*
- To compare and classify 3D shapes based on their geometrical properties.
- To choose an appropriate geometrical property to compare/classify a group of 3D shapes.

Vocabulary	**EQUAL**	The same as.	**2D Shape**	A shape with 2 dimensions (flat). They have width and height. They can only be drawn, not held.	**3D SHAPE**	A shape with 3 dimensions (height, width and depth). These can be held as well as drawn.
	SIDES	The lines which define the outside of a shape.	**VERTEX (2D)**	The points at which two sides of a shape meet.	**VERTEX (3D)**	The point at which three or more edges meet.
	EDGE	The line where two faces meet.	**FACE**	The flat surfaces of a 3D shape.	**SURFACE**	The outside layer of something.
	HORIZONTAL	A straight line which goes from left to right/right to left.	**VERTICAL**	A straight line which goes up and down.	**DIAGONAL**	A straight line which joins non-adjacent corners of a straight-sided shape.
	STRAIGHT	A line which does not curve. These are drawn with a ruler.	**CURVED**	A line that is bent. Usually this is smooth and continuous.	**LINE OF SYMMETRY**	A line that cuts a shape exactly in half, so the two sides are mirror images of one another.
	SYMMETRICAL	A shape with at least one line of symmetry.	**MIRROR IMAGE**	An image of object which is identical to another, but with the structure reversed (like your reflection in a mirror or either side of a symmetrical shape)	**ORIENTATION**	The angle at which an object or shape is presented from.
Enrichment						

Year 4 – Summer 1

Milestone LO (National Curriculum)

MULTIPLICATION

- Multiply two-digit and three-digit numbers by a one-digit number using formal written layout
- Multiply three numbers together.
- Use place value, known and derived facts to multiply mentally, including: multiplying by 0 and 1; multiplying together 3 numbers
- Solve problems involving multiplying and adding, including using the distributive law to multiply two-digit numbers by 1 digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects

MEASUREMENT

Converting units

- Convert between different units of measure [for example, kilometre to metre; hour to minute]
- Estimate, compare and calculate different measures
- Solve problems involving converting

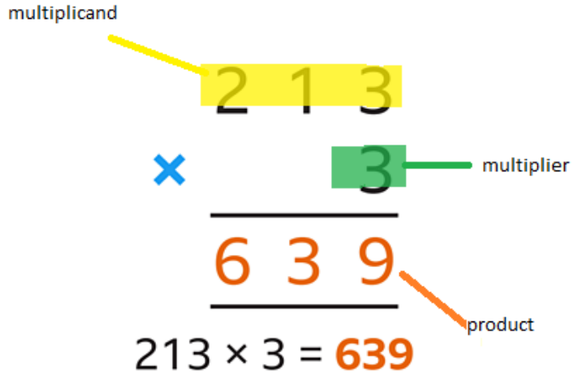
Revisited Knowledge

New knowledge

Domains	**Declarative knowledge** (substantive knowledge)	**Procedural knowledge** (disciplinary knowledge)	**Conditional knowledge** (knowing the when and the why)
Using place value to multiply ones numbers	**Multiplying and dividing by 10, 100 and 1,000** Children need to know that… • *There are 10 ones in a ten. (KS1)* • *There are 10 tens in a hundred. (Year 3)* • *There are 10 hundreds in a thousand. (Year 4 Autumn 1)* • When you multiply by 10, the number becomes 10 times bigger. Each digit moves one column to the left. • When you multiply by 100, the number becomes 100 times bigger. Each digit moves two columns to the left. • When you multiply by 1000, the number becomes 1,000 times bigger. Each digit moves three columns to the left. • When you divide by 10, the number becomes 10 times smaller. Each digit moves one column to the right. • When you divide by 100, the number becomes 100 times smaller. Each digit moves two columns to the right. • When you divide by 1000, the number becomes 1,000 times smaller. Each digit moves three columns to the right.	Children need to know how… • To multiply and divide by 10, 100 and 1,000.	Children need to know … • *When a problem has mixed units of a measure, we need to convert the measurements to the same unit of measure in order to compare them. (Year 3)* • When to multiply and when to divide when converting. • When a prefix gives you a clue about how to convert. Children need to know why… • ***We have different units of measure.*** *Things can vary in size hugely. If we did nott have units of measure, we would have to measure very large numbers, which would be very difficult. (Year 1)* • **Units of measure have the prefixes they do.** Often the prefix is a clue to the conversion required as it describes the relationship between units. • **We have to convert measures into the same measure.** Different units of measure describe different sized areas. Like with fractions that have different denominators, comparing measures with different units would be inaccurate as the units describe different amounts.

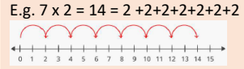
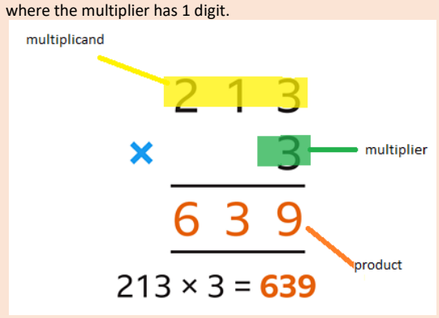
Vocabulary

DESCRIBE	To say what something is like.	**MEASUREMENT**	A way of precisely describing the quantity of something. It is a process that uses numbers to make these descriptions.	**UNIT OF MEASURE**	Measurements are made by working out 'how many' of something are the same size. A unit of measure tells us what the 'something' is.
STANDARD UNIT OF MEASURE	A formally recognised and widely used unit of measure which has a consistent size and has measurement tools available for (e.g. cm)	**NON-STANDARD UNIT OF MEASURE**	When other objects in the world are chosen to measure the size of something.	**DISTANCE**	How far something is. Length and height are examples of distance.
HEIGHT	Vertical distance	**LENGTH**	Horizontal distance	**PERIMETER**	The distance around the outline of a 2D shape.
MILLI-	A prefix meaning a thousandth of…	**CENTI**	A prefix meaning a hundredth of…	**KILO**	A prefix meaning a thousand.
MILLIMETRE	A tiny measure of distance, recorded with the unit notation mm. There are 1000mm in 1m. There are 10mm in 1cm	**CENTIMETRE**	A small measure of distance, recorded with the unit notation cm. There are 100cm in 1m.	**METRE**	A large measure of distance, recorded with the unit notation m.
KILOMETRE	A large measure of distance, recorded with the unit notation km. There are 1000 m in a kilometre.	**GRAM**	A small unit of measure for mass/weight	**KILOGRAM**	A large unit of measure for mass/weight.
MILLILITRE	A small unit of measure for volume and capacity.	**LITRE**	A large unit of measure for volume and capacity.	**ESTIMATE**	To make a 'sensible guess' based on your knowledge of and experience with number.
SCALE	A type of number line, often found on measuring tools. The type of scale depends on the interval between each mark. For example, most rules have a 1cm scale as there is 1cm between each mark.				

Multiplication	Children need to know that… • *Multiplication is a commutative mathematical operation that indicates how many times a number is added to itself and is represented by the symbol 'x'. (Year 1)* • *Commutative means it can be done in any order (Year 1)* • *An array is a way of showing multiplication by arranging dots or counters into rows and columns (Year 1)* • *An even number is a number that is divisible by 2 (Year 2)* • *An odd number is a number that is not divisible by 2. (Year 2)* • *The formal language of multiplication (multiplier, multiplicand, product) (Year 1)* • *The 0,1,2,5 and 10 times tables. (Year 2). The 3, 4 and 8 times table (Year 3) The 6,7,9,11 and 12 times tables (Year 4 Autumn 1)* • *The patterns we see in the 2,5,10 and 3 number sequences. (Year 2) The patterns we see in the 4 and 8 number sequences (Year 3) The patterns we see in the 6,7,9,11 and 12 times tables (Year 4 Autumn 1)* • *The connections between different times tables we have learned (Year 3)* • *The multiplication facts we are expected to learn are called times tables. (Year 3)* • *A multiple of a number can be divided by that number without a remainder (e.g. 25 is a multiple of 5 because 25 can be divided by 5 without a remainder).* • *Related facts are those which are linked. We can use related facts to help us find the answer to mathematical questions quickly. The related facts we can use are our place value (e.g. 2 x 20 solved using 2 x 2) and fact families. (Year 3)* • *The distributive law states that larger numbers can be multiplied by partitioning a large number into smaller parts, multiplying the smaller parts by the multiplier and then adding the products together. (e.g. 29 x 4 can be solved by doing (20 x 4) + (9 x 4)) (Year 3)* • *The formal written method of expanded short multiplication uses the distributive law to simplify multiplication of larger numbers. (Year 3)* • *Inverse means the opposite. Division is the inverse of multiplication. (Year 3)* • *When any number is multiplied by 0, the product is 0. (Year 4 Autumn 1)* • *When any number is multiplied by 1, it remains the same. (Year 4 Autumn 1)* • *A derived fact is a fact worked out using facts you already know (e.g. the relationship between the times tables, known facts and place value, using a known fact and adding a multiple or fact families). (Year 4 Autumn 1)* • *A factor is a number that a multiple can be divided by without a remainder (it gives an integer quotient). (Year 4 Autumn 1)* • *An integer is a whole number. (Year 4 Autumn 1)* • *Factors come in pairs, which multiply together to create a multiple. (Year 4 Autumn 1)* • When we multiply three numbers together, we multiply the product of the first two numbers by the third number. • Because multiplication is commutative, we can multiply three numbers together in any order. • The formal written method of compact short multiplication uses the distributive law to simplify the multiplication of larger numbers.  • The multiplier is multiplied by each column of the multiplicand in turn from smallest to largest. • If the product of a single multiplication is greater than 9, any overflow must be regrouped in the next column, just as is done in column addition. This is recorded with a small notation of the	Children need to know how… • *To count in multiples of 2, 5, 10, 3, 4, 8, 6, 7, 9, 11 and 12 (Year 2, 3 & 4)* • *To write multiplication number sentences (Year 1)* • *To identify whether a problem requires multiplication or division using more advanced mathematical language and reasoning (e.g. part, whole, multiplier, multiplicand, product, dividend, divisor, quotient) (Year 2)* • *To solve missing number questions using the inverse.(Year2)* • *To use a range of strategies to solve multiplication problems (See calculation policy - Year 3)* • *To choose the most efficient method (Year 2)* • *To identify fact families (Year 3)* • *To use knowledge of place value to multiply. (Year 3)* • *To write and calculate mathematical statements for 2s x 1d multiplication statements using the related facts of tables they know (e.g. 2 x 20 as linked to 2 x 2) (Year 3)* • *To use the expanded column method as a way of recording and solving multiplication problems using their knowledge of related facts. (Year 3)* • *To solve problems including missing number problems and inverse operations. (Year 3)* • *To multiply by 0 and 1 mentally, explaining mathematically why the product is derived. (Year 3)* • *To recall and use multiplication facts for the multiplication tables up to 12 x 12 when solving problems. (Year 3)* • *To use known facts and place value to multiply mentally when the product is less than or equal to 9,999. (Year 3)* • *To derive multiplication facts using knowledge of fact families, commutativity and factor pairs. (Year 3)* • To multiply three numbers together. • To select the order to multiply three numbers. • To multiply two-digit and three-digit numbers by a one-digit number using the formal written method of compact short multiplication. • To solve problems involving multiplying and adding numbers, including integer scaling problems and harder correspondence problems such as n objects are connected to m objects.	Children need to know when… • *to use a times table based on the factors in the problem. (Year 3)* • *patterns within the times tables can help solve a problem. (Year 3)* • *it is appropriate to use known multiplication facts to find related products. (Year 4)* • *to apply the commutative property of multiplication to reorder factors for easier calculation. (Year 3)* • *to use times tables knowledge to check the accuracy of multiplication answers. (Year 3)* • *A problem requires multiplication based on reasoning about wholes, parts and groups (Year 3)* • *When accurate use of place value columns is important to ensure accurate calculation. (Year 3)* • *To use estimation (rounding) to check the reasonableness of an answer (Year 4 Autumn 1)* • to use a written method (e.g. compact short multiplication) to solve a multiplication problem. Children need to know why • ***We need to develop rapid recall of key multiplication and division number facts.*** *Having fluent and automatic recall of number facts allows us to 'know' the answer rather than working it out each time. This makes it easier for our brains (reducing cognitive load) which helps us to solve trickier problems. (Year 2)* • ***We develop a range of strategies to help simplify and check the products to multiplication calculations.*** *Developing efficiency will allow us to work with numbers quickly and flexibly. (Year 3)* • ***You need to multiply each digit from the multiplier by the multiplicand before adding to find the product.*** *The expanded column method works by partitioning the multiplier into tens and ones and completing two smaller multiplications which can be assisted by knowing our number facts. (Year 3)* • ***Regrouping is also important in formal written multiplication.*** *Often, the products of your multiplications will be greater than 9. Therefore, because 10 ones are equivalent to one 10, it is important to exchange to know how many are* in each column. (Year 3) • ***The product of any number multiplied by 0 is 0.*** *When we multiply by 0, we either have 0 groups of an amount (0) or we have lots of groups with 0 in (0). In either case, the quantity we have is 0. (Year 4 Autumn 1)* • ***The product of any number multiplied by 1 is the same as the original number.*** *When we multiply by 1, we either have 1 group with an exact amount (itself) or we have an exact number of groups with 1 in (itself). In either case, the quantity we have is the same as the factor we know. (Year 4 Autumn 1)* • **We progress from expanded column multiplication to compact short multiplication.** It is a more efficient method and supports our progress to long multiplication of a 3d x 2d number in upper KS2.

regrouped digit under the next column.

Vocabulary

EQUAL	The same as.	**EQUAL GROUPS**	The same quantity in each group.	**MULTIPLICATION**	When you have lots of copies of the same group or number.
MULTIPLIER	The number you are multiplying by.	**MULTIPLICAND**	The number which is being multiplied	**PRODUCT**	A result of multiplying two or more numbers together.
COMMUTATIVE	A calculation which will give the same answer, regardless of the order in which it is performed. Addition and multiplication are commutative.	**REPEATED ADDITION**	A way of solving multiplication problems where the multiplicand is added repeatedly using a number line or number sentences. E.g. 7 x 2 = 14 = 2 +2+2+2+2+2+2 	**ARRAY**	A way of showing (and solving) multiplication problems where groups are arranged systematically in rows and columns. Multiplier = rows. Multiplicand = columns. e.g. 
INVERSE	The opposite calculation. This undoes what was done by the previous calculation. Multiplication and division are inverse operations.	**TIMES TABLES**	a list of multiplication facts for a particular number which need to be memorised and quickly recalled.	**DERIVED FACT**	A fact worked out using facts you already know.
EVEN NUMBER	Multiples of 2. These can be divided by 2 without leaving a remainder. Even numbers end in 0,2,4,6,8.	**ODD NUMBER**	Numbers which are not multiples of 2. These leave a remainder when divided by 2. Odd numbers end in 1,3,5,7,9	**FACT FAMILIES**	A set of mathematical facts which are closely related. Knowing one means you know all. For example, 2 x 3 = 6, 3 x 2 = 6, 6 ÷ 3 = 2, 6 ÷2 = 3
MULTIPLE	The products which are created from a specific multiplier. E.g. multiples of 2 are 2,4,6,8,10…	**FACTOR**	A number which a multiple can be divided by without a remainder (giving an integer quotient)	**INTEGER**	A whole number.
PRIME NUMBER	A number which only has 2 factors: one and itself.	**DISTRIBUTIVE LAW**	The mathematical law that states larger numbers can be multiplied by partitioning the large number into smaller parts, multiplying the smaller parts by the multiplier and then adding the products together. (e.g. 29 x 4 can be solved by doing (20 x 4) + (9 x 4)	**COMPACT SHORT MULTIPLICATION**	The formal written method used to solve larger multiplication problems where the multiplier has 1 digit. 

Converting units

General Language of Measure

Children need to know that…

- *To compare has two different meanings:*
  - *to say how something is like or unlike something else.*
  - *To describe which is larger and which is smaller (and by how many) (Year 2 Autumn 1)*
- *Measurement is a precise way to describe the quantity of something (e.g. length, height, weight or capacity). (Year 1)*
- *Measurements are always expressed in 2 parts, the quantity and the specific unit of measure. (Year 1)*

Length - Conversions

Children need to know that…

- *Length and height are measures of distance. (Year 1)*
- *A metre is a standard unit of measure used to measure moderately large distances. (Year 3)*
- *Distances measured in metres are written as _m. (Year 3)*
- *A centimetre is a standard unit of measure used to measure short distances. (Year 3)*
- *Distances measured in centimetres are written as _cm. (Year 3)*
- *A millimetre is a unit of measure used to measure very short distances. (Year 3)*
- *Distances measured in millimetres are written as _mm. (Year 3)*
- *1 metre is equal to 100 centimetres and 1000 millimetres (Year 3)*
- *1 centimetre is equal to 10 millimetres (Year 3)*
- A kilometre is a standard unit of measure used to measure very long distances.
- The prefix kilo means one thousand.
- The prefix milli means one thousandth

Children need to know how…

- to convert between different units of related measure.
  - m → km (÷ 1,000); km → m (x1,000)
  - cm → m (÷100); m → cm (x100)
  - mm→cm (÷10); cm →mm (x10)
  - mm→m (÷1,000); m→mm (x1,000)
  - g → kg (÷ 1,000); kg → g (x1,000)
  - ml → l (÷ 1,000); l → ml (x1,000)
- to estimate amounts using rounding
- to calculate with different measures selecting an appropriate operations and methods.
- to compare different measures using <, > and =, converting if necessary.

Children need to know …

- *When a problem has mixed units of a measure, we need to convert the measurements to the same unit of measure in order to compare them. (Year 3)*
- When to multiply and when to divide when converting.
- When a prefix gives you a clue about how to convert.

Children need to know why…

- ***We have different units of measure.*** *Things can vary in size hugely. If we didn't have units of measure, we would have to measure very large numbers, which would be very difficult. (Year 1)*
- **Units of measure have the prefixes they do.** Often the prefix is a clue to the conversion required as it describes the relationship between units.
- **We have to convert measures into the same measure.** Different units of measure describe different sized areas. Like with fractions that have different denominators, comparing measures with different units would be inaccurate as the units describe different amounts.

	• The prefix centi means one hundredth.
	• Conversions:
	  ○ m → km (÷ 1,000); km → m (x1,000)
	  ○ cm → m (÷100); m → cm (x100)
	  ○ mm→cm (÷10); cm →mm (x10)
	  ○ mm→m (÷1,000); m→mm (x1,000)
	
	Mass - Conversions
	Children need to know that…
	• *Weight is a measure of 'heaviness'. Weight is affected by gravity. (Year 1)*
	• *Mass is also a measure of 'heaviness'. It measures the specific amount of matter something contains. It is not affected by gravity. (Year 1)*
	• *Both mass and weight can be measured in grams and kilograms. (Year 1)*
	• *Grams are a small unit of measure, used to measure light things. (Year 1)*
	• *Amounts measured in grams are written as Xg. (Year 1)*
	• *Kilograms are a large unit of measure, used to measure heavy things. (Year 1)*
	• *Amounts measured in kilograms are written as Xkg. (Year 1)*
	• *A kilogram is a unit of mass equal to 1,000 grams (1kg = 1,000g) (Year 3)*
	• The prefix kilo means one thousand
	• Conversions:
	  ○ g → kg (÷ 1,000); kg → g (x1,000)
	
	Capacity - Conversions
	Children need to know that…
	• *Capacity describes the container: the amount of something a container can hold. (Year 1)*
	• *Volume describes the substance: the amount of space it takes up. (Year 1)*
	• *Litres are a unit of measure used to measure larger amounts of liquids (both capacity and volume). (Year 1)*
	• *Amounts measured in litres are written Xl. (Year 1)*
	• *Millilitres is a unit of measure to measure smaller amounts of liquid (both capacity and volume). (Year 1)*
	• *Amounts measured in millilitres are written Xml. (Year 1)*
	• *A litre is a unit of capacity equal to 1,000 millilitres e.g. 1l = 1,000ml (Year 3)*
	• The prefix milli means one thousandth
	• Conversions:
	  ○ ml → l (÷ 1,000); l → ml (x1,000)
		• to order different measures, converting if necessary.
		• to solve problems involving converting measures.	

Enrichment & wider development			

Year 4 - Summer 2

Milestone LO (National Curriculum)

DIVISION

Children should be taught to:

- Divide two-digit and three-digit numbers by a one-digit number using formal written layout
- Solve problems involving division

MEASUREMENT

Money

- Convert between different units of measure
- Estimate, compare and calculate different measures, including money in pounds and pence
- Solve simple money problems involving decimals to two decimal places

GEOMETRY

Position and direction

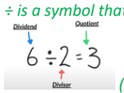
- Describe positions on a 2D grid as coordinates in the first quadrant
- Describe movements between positions as translations of a given unit to the left/right and up/down
- Plot specified points and draw sides to complete a given polygon.

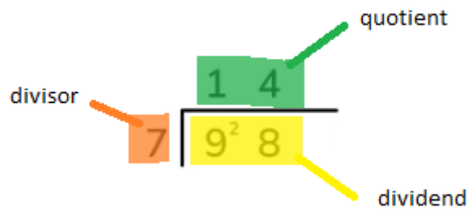
STATISTICS

- Interpret and present discrete and continuous data using appropriate graphical methods, including bar charts and time graphs.
- Solve comparison, sum and difference problems using information presented in bar charts, pictograms, tables and other graphs.

Revisited Knowledge

New knowledge

Domains	**Declarative knowledge** (substantive knowledge)	**Procedural knowledge** (disciplinary knowledge)	**Conditional knowledge** (knowing the when and the why)
Division	Children need to know that… • *Equal means the same and is shown by the symbol = (Year 1)* • *'Equal groups' means you have the same number of objects in each group. (Year 1)* • *Division can be seen in two ways: (Year 1)* ○ ***Division as sharing:** sharing the dividend into a specific number of groups (e.g. 12 ÷ 2 → share 12 equally between two groups. How many counters are in each group?).* ○ ***Division as grouping:** is sharing the dividend into equal size groups. (e.g. 12 ÷ 2 → group the 12 counters into lots of groups of two. How many groups are there?)* • *÷ is a symbol that means division. (Year 1)* •  *(Year 1)* • *Half means dividing something by 2 (Year 1)* • *Division is not commutative. (Year 2)* • *In division, the whole (dividend) must always be before the divisor (Year 2)* • *Multiplication is the inverse of division (Year 2)* • *A multiple of a number can be divided by that number without a remainder (e.g. 25 is a multiple of 5 because 25 can be divided by 5 without a remainder). (Year 3)* • *Relationships between the times tables they know (all) (Year 4 Autumn 1).* • *A remainder is the amount left over when something cannot be shared or grouped equally. (Year 3)* • *Dividend is the whole. The number which is to be divided. (Year 3)* • *Divisor is the number the dividend is going to be divided by. This could tell us the number of groups to create (dividing by sharing) or the number in each group (dividing by grouping). (Year 3)* • *Quotient is the answer to a division question. This could mean the number of groups created or the quantity in each group, depending on whether we are dividing by grouping or by sharing. (Year 3)* • *Divisibility Rules for 1, 2, 3, 4, 5, 8 and 10. (Year 3)*	Children need to know how… • *To identify equal groups (Year 1)* • *To justify how they know a group is equal. (Year 1)* • *To write division number sentences using the ÷ symbol and =. (Year 1)* • *To represent division as sharing and grouping (Year 1)* • *To solve division problems using an appropriate method (mentally by recalling the number facts they have learned, practically or repeated subtraction on a number line) (Year 1)* • *To identify whether a problem requires multiplication or division using more advanced mathematical language and reasoning (e.g. part, whole, multiplier, multiplicand, product, dividend, divisor, quotient) (Year 2)* • *To use the inverse relationship between multiplication and division. (Year 2)* • *To solve missing number problems using the inverse relationship. (Year 2)* • *To check their calculations using the inverse relationship. (Year 2)* • *To count forwards and backwards in 1,2,3,4,5,8 and 10. (Year 3)* • *To recall and find multiplication facts for the 2,3,4,5,8, 10 times tables (Year 3)* • *To find the associated division facts for the times tables that they already know (2,3,4,5,8,10) (Year 3)* • *To represent division problems confidently using bar models, part-part whole models, arrays and open arrays. (Year 3)* • *To divide any number by 1.* • *To use divisibility rules to suggest whether a division will be possible without a remainder before calculating.* • *To recall division facts for multiplication tables up to 12 x 12.* • *To use place value and knowledge of fact families to mentally solve division problems.*	Children need to know… • *When a question requires multiplication or division based on their knowledge of the underlying structures of these calculations. (Year 2)* • *When a strategy is useful and appropriate for solving a division problem (Year 2)* • *When a problem can be solved mentally using a known fact (Year 2)* • *Which multiplication fact they have learned will help them solve a division problem. (Year 3)* • *When we are looking at missing number problems, we need to work out which part of the problem we are missing. (Year 3)* • *When to use the inverse to check an answer. (Year 3)* • *Where patterns can be used to help solve more complex division problems efficiently (e.g. repeatedly dividing by 2). (Year 3)* • When a problem can be solved mentally using a derived fact. Children need to know why… • ***There are a range of ways of solving multiplication and division problems.** Different problems may be visualised better using different representations. (Year 1)* • ***You get the same quotient regardless of whether you solve a division problem by grouping or sharing.** We*

	• *A derived fact is a fact worked out using facts you already know (e.g. the relationship between the times tables, known facts and place value, using a known fact and adding a multiple or fact families). (Year 3)* • *A factor is a number that a multiple can be divided by without a remainder (it gives an integer quotient). (Year 3)* • *An integer is a whole number. (Year 3)* • *Factors come in pairs, which multiply together to create a multiple. (Year 3)* • *Any number divided by 1 remains the same.* • *The divisibility rules* • *We can derive division facts using known facts (e.g. fact families, place value)* • The formal written method of short division is sometimes called 'bus stop' method.  • • The formal written method of short division uses knowledge of 'division by grouping' and partitioning (see calculation policy for exemplification) • Calculation starts from the largest place value column. • If there is a remainder in a column, it is exchanged into the next smallest column. This is recorded on the formal written method using a small, superscript digit.	• To divide two and three digit numbers by a one digit number using the formal written method of short division (bus stop). • To exchange where necessary when using the formal written method of short division. • To solve mathematical problems involving division. • To check the reasonableness of answers using estimation (rounding and known facts) • To check calculations using the inverse.	*can rotate our array to show the commutative nature of multiplication. (Year 1)* • ***We need to develop rapid recall of key multiplication and division number facts.*** *Having fluent and automatic recall of number facts allows us to 'know' the answer rather than working it out each time. This makes it easier for our brains (reducing cognitive load) which helps us to solve trickier problems. (Year 2)* • ***An open array is a useful way of visualising division problems.*** *Open arrays can help us when we are multiplying and dividing much larger numbers. They also help us to solve area problems later on.* • **The formal written method starts with the largest column.** Because we are dividing by grouping, there may be a remainder left. If there is a remainder, this needs to be exchanged into a smaller column. If we started from a smaller column, when we reached a column which required an exchange, we would then need to recalculate the previous columns.

Vocabulary

EQUAL	The same as.	**EQUAL GROUPS**	The same quantity in each group.	**INVERSE**	The opposite calculation. This undoes what was done by the previous calculation. Multiplication and division are inverse operations.
DIVISION	Where a whole is split into two or more equal groups.	**DIVISION AS SHARING (PARTITIVE DIVISION)**	The divisor tells you the number of groups to share the dividend between. E.g. 10÷2=5 	**DIVISION AS GROUPING (QUOTIVE DIVISION)**	The divisor tells you the number in each group. E.g. 10÷2=5 
DIVIDEND	A number to be divided by another number (the whole)	**DIVISOR**	The number which the dividend is being divided by. Tells you either the number of parts or the size of each part.	**QUOTIENT**	A result of dividing one number by another. Depending on the role of the divisor, this either tells you the number of parts or the size of each equal part.
FACT FAMILIES	A set of mathematical facts which are closely related. Knowing on means you know all. For example 2 x 3 = 6, 3 x 2 = 6, 6 ÷ 3 = 2, 6 ÷2 = 3	**REMAINDER**	The amount left over when you divide a dividend by a divisor which cannot divide perfectly.	**REPEATED SUBTRACTION**	A strategy for solving division problems where you count back in multiples, sometimes supported by a number line.
SHORT DIVISION	A formal written method used to solve some larger division problems. This is sometimes colloquially called bus stop method.				

Money	**Calculation**
	Children need to know that…
	• *Change is the amount we have left when we have bought something with coins/notes. (Year 2)*
	• *£ sign formation: (Year 2)*
	
	Currency
	Children need to know that…
	• *'Money' describes a currency used to pay. In the UK, our currency uses pounds/pence. (Year 1)*
	• *Pence is the plural of penny and is used when referring to 2 or more pennies. (Year 1)*
	• *£ is a symbol which means pounds. p is a symbol which means pence. (Year 1)*
	
	Equivalences
	Children need to know that…
	• *£1 = 100 p (Year 1)*
	• Conversions
	  ○ £ → p (x 100)
	  ○ P → £ (÷ 100)
		Children need to know how…
		• *To recognise the value of each coin and note in British currency. (Year 1)*
		• *To describe money as £____ and ____ p (Year 2)*
		• *To find different combinations of coins that total the same amount. (Year 2)*
		• *To solve problems by adding amounts (of the same unit) together, giving their answer in one unit (not converting between £ and p). (Year 2)*
		• *To solve problems by subtracting amounts of the same unit to find change. (Year 2)*
		• *To calculate the value of an amount of money by counting in multiples, starting with the largest value. (Year 3)*
		• *To add and subtract amounts of money (increasingly relying on mental methods and jottings), including calculating change. (Year 3)*
		• To convert between pounds and pence.
		• To check the reasonableness of an answer by estimating using rounding.
		• To record amounts of money using the standard decimal notation (£0.00)
		• To compare and order amounts of money presented in standard decimal notation and as £___ and ___ p.
			Children need to know when…
			• *To use certain coins to make an amount. (Year 2)*
			• *to choose coins or notes based on the amounts of money involved. (Year 3)*
			• *a problem requires addition or subtraction based on their understanding of parts and wholes. (Year 3)*
			• *to apply knowledge of money to solve real-world problems or word problems by identifying currency symbols or words. (Year 3)*
			• amounts of money may need to be converted before calculation.
			Children need to know why…
			• ***Recognising currency is important.*** *They may need to use coins and notes to pay for things when they are older. Electronic money still uses the same system of £*
			• ***We need to add money together in real life situations.*** *We will often want to buy more than one thing, or we will want to spend money with a friend to buy something bigger. (Year 2)*

<table>
<tr><td></td><td>

Coins and Notes

Children need to know that…

- *In the UK, money can be made up of coins and notes that have a value. There isn't a coin/note for every number of the number system. The size of a coin/note does not relate to its quantitative value. (Year 1)*
- *We have 8 different coins: 1p, 2p, 5p, 10p, 20p, 50p, £1 and £2 (shown from smallest to largest value) We have 4 different notes: £5, £10, £20, and £50. What each of these looks like. (Year 1)*

</td><td>

- To calculate amounts in £ and p using the four operations and fractions.
- To solve simple money problems involving decimals to 2dp using appropriate methods and operations.

</td><td>

- ***We need to subtract money in real life situations.*** *We will often need to work out whether we have enough money to buy the thing that we want to buy. (Year 2)*
- ***We learn to calculate change.*** *It is unfair for a shop to keep more of your money than is needed for the thing that you are buying. If the coins you have do not make the perfect amount for the item you want, change allows you to buy it and get the extra money back. (Year 2)*

</td></tr>
<tr><td>Vocabulary</td><td colspan="3">

CURRENCY	The name for the specific system of money used in a particular country. Different countries have different currencies.	**MONEY**	The objects used to pay for items. In the UK, we use pounds and pennies (which can be found in coins and notes or electronically).	**PAY**	To provide money in exchange for something.
COST	How much money you have to pay to buy the item.	**AFFORD**	Whether you have enough money to pay the full cost of the item.	**CHANGE**	The money a seller has to give you back if the coins you give have a higher value than the cost of the item.
COIN	A small, flat piece of metal which represents a particular amount of money.	**NOTE**	A thin paper-like plastic rectangle sheet which represents a particular amount of money.	**POUND**	The larger 'unit' of money in the GBP currency. Represented by £. £1 = 100p
PENCE	The smaller 'unit' of money in the GBP. Represented by p. 100p = £1				

</td></tr>
<tr><td>Statistics</td><td>

Understanding Statistics

Children need to know that…

- *To compare has two different meanings:*
  - *to say how something is like or unlike something else.*
  - *To describe which is larger and which is smaller (and by how many) (Year 2 Autumn 1)*
- *Data is the word used to describe information. This information could include facts, observations, numbers or measurements. (Year 2)*
- *Data can be presented in different types of charts and diagrams to make it easy to understand. (Year 2)*
- *To categorise is to group things that share some commonality. (Year 2)*
- *Categorical data is when you count the number of data points in a non-numeric category (e.g. the number of children with blue, green and brown eyes). (Year 2)*
- *Statistics is the collection, analysis, interpretation, presentation, and organisation of data.*
- *Scaling is when you are given information about something and then have to apply it to a smaller or larger quantity by multiplying or dividing. In graphs, this can be used to help us show data where larger numbers are involved. (Year 3)*
- *When drawing graphs and charts, (Year 3)*
  - *intervals on scales must be evenly spaced.*
  - *Axes must be drawn with a ruler and meet at a right angle.*
  - *Charts must have a clear title which describes what they show.*
  - *Axes must be clearly labelled (with units if appropriate)*
- Discrete variables are variables that can only have a set of specific values (with no in-between values) – things that can be counted. For example the number of cars in a car park is an example of discrete data.
- Continuous variables can be any value within a range. Most measurements are continuous variables. For example, height, weight, temperature and length are all examples of continuous data.

Pictograms

Children need to know that…

- *A pictogram is a chart that uses picture or symbols to represent data. (Year 2)*
- *Sometimes a picture in a pictogram may represent more than one. Then we need to use our knowledge of counting number sequences. (Year 2)*
- *Sometimes we may see half a picture. That means we have half the amount the picture is worth. (Year 2)*

Tally Charts

Children need to know that…

- *A tally chart is used to collect data quickly and efficiently. (Year 2)*
- *Each line drawn adds one. (Year 2)*
- *The first four lines are drawn as short vertical lines next to one another. (Year 2)*
- *Every fifth line is drawn diagonally across 4 vertical lines to create a group of 5 lines. (Year 2)*
- *You can work out how many tally marks you have by counting your 'groups' by using your multiples of 5, then counting on in ones to finish. (Year 2)*

Bar Charts

</td><td>

Children need to know how…

- *To ask and answer simple questions about categorical data.*
- *To calculate the total of different categories within categorical datasets shown in different ways (pictogram, tally chart, block diagram and table) (Year 2)*
- *To compare different categories within categorical datasets shown in different ways (pictogram, tally chart, block diagram and table) (Year 2)*
- *To sort categories within categorical datasets by quantity.*
- *To interpret the data shown in different ways (pictograms, tally charts, block diagrams and tables) (Year 2)*
- *To construct pictograms, tally charts, block diagrams and tables. (Year 2)*
- *To use and interpret a simple key. (Year 2)*
- *To present, read and interpret information from pictograms with a key, bar charts and tables. (Year 3)*
- *To interpret keys using knowledge of multiplication and division. (Year 3)*
- *To solve one-step and two-step problems using information presented in bar charts and pictograms with keys and tables. (Year 3)*
- To interpret discrete and continuous data from a range of charts taught so far, e.g. bar charts and time graphs.
- To present discrete and continuous data using a range of charts taught so far, e.g. bar charts and time graphs.
- To solve comparison, sum and difference problems using information presented in bar charts, pictograms, tables and other graphs.

</td><td>

Children need to know when…

- *To use different charts to represent data (pictograms, tally charts, block diagrams, tables,* bar charts*) (Year 3)*
- *Bar charts are good for showing categorical and discrete data. (Year 2)*
- *to use appropriate data collection techniques like surveys, tallies, or observations based on the data required. (Year 3)*
- *you have collected enough data to draw conclusions and compare data. (Year 3)*
- *there is a pattern or trend in the data, there is a conclusion to be drawn. (Year 3)*
- Comparing sets of data categorical data, to look for key differences.
- Comparing sets of continuous data, especially for data which changes over time, to look for patterns and trends.
- An approach to collecting data may be most appropriate, thinking about sample size, survey questions and data collection methods.
- When designing a survey to collect data, children need to plan their approach by considering factors such as sample size, survey questions, and data collection methods.
- An apparent error found when analysing data/calculating with data may mean they need to think critically on their approach and make changes to their strategy.

Children need to know why…

- ***There are lots of different styles of chart.*** *Different charts represent different types of data better. For example, categorical data is represented well by the charts we have learned in*

</td></tr>
</table>

Children need to know that…

- *Have two axes (straight, perpendicular line scales which meet at a point called the origin) (Year 3)*
  - *The X axis is the horizontal axis*
  - *The Y axis is the vertical axis.*
- *Display categorical data by using rectangular bars of different heights. (Year 3)*
- *The X axis shows the category (Year 3)*
- *The Y axis shows the number of data points in that category. (Year 3)*
  - This can be discrete or continuous (average)

Tables

Children need to know that…

- *A table is a way of presenting data using rows and columns. (Year 2)*

Time Graphs

Children need to know that…

- A time graph is a type of line graph that plots time on the x axis and a second (often continuous) variable on the y axis.

- Time can be plotted in a range of ways, including hours, minutes, seconds etc.
- Data points are connected using a line to indicate how things may have changed over time.

year 2 and 3 because these charts help us to 'count' the numbers in each category. (Year 2)

- ***We need to use charts to represent data.*** *Data can be very complicated. Charts make it easier for people to look out the data and understand what it is teaching us. (Year 2)*
- ***We use different types of chart to collect and present data.*** *Some charts are good for recording data quickly (tally chart) – these are useful for data collection; others are helpful for people to look at and make inferences about the data but take longer to construct (bar charts, scaled pictograms) – these are useful for data presentation. (Year 3)*
- ***Although block diagrams and bar charts look the same, we generally use a bar chart.*** *They show the same class of information in the same way. Block diagrams restrict the quantities that you can show without using scaling. (Year 3)*

Vocabulary	**DATA**	Information.	**CHART/DIAGRAM**	A visual way of presenting data to make it easier to understand.	**QUESTION**	A type of sentence which requires an answer. It usually starts with a question word and ends with a ?
	CATEGORICAL DATA	Data which counts the number of things (e.g. people) in each category.	**CONTINUOUS DATA**	can be any value within a range. Most measurements are continuous variables. For example, height, weight, temperature and length are all examples of continuous data.	**DISCRETE DATA**	can only have a set of specific values (with no in-between values) – things that can be counted. For example the number of cars in a car park is an example of discrete data.
	KEY	A small picture to the side of a chart which tells the reader how to interpret the chart. For example, it may tell you how many data points a picture in a pictogram is worth.	**TALLY MARK**	The small lines used in a tally chart to record individual data points.		
	CATEGORY	Group	**X AXIS**	The horizontal axis. On a bar chart, the X axis records the categories.	**Y AXIS**	The vertical axis. On a bar chart, the X axis records the frequency.
	ORIGIN	The point where the X and Y axis meet at a right angle.	**SCALE**	The 'number line' which runs along the axis/axes.	**INTERVALS**	The gap between individual data points on the axis.
Enrichment & wider development						