Year 5

Year 5 - Autumn 1

National Curriculum Milestones

Place value

Pupils should be taught to:

- Read, write, order and compare numbers to at least 1,000,000 and determine the value of each digit
- Count forwards or backwards in steps of powers of 10 for any given number up to 1,000,000
- Interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers, including through zero
- Round any number up to 1,000,000 to the nearest 10, 100, 1,000, 10,000 and 100,000
- Solve number problems and practical problems that involve all of the above
- Read Roman numerals to 1,000 (m) and recognise years written in Roman numerals.

Addition and subtraction

Pupils should be taught to:

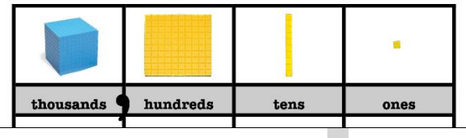
- Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)
- Add and subtract numbers mentally with increasingly large numbers
- Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.

Geometry: Angles

- Know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles
- Draw given angles, and measure them in degrees (°)
- Identify: angles at a point and one whole turn (total 360°)
- Angles at a point on a straight line and 1/2 a turn (total 180°)
- And other multiples of 90°
- Use the properties of rectangles to deduce related facts and find missing angles

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)* • *The counting sequences for multiples of 0,1,2,3,4,5,6,7,8,9,10,11 and 12 and their associated divisibility rules. (Year 4)* • *The counting sequences for multiples of 25, 50, 100 and 1000. (Year 4)* • Powers of 10 are any integer powers of the number 10. Powers of 10 include 10, 100, 1,000, 10,000, 100,000 and 1,000,000. **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 1,2,3,4):*  	**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 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 25, 50, 100 and 1000 (Year 4)* • *To find 1, 10, 100 and 1000 more and one less than a given number (Year 4)* • To count forwards or backwards in steps of powers of 10 for any given number up to 1,000,000 **Representing Number** Children need to know how… • *To recognise the place value of each digit in a 4d number. Represent numbers to 10,000 in different ways (concrete, pictorial, abstract), including in numerals and words (Year 3/4)* • *To partition numbers in different ways (Year 2,3,4)* • *To estimate numbers and amounts using knowledge of place value/counting (Year 2,3,4)* • *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 6 digit number. • To read and write numbers up to at least 1,000,000 in numerals and words. • To represent numbers up to 1,000,000 in a range of different ways (CPA).	Children need to know when… • *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.* 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*

- *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)*
- *Numbers can be partitioned into their place value (e.g. 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) One common way to estimate involves using rounding.*
- *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 1000 ones in one thousand (Year 3).*
- *A comma is used to separate the digits in the thousands and hundreds columns, which helps us read it out loud. (Year 4)*
- A ten-thousand is written 10,000. There are 10 thousands in a ten-thousand. There are 100 hundreds in a ten-thousand. There are 1,000 tens in a ten-thousand. There are 10,000 ones in a ten-thousand.
- A hundred thousand is written 100,000. There are 10 ten-thousands in a hundred-thousand. There are 100 thousands in a hundred thousand. There are 1,000 hundreds in a hundred thousand. There are 10,000 tens in a hundred thousand. There are 100,000 ones in a hundred thousand.
- A million is written 1,000,000.
- A comma is used to separate the millions and hundred-thousands digits in a millions number. This helps us read the number out loud.

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, for example using the squares in our books. (Year 3)*
- *When we find powers of 10 (10,100,1000) more/less, the focus column increases or decreases by 1. (Year 4)*
- *When we are finding a power of 10 more, if this causes 'overflow' we will need to 'regroup' and the next largest column will increase and the focus column will become zero. (Year 4)*
- *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'. This means the next largest column will decrease by 1 and the focus column will become 9. (Year 4)*

Rounding

Children need to know that…

- *Rounding numbers makes them 'easier' to use or understand whilst keeping the number close to its original value. (Year 4)*
- *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)*

Negative Numbers

Children need to know that…

- *A negative number is a number less than 0. (Year 4)*
- *Numbers below 0 are shown as minus numbers with the minus symbol (-) e.g. – 8 (Year 4)*

Roman Numerals

Children need to know that…

- *Roman numerals is 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. (Year 4)*
- *Roman numerals are still seen in many places in the world for specific purposes. (Year 4)*

- To estimate larger numbers (up to 1,000,000) using their knowledge of place value and counting.
- To partition numbers flexibly.

Comparison

Children need to know how…

- *To use the mathematical symbols <, > and =*
- *To compare numbers beyond 1000 (Year 4).*
- *To order numbers beyond 1000 in ascending and descending order (Year 4).*
- *To find 10, 100 and 1000 more or less than a given number (Year 3/4)*
- To compare numbers up to 1,000,000 using <, > and =.
- To order numbers up to 10,000,000 in ascending and descending order.

Rounding

Children need to know how…

- *To round any number to the nearest 10, 100 or 1,000. (Year 4)*
- *To round decimal numbers to the nearest one whole. (Year 4)*
- To round any number up to 1,000,000 to the nearest 10, 100, 1000, 10,000 and 100,000.

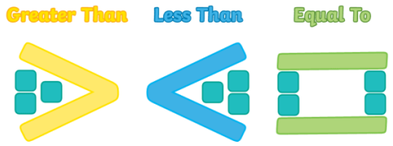
Negative Numbers

Children need to know how…

- *To count backwards through 0 to include negative numbers (Year 4)*
- To count forwards and backwards with positive and negative whole numbers, including through zero.
- To read, write and interpret negative numbers in context.

Roman Numerals

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. (Year 4)*
- ***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. (Year 4)*
- **We introduce a new comma between the millions and hundreds thousands column.** Our numbers are written and said in 'chunks' of larger units. The first comma indicates that the three digits on the right are a said 'chunk' of ones. The second comma shows that the hundred-thousand, ten-thousand and thousand columns are read as a 'chunk' of thousands. On the left of that comma, we read a 'chunk' of millions.

	• *In Roman numerals, alphabetic symbols are used as the digits which represent fixed positive numbers(Year 4)*
	  ○ *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. (Year 4)*
	• *Symbols should be arranged from highest to lowest value, except in subtractive combinations. (Year 4)*
	• *A symbol can only be repeated up to three times in succession (e.g., III = 3). (Year 4)*
	• *When large symbols are followed by small symbols, the value is calculated by adding. (e.g. XI is 11 because it shows 10 + 1) (Year 4)*
	• *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). (Year 4)*
	• *Only certain pairings are allowed for subtractive combinations. Between 1 and 100, these are (e.g., IV = 4, IX = 9, XL = 40, XC = 90). (Year 4)*
	• In Roman Numerals, M means 1,000.
		Children need to know how…
		• *To read Roman numerals to 100 (i → c) (Year 4)*
		• *To write numbers in Roman Numerals up to 100. (Year 4)*
		• To read Roman numerals to 100 (I to C) (revisit year 4)
		• To read Roman numerals to 1000 (m)
		• To recognise years written in Roman numerals.
		
		To solve number and practical problems that involve all of the above and with increasingly large positive and negative numbers.	

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.	**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 hundred; there are 1000 ones in a hundred.	**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 ideas 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 and Subtraction

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. 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 (addend, sum) (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)* We can regroup 10 hundreds to create 1 thousand. (Year 4)

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 apply appropriate mental strategies when adding and subtracting numbers (see number facts and mental strategies mapping)*
- *To accurately lay calculations out using the squares in their books to support a formal written method for addition/subtraction*
- *To add and subtract numbers with up to four digits using the formal written method of columnar addition/subtraction (Year 4)*
- *When adding, to regroup in the tens, hundreds and thousands columns (Year 4)*
- *When subtracting, to exchange from the tens, hundreds and thousands columns (Year 4)*
- *To solve two-step problems using their knowledge of addition and subtraction. (Year 4)*
- *To identify fact families and inverse calculations (Year 3)*
- *To solve missing number problems using the inverse relationship (KS1)*
- *To check the reasonableness of an addition/subtraction calculation by estimating using rounding (Year 4)*

Children need to know …

- *A specific calculation strategy may be most useful (e.g. number line, mental strategies, use of manipulatives, pictorial representations, formal written subtraction) (all previous year groups)*
- *When regrouping is required in formal columnar addition. (Year 3)*
- *When exchanging is required in formal columnar subtraction (Year 3)*
- *Where to start adding/subtracting from when using the formal written method of columnar addition/subtraction: the smallest place value column (Year 3)*
- *When to use addition/subtraction to solve missing number problems or problems in context based on reasoning about parts and wholes. (Year 4)*

- *Estimate means to make a 'sensible guess' using your knowledge of number. (Year 2,3,4)* 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. (Year 4)
- *To recognise the place value of each digit in numbers up to 1,000,000. (Year 5 Autumn 1)*
- We can regroup ten thousands to make one ten thousand.
- We can regroup ten ten-thousands to make one hundred thousand.
- We can regroup ten hundred thousands to make one million.

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 ten hundreds (Year 4)*
- *If the minuend is smaller than the subtrahend, the difference will be a negative number. (Year 4)*
- *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. (Year 4)*
- We can exchange 1 ten-thousand for 10 thousands.
- We can exchange 1 hundred-thousand for 10 ten-thousands.
- We can exchange 1 million for 10 hundred-thousands.

- *To check their calculations using the inverse relationship (Year 3/4)*
- To efficiently add and subtract mentally with increasingly large numbers, supported by jottings if needed.
- To add and subtract integers with more than four digits using the formal written methods of columnar addition and subtraction.
- To confidently select a checking strategy (e.g. inverse, rounding)
- To use rounding to determine levels of accuracy when reasoning and problem solving.
- To solve addition and subtraction multi-step problems in context, deciding which operations and methods to use and why.

- *When it is appropriate to check calculations by adding the numbers in reverse order, using the inverse, use rounding to estimate etc. (Year 3/4)*
- *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. (Year 4)*

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.*
- ***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)*
- ***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. (Year 4)*
- ***We begin column addition and subtraction 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. (Year 4)*
- ***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)*
- ***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)*

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.
NUMBER SENTENCE	A way of representing a mathematical operation using symbols (+,-,x,÷,= etc)	**SYMBOL**	An abstract image used to represent an idea (e.g. digits, +, =)	**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
ADDEND	The numbers which are being added. These are parts of the whole.	**SUM**	The answer to an addition. This is the whole.	**EXPANDED FORM**	a way of writing numbers to show the value of each digit (e.g., 325 written as 300 + 20 + 5)
COLUMNAR ADDITION	The formal written method of column addition	**VERTICAL ADDITION**	Adding by arranging addends in columns, organised by their place value. Formal column method is an example of vertical addition.	**OVERFLOW**	When the sum of the addends in a column is greater than 9. This indicates that you need to regroup before solving.
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.	**PARTIAL SUM**	The sum to the addends in each column (not the whole number sentence)
SUBTRATION	Removing a part from the whole.	**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)	**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).

	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.	**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.	**ASSOCIATIVE PROPERTY**	The property that states that the grouping of numbers in addition or subtraction does not affect the result (e.g., (a+b)+c=a+(b+c)(a + b) + c = a + (b + c)(a+b)+c=a+(b+c))	**COMPENSATION**	Adjusting one number to make a calculation easier (e.g., adjusting numbers to end in multiples of ten).
	EFFICIENT	Using the most effective and least time-consuming method to solve addition or subtraction problems	**IDENTITY ELEMENT**	The number zero in addition (e.g., a+0=aa + 0 = aa+0=a).	**INVERSE ELEMENT**	The opposite of a number in addition or subtraction (e.g., a−a=0a - a = 0a−a=0).

Angles

- *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)*
- *Angles are a property of shape or a measure of turns. (Year 3)*
- *Angles are measured in degrees. (Year 3)*
- *The symbol for the unit of measure, degrees, is ° (the degree symbol). Unlike the unit of measure for temperature, this is not followed by a letter. (Year 3)*
- *Angles are shown using this type of notation:*
- *Different types of angles: (Year 4)*
  - *Acute angle <90º*
  - *Right angle – 90º (a quarter turn). Right angles are shown by this type of notation.*
  - *Obtuse angle > 90º*
  - *Straight angle – 180º (half turn). 2 right angled turns in the same direction.*
- *A three-quarter turn three right-angled turns in the same direction (Year 2). There are 270º in a three-quarter turn*
- *There are 360° in a whole turn. (Year 3)*
- *A protractor is a tool you will use later in school to measure the size of angles. Like a ruler, this has two scales which can be used. You can find the size of an angle using a protractor. (Year 3)*
- When using a protractor, you need to make sure that the vertex of the angle is at the origin on the protractor (the indent or dot at the centre of the bottom line). You then need to read from the scale where the bottom line of the angle is pointing.
- Angles which are larger than a straight angle and smaller than a full turn are called reflex angles.
- Protractors can also be used to draw angles. You draw angles by placing the origin on the protractor at the end of a straight line. You then make a mark on the appropriate scale to show where the second, intersecting line should start from.
- The sum of the angles within a quadrilateral is 360º.
- Squares and rectangles have all right angles.

Children need to know how…

- *To describe position, direction and movement using directional language (KS1)*
- *To describe whether a rotation is clockwise or anticlockwise. (Year 2)*
- *To describe rotation in terms of right angles (Year 2)*
- *To recognise right, straight, acute and obtuse angles, including in shapes. (Year 3)*
- *To use the correct notation to show angles in diagrams (Year 3)*
- *To describe angles as multiples of right angles (Year 3)*
- *To use a protractor to say if an angle is a 'right angle' an 'acute angle' or an 'obtuse angle' matching up the lines and starting from 0 on the appropriate side of the protractor. (Year 4)*
- *To compare angles in relation to right angles using the terms greater than and less than. (Year 3)*
- *To describe how many degrees there are in an angle (right angle (90º), straight angle (180º), three-quarter turn (270º), full turn(360º)). (Year 4)*
- *To describe angles as right angles, straight angles, obtuse angles and acute angles or as greater than a straight angle (Year 4)*
- *To compare angles up to 180º using <, > and = (Year 4)*
- *To order angles up to 180º (Year 4)*
- To identify angles at a point.
- To estimate the size of acute, obtuse and reflex angles, using their knowledge of measurement and right angles.
- To compare acute, obtuse and reflex angles using <, >, =.
- To order angles in ascending and descending order.
- To accurately measure angles in degrees using a protractor.
- To accurately draw angles using a protractor.
- To use the properties of rectangles to deduce related facts and find missing angles.

Children need to know when…

- *an angle is a property of shape and when it is a measure of turn. (Year 3)*
- *an angle is made up of right angles. When we draw lines, we use a ruler to draw a horizontal/vertical line segment of a specified length (Year 3)*
- *we see different types of angles and lines in real life. (Year 3)*
- to use a protractor to check if a pair of lines are perpendicular or intersecting.
- We are looking at an acute, right, straight or reflex angle.
- It is necessary to measure and draw angles precisely. (e.g. when completing technical drawings and drawing regular polygons).
- A rough estimate is acceptable.
- To add/subtract angles to find the size of missing angles in a diagram.
- To apply angles knowledge to real-life contexts (e.g. determining if a piece of paper is correctly folded)
- To check the reasonableness of a measurement using estimation.
- To use measurement tools (protractors/rulers)

Children need to know why…

- ***We learn to describe movement.*** *Sometimes we will need to explain where/how something is moving to someone who is not there. Having the language of position and direction allows us to do this. (Year 1)*
- ***There are two scales on a protractor.*** *Angles can point in different directions. The two scales allow you to measure angles pointing in different directions with ease. (Year 3)*
- *A right angle notation uses a 'box'. Because this reflects the 90o turn of a right angle. This visual similarity helps people to identify this important angle efficiently in diagrams. (Year 3)*

	2D SHAPE	A shape with 2 dimensions (flat). They have width and height. They can only be drawn, not held.	POLYGON	a closed two-dimensional shape with straight sides.	**SIDES**	The lines which define the outside of a shape.
	VERTEX (2D)	The points at which two sides of a shape meet.	**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.	**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.
	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.	**INTERSECT**	Where two lines cross
	PARALLEL LINES	lines that are always the same distance apart and never intersect.	**PERPENDICULAR LINES**	lines that intersect at a right angle (90 degrees).	**INTERSECTING LINES**	lines that cross or meet (but not at a right angle)
	RAY	a part of a line that has one endpoint and extends indefinitely in one direction.	**ANGLE**	A measure of turn. This can describe movement or can be a property of shape.	**DEGREE**	The unit of measure for angles. Uses the unit notation X°
	FULL TURN	Turning a full circle: starting and finishing in the same position. A full turn is 360°	**STRAIGHT ANGLE (HALF TURN)**	Half the size of a full turn. The object will face the opposite direction at the end of the turn. A half turn is 180°	**RIGHT ANGLE (QUARTER TURN)**	Quarter the size of a full turn. The object will be facing to the left or right of its starting direction. A right angle is 90°
	PROTRACTOR	A measurement tool used for measuring the size of angles.	**ACUTE ANGLE**	An acute angle is <90°	**OBTUSE ANGLE**	An obtuse angle is > 90° and < 180°
	REFLEX ANGLE	A reflex angle is >180° and <360°	**REGULAR POLYGON**	A three or more sided shape where all the sides are the same length and all of the angles are the same size		

Enrichment & wider development	

Year 5 - Autumn 2

National Curriculum Milestones

Multiplication

Pupils should be taught to:

- Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers
- Know and use the vocabulary of prime numbers, prime factors and composite (nonprime) numbers
- Establish whether a number up to 100 is prime and recall prime numbers up to 19
- Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers
- Multiply numbers mentally drawing upon known facts
- Multiply whole numbers and those involving decimals by 10, 100 and 1,000
- Recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3})
- Solve problems involving multiplication including using their knowledge of factors and multiples, squares and cubes
- Solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign
- Solve problems involving multiplication, including scaling by simple fractions and problems involving simple rates.

Perimeter area and volume:

Pupils should be taught to:

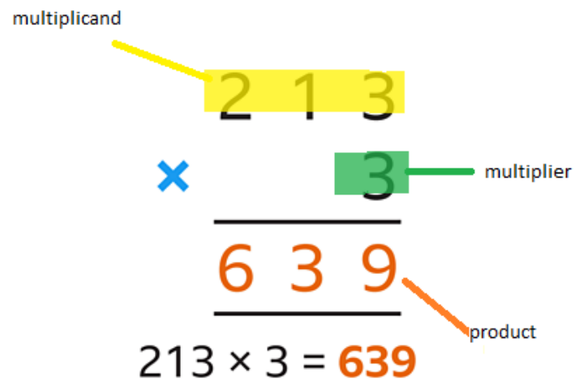
- Measure and calculate the perimeter of composite rectilinear shapes in centimetres and metres
- Calculate and compare the area of rectangles (including squares), and including using standard units, square centimetres (cm2) and square metres (m2)
- Estimate the area of irregular shapes
- Estimate volume [for example, using 1 cm^3 blocks to build cubes/cuboids] and capacity [for example, using water]
- Use all four operations to solve problems involving measure

Revisited knowledge

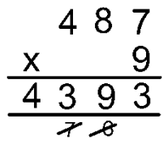
New knowledge

Domains	**Declarative Knowledge** (Substantive Knowledge)	**Procedural Knowledge** (Disciplinary Knowledge)	**Conditional Knowledge** (Knowing the when and the why)
Multiplication	**Multiples, Factors and Primes** 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)* • *The formal language of multiplication (multiplicand, multiplier, product) (Year 1)* • *The 0,1,2,5 and 10 times tables. (Year 2). The 3, 4, 8 times table (Year 3) The 6,7,9,11 and 12 times tables (Year 4)* • *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 4)* • *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)* • *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. (Year 4)* • *When any number is multiplied by 1, it remains the same. (Year 4)* • *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)* • *A factor is a number that a multiple can be divided by without a remainder (it gives an integer quotient). (Year 4)* • *An integer is a whole number. (Year 4)* • *Factors come in pairs, which multiply together to create a multiple. (Year 4)* • *When we multiply three numbers together, we multiply the product of the first two numbers by the third number. (Year 4)*	**Multiples, Factors and Primes** 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 solve missing number questions using the inverse. (Year 2)* • *To use a range of strategies to solve multiplication problems (all previous)* • *To identify fact families (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. (all previous)* • *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. (Year 4)* • *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.* • To recognise and use factor pairs and commutativity in mental calculations. • To identify multiples and factors of numbers. • To find all factor pairs of a number • To find common factors of two numbers • To establish whether a number up to 100 is prime and explain using the vocabulary of prime numbers, prime factors and composite (non-prime) numbers • To recognise and use square numbers and cube numbers.	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)* • The product of any number being multiplied is a 'multiple' of the multiplier and multiplicand. • A question involves finding multiples of a number. • A number is a factor of a number. • To use divisibility rules to work out if a number is a factor of another number. • A number is prime. • They will need to work systematically to find the alternatives. 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*

	• Factor pairs are two numbers that, together, act as factors of a multiple. When multiplied together, they create a specific product.
	• Factors are numbers which can act as the divisor for a multiple, creating an integer quotient (no remainder).
	• A prime number is a number with exactly two factors: 1 and itself.
	  ○ There are 8 prime numbers under 20: 2,3,5,7,11,13,17 and 19.
	• A composite number is any non-prime number. It has 3 or more factors.
	• A square number is the product of a number multiplied by itself.
	  ○ They are called square numbers because, when created with practical resources, they can be arranged in a perfect square array.
	  ○ The notation for a square number is N^2
	  ○ The first 12 square numbers are 1^2=1, 2^2=4, 3^2=9, 4^2=16, 5^2=25, 6^2=36, 7^2=49, 8^2=64, 9^2=81, 10^2=100, 11^2=121, 12^2=144.
	• A cube number is the product of a number which has been multiplied by itself and then by itself again.
	  ○ They are called cube numbers because, when created with practical resources, they form a perfect cube.
	  ○ The notation for a cube number is N^3
	  ○ The first 12 cube numbers are 1^3, 2^3, 3^3, 4^3, 5^3, 6^3, 7^3, 8^3, 9^3, 10^3, 11^3, 12^3
		• Solve problems involving multiplication by using their knowledge of factors and multiples, squares and cubes	*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)*
			• ***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 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. (Year 4 Autumn 1)*

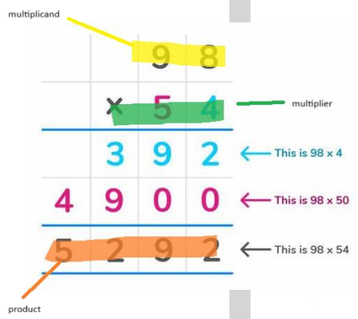
Multiplication	**Written multiplication**
	Children need to know that…
	• *Multiplication is a commutative mathematical operation that indicates how many times a number is added to itself and is represented by the symbol 'x'. (Year 1)*
	• *Commutative means it can be done in any order (Year 1)*
	• *The formal language of multiplication (multiplicand, multiplier, product) (Year 1)*
	• *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. (Year 4 Autumn 1)*
	• *When any number is multiplied by 1, it remains the same. (Year 4 Autumn 1)*
	• *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)*
	• *Because multiplication is commutative, we can multiply three numbers together in any order.*
	• ***SHORT MULTIPLICATION***
	  ○ *The formal written method of compact short multiplication uses the distributive law to simplify the multiplication of larger numbers. (Year 4)*
	 
	
	  ○ *The multiplier is multiplied by each column of the multiplicand in turn from smallest to largest. (Year 4)*
	  ○ *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 regrouped*
		Multiplication
		Children need to know how…
		• *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 (previous years)*
		• *To choose the most efficient method (Year 2)*
		• *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 (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 two-digit and three-digit numbers by a one-digit number using the formal written method of compact short multiplication. (Year 4)*
		• *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. (Year 4)*
		• Multiply integers and decimals by 10, 100 and 1,000.
		• Use place value, known and derived facts to multiply larger numbers mentally.
		• Multiply numbers up to 4 digits by a 1-digit number using the formal written method of compact formal written multiplication.
		• Multiply numbers with up to 4 digits by a 2-digit number using the formal written method of long multiplication.
		• Solve multi-step problems including a combination of operations.
		• Solve problems involving multiplication, including scaling by simple fractions and problems involving simple rates.
			Children need to know when…
			• *to use a times table based on the factors in the 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)*
			• *to use short compact formal written multiplication to solve a multiplication problem. (Year 4)*
			• To use long multiplication to solve a 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 groups*

digit under the next column. (Year 4)



LONG MULTIPLICATION

- The formal written method of long multiplication uses the distributive property of multiplication to simplify large calculations.
- The multiplier and multiplicand are arranged neatly in place value columns.



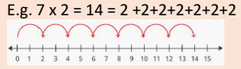
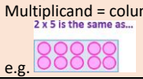
- The ones digit of the multiplier is multiplied by the multiplicand (following the same process as short multiplication).
- The tens digit of the multiplier is multiplied by the multiplicand (following the same process as short multiplication).
- Before completing the tens-digit multiplication, a place holder zero needs to be placed in the ones column. This is because the multiplier has a value of tens.
- The two partial-products then need to be added together to find the final product.

- Scaling is when you are given information about something and then have to apply it to a smaller or larger quantity (e.g. 3 times as many).
- Rates are a fixed price paid or charge or something.

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.
- **We use long multiplication to multiply larger numbers by a 2-digit numbers.** It allows us to use our knowledge of place value to simplify larger calculations and solve large multiplications with accuracy.
- **We put a placeholder zero in the ones column when we multiply by the tens number of the multiplier.** The tens number of the multiplier has a value of 'ten'. Therefore, placing the zero in the ones column retains that place value.

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 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)	**PRIME NUMBER**	A number which only has 2 factors: one and itself.
SQUARE NUMBER	The product of a number multiplied by itself	**CUBE NUMBER**	The product of a number multiplied by itself and then by itself again.	**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. 	**LONG MULTIPLICATION**	A formal written method used to multiply a larger multiplicand by a 2 digit multiplier. 	**INTEGER**	A whole number.

Perimeter, area and volume

Perimeter

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 1000millimeters in 1m (Year 3)*
- *There are 100cm in 1m. (Year 1)*
- *Perimeter is the distance around the outside of a shape (Year 3)*

Area

Children need to know that…

- *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. (Year 4)*
- *Area is measured in square units (e.g. mm^2, cm^2, m^2) (Year 4)*
- *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.) (Year 4)*
- *A rectilinear shape is a 2D shape made up of squares and rectangles. (Year 4)*
- *We can find the area by counting squares within a rectilinear shape. This works very much like an array in multiplication. (Year 4)*
- A composite or compound shape is any shape made of two or more geometric shapes.
- We can calculate the area of a rectangle or square by multiplying the length by the width.
- The formulae to calculate the area of a square is l^2
- The formulae to calculate the area of a rectangle is l x w
- We can calculate the area of composite rectilinear shapes by breaking them down into smaller squares and rectangles.
- An irregular shape has no equal sides or equal angles.

Volume

Children need to know that…

- Cubic units are another type of unit used to measure volume (e.g. $5cm^3$)
- To measure volume in cubic units, you multiply length x width x height.

Perimeter

Children need to know how…

- *To describe distance using the language long and short. (Year 1)*
- *To compare lengths using comparative language (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 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. (Year 4)*
- *To calculate the perimeter of more complex rectilinear shapes not draw to scale by adding the lengths together. (Year 4)*
- *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) (Year 4)*
- To measure and calculate the perimeter of composite rectilinear shapes in standard units of measure (e.g. cm and m)
- To begin to use the algebraic formulae to remember how to calculate the perimeter of squares "4a" and rectangles "2(a+b)".

Area

Children need to know how…

- *To find the area of rectilinear shapes (not drawn to scale) by counting squares. (Year 4)*
- *To give the area of rectilinear shapes using the correct unit (cm^2 or m^2) (Year 4)*
- To calculate the area of rectangles (including squares) using standard units (e.g. cm^2 and m^2).
- To compare the area of rectilinear shapes.
- To estimate the area of irregular shapes using knowledge of halves and quarters

Volume

Children need to know how…

- To estimate volume in cm^3 by using blocks to build cubes and cuboids
- To estimate capacity using water.

To solve measure problems involving all four operations.

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. (Year 4)*
- *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. (Year 4)*
- *To use different units of measure based on the size of the space/distance being measured. (Year 4)*
- To break a rectilinear shape into smaller rectangles to help solve perimeter and area problems.
- To apply their knowledge of measurement in real-life contexts.

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.
- **We can learn formulae to help us remember how to calculate area and perimeter.** Because geometric shapes follow regular rules, we can find short ways of reminding us of those rules.

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 1000mm 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.
	LENGTH	The distance from the bottom to the top of a quadrilateral/shape.	**WIDTH**	The distance from the left to the right.		
Enrichment & wider development						

Year 5 - Spring 1

National Curriculum Milestones

Division

- Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers
- Multiply and divide numbers mentally drawing upon known facts
- Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context
- Divide whole numbers and those involving decimals by 10, 100 and 1,000
- Solve problems involving division including using their knowledge of factors and multiples, squares and cubes
- Solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign
- Solve problems involving division, including scaling by simple fractions and problems involving simple rates.

Geometry: properties of shape

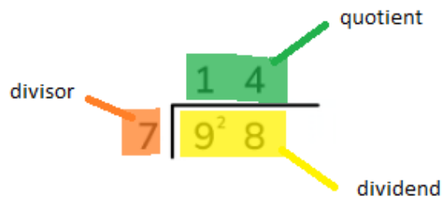
- Identify 3D shapes, including cubes and other cuboids, from 2D representations
- Use the properties of rectangles to deduce related facts and find missing lengths
- Distinguish between regular and irregular polygons based on reasoning about equal sides and angles.

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)*
	• *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. (Year 4)*
	• *The divisibility rules for(Year 4)*
	  ○ *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. (Year 4)*
		• *To use divisibility rules to suggest whether a division will be possible without a remainder before calculating. (Year 4)*
		• *To recall division facts for multiplication tables up to 12 x 12. (Year 4)*
		• *To use place value and knowledge of fact families to mentally solve division problems.*
		• *To divide two and three digit numbers by a one digit number using the formal written method of short division (bus stop). (Year 4)*
		• *To exchange where necessary when using the formal written method of short division.*
		• *To solve mathematical problems involving division. (Year 4)*
		• *To check the reasonableness of answers using estimation (rounding and known facts) (Year 4)*
			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. (Year 4)*
			• When to determine the price per unit when solving a rates problem.
			
			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. (Year 2)*
			• ***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. (Year 4)*

	○ *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) (Year 4)* • *The formal written method of short division is sometimes called 'bus stop' method. (Year 4)*  • *(Year 4)* • *The formal written method of short division uses knowledge of 'division by grouping' and partitioning (see calculation policy for exemplification) (Year 4)* • *Calculation starts from the largest place value column. (Year 4)* • *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. (Year 4)*	• *To check calculations using the inverse. (Year 4)* • *To identify multiples and factors, including finding all factor pairs of a number and common factors of 2 numbers (Year 5 Autumn 2)* • To use derived facts, multiples, factors, squares and cubes to solve problems involving multiplication and division. • To divide four-digit numbers by a one-digit number using the formal written method of short division. • To interpret remainders appropriately for the context. • To divide integers by 10, 100 and 1,000. • To solve problems involving a mixture of operations. • To solve problems including understanding the meaning of the equals sign. • To solve problems involving scaling by simple fractions and problems involving simple rates.	• **Remainders occur.** Remainders occur when we cannot divide a dividend perfectly by the divisor.

	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.				

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, not held. (Year 1)* • *2D shapes have sides and vertices (Year 1)* • *A polygon is a word for a multiple sided shape. (Year 3)* • *A semicircle is exactly half of a circle. (Year 3)* • *The names and properties of a range of different 2D shapes: circles, triangles, quadrilaterals, pentagons, hexagons and octagons (Year 1)* • *The names and properties of a range of quadrilaterals: squares, rectangles, trapeziums, rhombuses, parallelograms (Year 3)* • *The names and properties of a range of triangles: equilateral, isosceles, scalene, right angled.* • *Symmetry means when something is exactly the same on either side. Lines of symmetry can be diagonal, horizontal or vertical. (Year 2)* • '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.) • The names and properties of some more complex polygons: **Name** / **Number of sides** / **Number of Vertices** Heptagon / 7 / 7 Nonagon / 9 / 9 Decagon / 10 / 10 Hendecagon / 11 / 11 Dodecagon / 12 / 12 • A regular polygon is a polygon where all sides and angles are equal. • An irregular polygon is a polygon where there is at least one unequal angle or side. • The sum of the angles in different shapes: ○ Triangle: 180° ○ Quadrilateral: 360°	**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 quadrilaterals.* • *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 quadrilaterals.) (Year 4)* • *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. (Year 4)* • *To complete simple symmetrical figures with respect to a specific line of symmetry (including horizontal, diagonal and vertical lines of symmetry) (Year 4)* • To use the properties of rectangles (internal angles, types of lines) to deduce related facts and missing lengths in rectilinear shapes. • To distinguish between regular and irregular shapes using reasoning about equal sides and angles.	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. (Year 4)* • *a geometrical property would be a useful way of comparing and classifying shapes. (Year 4)* • A specific property of a shape will help you find an unknown. 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. (Year 4)* • **Regular and irregular is the term chosen to describe shape:** Regular indicates same-ness, whereas irregular indicates difference. • **We need to be able to understand and manipulate nets.** Many instances of hollow 3D shapes in real life are constructed from nets.

	3D Shape Children need to know that… • *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 names and properties of a range of 3D shapes: sphere, pyramid, cone, cylinder, triangular prism, cube, cuboid (Year 1)* • *Orientation is the angle at which an object or shape is presented from. (Year 3)* • A net is a 2D representation of the faces of a 3D shape which has been 'opened up'.	**3D Shape** Children need to know how… • *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 e.g. Multilink, plasticine, k-nex. (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. • To identify 3D shapes (including cubes and cuboids) from a range of 2D representations, including nets.	

	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.
	PARALLEL LINES		**PERPENDICULAR LINES**		**INTERSECTING LINES**	
	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.
	ACUTE ANGLE	An acute angle is <90º	**RIGHT ANGLE**	A right angle is 90º	**OBTUSE ANGLE**	An obtuse angle is > 90º and < 180º
	REFLEX ANGLE	A reflex angle is >180º but < 360º	**SYMMETRICAL**	A shape with at least one line of symmetry.		
	POLYGON	A closed shape with three or more sides.	**REGULAR POLYGON**	A polygon where all sides and angles are equal.	**IRREGULAR POLYGON**	A polygon with at least one unequal side or angle.
Enrichment & wider development						

Year 5 Spring 2

National Curriculum Milestones
Measure: Time

- solve problems involving converting between units of time

Fractions

- Compare and order fractions whose denominators are all multiples of the same number
- Identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths
- Recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements > 1 as a mixed number [for example, 2/5 + 4/5 = 6/5 = 1 1/5]
- Add and subtract fractions with the same denominator and denominators that are multiples of the same number
- Multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams
- Solve problems with fractions with a denominator of a multiple of 10 or 25.

Revisited knowledge
New knowledge

Domains	**Declarative Knowledge** (Substantive Knowledge)	**Procedural Knowledge** (Disciplinary Knowledge)	**Conditional Knowledge** (Knowing the when and the why)
Time	**Describing Time** Children need to know that… • *Time is a measurement for how long it takes for things to happen. (Year 1)* • *When we describe time, we use comparative language, such as before, after, next, first, today, yesterday, tomorrow, quicker, slower, earlier, later. (Year 1)* • *Chronological order means listing events in order from earliest to latest. (Year 1)* • *There are 24 hours in a day; There are 7 days in a week: Monday, Tuesday, Wednesday, Thursday, Friday, Saturday and Sunday. (Year 1)* • *In England, we often describe weeks as starting on Monday and ending on Sunday. (Year 1)* • *There are twelve months in a year. There are about 365 and one quarter days in a year. Therefore, most years have 365; every fourth year has 366 days. This is the time it takes earth to orbit the sun. (Year 1)* • *Am stands for ante meridiem. This means a time 'before noon' and refers to the period from midnight until noon. Pm stands for post meridiem. This means 'after noon' and refers to the period from noon until midnight. (Year 3)* • *Morning is a general term used to describe the period of time before noon. Afternoon is a general term used to describe the period of time after noon. (Year 3)* • *Midday means noon/12:00pm. Midnight is at 00:00am. (Year 3)* • A decade is a period of 10 years. • A fortnight is a period of 2 weeks. • A millennia is a period of 1,000 years.	**Describing Time** Children need to know how… • *To compare the duration and sequence of events using the language quicker, slower, earlier, later (Year 1)* • *To sequence events in chronological order and verbalise their justification using the language before, after, next, first, today, yesterday, tomorrow, morning, after and evening. (Year 1)* • *To use language relating to dates including days of the week, weeks, months of the year, years (Year 1)* • *To convert between different units of time (Year 4)* ○ *Seconds → minutes; minutes → seconds.* ○ *Seconds → hours; hours → seconds.* ○ *Minutes → hours; hours → minutes.* ○ *Hours → days; days → hours.* ○ *Days → weeks; weeks → days.* ○ *Days → months; months → days* ○ *Days → years; years → days* ○ *Weeks → months; months → weeks.* ○ *Weeks → years; years → weeks.* ○ *Months → years; years → months.* ○ Decades → years; years → decades ○ Fortnights → weeks; weeks → fortnights ○ Fortnights → days; days → fortnights ○ Years → millennia; millennia → years • To solve problems involving converting between units of time.	Children need to know when… • *To convert between different units of measure.* Children need to know why… • ***Sometimes we describe time using 'past' and sometimes we describe time using 'to'.*** *The half hour mark is really important to us. This separates when we use past and to. Times which are 'past' are closer to the current hour. Times which are 'to' are closer to the next hour. It helps us to understand how far through the hour we are. (Year 2)* • ***We have two types of clocks: analogue and digital.*** *Digital clocks are more popular today because of electricity and because they are easier to read. Analogue clocks are an older design because they used to be clockwork powered. (Year 3)* • ***We need to convert between units of time.*** *Like with all units of measure, we must convert to the same unit of measure to be able to compare or calculate. The unit of measure tells us how big the parts are. (Year 4)*

Vocabulary

TIME	A measurement of how long things take to happen.	**CHRONOLOGICAL ORDER**	Listing events in order from the earliest to the latest.	**MORNING**	The first part of the day, from 00:00-11:59
AFTERNOON	The second part of the day, from 12:00-23:59.	**DAYS**	A 24 hour period, starting at midnight. There are 7 days in a week.	**WEEK**	The 7 days (normally seen as starting with Monday and ending with Sunday)
WEEKEND	Saturday and Sunday.	**MONTHS**	Approximately 4 weeks. There are 12 months in a year. Based on the movement of the moon.	**YEAR**	365 days. Based on the movement of the Earth around the sun.
SECONDS	A unit of measure for time. The smallest common unit of measure. There are 60 seconds in a minute.	**MINUTE**	A unit of measure for time. There are 60 minutes in an hour.	**HOUR**	A unit of measure for time. There are 24 hours in a day.
ANALOGUE CLOCK	A clock with a circle face and 2 (or 3) hands which move around clockwise to show the time.	**DIGITAL CLOCK**	A clock which is usually rectangular, and shows time in numbers.	**MINUTE HAND**	Longer thinner hand on the analogue clock which moves quicker.
HOUR HAND	Shorter, thicker hand of the analogue clock which moves slower.	**O'CLOCK**	Describes the hour of the day we are currently on.	**HALF-PAST**	Suggests we are half-way through the current hour (30 minutes)
Ante Meridiem (am)	On the 12-hour clock, indicates a time between midnight and midday.	**Post meridiem (pm)**	On the 12-hour clock, indicates a time between midday and midnight. (12:00 and 23:59)	**24 HOUR CLOCK**	a timekeeping system in which the day is divided into 24 hours, starting at midnight (00:00) and ending at midnight the next day (23:59).

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)*
	• *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 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)*
	• *To find a fraction of a quantity, we need to first divide by the denominator and then multiply by the numerator. (Year 3)*
	• *A tenth is 1 part out of 10. Tenths arise from dividing an object into 10 equal parts. (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. (Year 4)*
	• A fraction smaller than one whole is known as a proper fraction (the numerator is smaller than the denominator)
	• Fractions larger than one whole can be written in different ways:
	  ○ **Improper Fractions:** The numerator is larger than the denominator.
	  ○ **Mixed Numbers:** The improper fraction is partitioned into 'wholes' and 'parts'. The wholes are written as an integer number. This is shown by using a larger notation. The part is shown as a proper fraction. For example, $\frac{6}{5}$ (improper fraction) = $1\frac{1}{5}$ (mixed number)
	• We usually express fractions greater than 1 as mixed numbers.
	
	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'(Year 4)*
	• Common denominators means a pair or group of fractions have the same denominator.
	• We can create new, larger equivalent fractions in two ways:
	  ○ Multiplying the numerator and denominator by the same multiplier.
	  ○ Dividing the numerator and denominator by the same divisor. This is called simplifying the fraction.
	• A fraction in its **simplest form** is the equivalent fraction with the smallest possible value for the numerator and denominator.
	
	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)*
	• *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.*
	• We can order fractions in ascending or descending order.
	• We can use our knowledge of equivalent fractions to create pairs of fractions with common denominators.
	• Fractions with different denominators can be compared by finding equivalent fractions with a common denominator.
	
	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.*
	• We can use our knowledge of equivalent fractions to create pairs of fractions with common denominators.
		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. (Year 4)*
		• *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. (Year 4)*
		• To convert between mixed numbers and improper 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. (Year 4)*
		• To find pairs of equivalent fractions by calculating efficiently using knowledge of factors and multiples.
		
		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 = (Year 4)*
		• *To compare and order increasingly complex fractions. (Year 4)*
		• To compare and order fractions with different denominators by using knowledge of equivalent fractions to find common denominators (when the denominators are all multiples of the same number).
		
		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)*
			Children need to know when …
			• *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 (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 (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)*
			• To represent a fraction >1 as a mixed number and when to represent it as an improper fraction.
			• A common denominator needs to be found to solve a problem.
			• To find the common denominator by simplifying.
			• To find the common denominator by multiplying.
			• To use 'fractions of amounts' as a strategy for multiplying a fraction by an integer.
			• To use 'repeated addition' (multiplying the numerator only) as a strategy for multiplying a fraction by an integer.
			• To use the distributive law to multiply a fraction by an integer.
			
			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. (Year 4)*
			• **The product can get smaller when we multiply an integer by a fraction.** A proper fraction is less than one whole. This means we are not making complete groups, but instead are splitting the whole into partial groups. This is why we don't say, early in our education, that multiplication always makes the product bigger.

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Fractions with different denominators can be added/subtracted by finding a common denominator, using knowledge of equivalent fractions.

Multiplying Fractions
Children need to know that…

Fractions are a form of number, so can also be multiplied.
We can think of multiplying fractions by integers in two ways:

Fractions of amounts: The ‘x’ operation in a fraction question can also be thought of as meaning ‘of’. We can use our knowledge of fractions of amounts (e.g. $\frac{1}{2}$ x 4 is the same as $\frac{1}{2}$ of 4.)
Multiplication of the fraction: We can think of this as repeated addition: the numerator will change, but the denominator will stay the same. (e.g. $\frac{1}{2}$ x 4 is the same as . $\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}$)

The distributive law will help us to multiply a mixed number by an integer.

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To confidently add and subtract increasingly large unit and non-unit fractions with the same denominator (including adding three or more fractions). (Year 4)
To add and subtract fractions with different denominators by finding common denominators (when the denominators are all multiples of the same number).

Multiplying fractions
Pupils need to know how…

To multiply a proper number by an integer, supported by materials and diagrams.
To multiply a mixed number by an integer, supported by materials and diagrams.

To solve problems (including with fractions with denominators of multiples of 10 and 25) using knowledge of fractions

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<tr>
<td>Vocabulary</td>
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<tr><td>FRACTION</td><td>A way of representing mathematically how many equal parts of a whole you have.</td><td>PART</td><td>A section of the whole. In fractions, parts must always be equal.</td><td>WHOLE</td><td>A total amount. This is the sum of all the parts. In fractions, the number 1 represents 1 whole.</td></tr>
<tr><td>DENOMINATOR</td><td>The bottom number in a fraction. This describes the number of equal parts the whole has been split into.</td><td>DIVIDING LINE</td><td>The horizontal line which separates the numerator from the denominator.</td><td>NUMERATOR</td><td>The top number in a fraction. This describes the number of parts you have.</td></tr>
<tr><td>HALF</td><td>When a whole has been split into two equal parts.</td><td>QUARTER</td><td>When a whole has been split into four equal parts.</td><td>THIRD</td><td>When a whole has been split into three equal parts.</td></tr>
<tr><td>QUANTITY</td><td>A numerical amount.</td><td>COMPARE</td><td>Two meanings: a) to say what is the same or what is different. b) to identify the mathematical difference between numbers.</td><td>EQUAL/ EQUIVALENT</td><td>The same as.</td></tr>
<tr><td>EQUIVALENT FRACTION</td><td>Fractions that represent the same amount/number but which look different.</td><td>FRACTION WALL</td><td>A pictorial representation of small fractions. This helps to find equivalent fractions.</td><td>LIKE DENOMINATORS</td><td>Denominators are the same</td></tr>
<tr><td>LIKE NUMERATORS</td><td>Numerators are the same.</td><td>UNIT FRACTION</td><td>A fraction with a numerator of 1</td><td>NON-UNIT FRACTION</td><td>A fraction with a numerator larger than 1.</td></tr>
<tr><td>TENTH</td><td>One part when a whole has been divided by 10</td><td>HUNDREDTH</td><td>One part when a whole has been divided by 100</td><td>FRACTION FAMILY</td><td>A group of equivalent fractions.</td></tr>
<tr><td>COMMON DENOMINATOR</td><td>Like denominators.</td><td>PROPER FRACTION</td><td>A fraction less than 1 whole.</td><td>IMPROPER FRACTION</td><td>A fraction greater than a whole, written with a numerator larger than the denominator.</td></tr>
<tr><td>MIXED NUMBER</td><td>A fraction greater than a whole which has been partitioned into the ‘wholes’, written as integers, and the part, written as a proper fraction.</td><td>HIGHEST COMMON FACTOR</td><td>The largest possible factor of two different numbers. This can be used to write a fraction in its simplest form.</td><td>LOWEST COMMON MULTIPLE</td><td>The smallest possible number which is a multiple of two different numbers.</td></tr>
<tr><td>SIMPLIFYING</td><td>A process where the numerator and denominator are divided by the same divisor to create an equivalent fraction with a smaller numerator and denominator.</td><td>FRACTION IN ITS SIMPLEST FORM</td><td>The equivalent fraction with the smallest possible numerator and denominator, found by dividing the numerator and denominator by the highest common factor (HCF)</td><td></td><td></td></tr>
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Year 5 Summer 1

National Curriculum Milestones

Fractions, Decimals and Percentages

- read and write decimal numbers as fractions [for example, 0.71 = 71 /100
- recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
- round decimals with two decimal places to the nearest whole number and to one decimal place
- read, write, order and compare numbers with up to three decimal places
- solve problems involving number up to three decimal places
- recognise the per cent symbol (%) and understand that per cent relates to 'number of parts per hundred', and write percentages as a fraction with denominator 100, and as a decimal
- Solve problems which require knowing percentage and decimal equivalents of 1/2, 1/4, 1/5, 2/5, 4/5

Money

- use all four operations to solve problems involving money using decimal notation, including scaling.

Revisited knowledge
New knowledge

Domains	**Declarative Knowledge** (Substantive Knowledge)	**Procedural Knowledge** (Disciplinary Knowledge)	**Conditional Knowledge** (Knowing the when and the why)

Fractions, decimals and percentages	**Representing Decimal 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)*
	• *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 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)*
	• *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 proper fraction is a fraction < 1 (Year 5 Spring 2)*
	• *An improper fraction is a fraction > 1. Improper fractions can also be expressed as mixed numbers. (Year 5 Spring 2)*
	• *A tenth is 1 part out of 10. Tenths arise from dividing an object into 10 equal parts. (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. (Year 4)*
	• *Decimal numbers are another way of showing fractions of a whole and use the Base 10 number system. (Year 4)*
	• *With decimal numbers, our place value grid extends to the right, past the ones – see below. (Year 4)*
	 
	
	• *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. (Year 4)*
	• *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. (Year 4)*
	• *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. (Year 4)*
	• *0.1 = $\frac{1}{10}$ (Year 4)*
	• *Tenths are shown in the tenths column. (Year 4)*
	• *0.01 = $\frac{1}{100}$ (Year 4)*
	• *There are key fraction/decimal equivalents we need to learn: (Year 4)*
	  ○ *$\frac{1}{4}$ = 0.25*
	  ○ *$\frac{1}{2}$ = 0.5*
	  ○ *$\frac{3}{4}$ = 0.75*
	• *Hundredths are shown in the hundredths column. (Year 4)*
	• *Both fractions and decimals can be used to express fractional numbers greater than one whole. (Year 4)*
		Representing Decimal Fractions
		Pupils need to know how…
		• *To count up and down in tenths e.g. 1/10, 2/10, 3/10…To find a tenth of a quantity or shape by diving the whole by 10 (Year 3)*
		• *To count up and down in hundredths. To find a hundredth of a quantity or shape by dividing the whole by 10. (Year 4)*
		• *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. (Year 4)*
		• *To convert between mixed numbers and improper fractions. (Year 5 Spring 2)*
		• *To convert between fractions and decimals by recognising and writing decimal equivalents of any number of tenths and hundreds. (Year 4)*
		• To count up and down in thousandths. To find a thousandth of a quantity or shape by dividing the whole by 1000.
		• To convert between fractions and decimals by writing decimal equivalents of any number of tenths, hundredths and thousandths.
		• To recognise and use thousandths, relating them to hundredths and tenths.
		• To write fractional numbers (with tenths/hundredths/thousandths) 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, $\frac{1}{5}$=0.2, $\frac{2}{5}$=0.4, $\frac{3}{5}$=0.6, $\frac{4}{5}$=0.8.
			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.*
			• Rounding decimals may help with estimating.
			• It is most appropriate to present fractional amounts as fractions, decimals or percentages.
			• Converting between fractions, decimals and percentages is necessary to solve problems.
			• Percentages are used in real-life contexts.
			• Visual representations will support them to solve problems involving fraction, decimal and percentage equivalence.
			
			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) (Year 4)*
- *A place holder 0 is the use of the digit 0 to mark a column in a number which has no value (Year 1)*
- Most simple fractions can be converted to decimal numbers.
- Decimals represent fractions with denominators that are a power of 10.
- A thousandth is one part out of 1,000. Thousandths arise from dividing a whole by 1,000; a tenth by 100 or a hundredth by 10.
- Thousandths are written in the third column on the right of the decimal point.
- Thousandths numbers are 3dp numbers.
- The integer in a mixed number is recorded on the left of the decimal point.

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)*

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)*

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. (Year 4)*
- *When we divide a number by 100, the digits move two columns to the right, becoming one hundred times smaller. (Year 4)*
- When we divide a number by 1,000, the digits move three columns to the right, becoming one thousand times smaller.

Percentages
Children need to know that…
- A percentage is another way of writing a fraction with a denominator of 100 (e.g. $\frac{25}{100}$ = 25 %)
- Percentages are shown with the % symbol.
- Percentage means "parts out of 100".
- We can convert between fractions, decimals and percentages by looking for common denominators of 10 and 100.
- Common fraction/decimal/percentage equivalents which we need to learn by heart are

Fraction	Decimal	Percentage
1	1	100%
$\frac{1}{10}$	0.1	10%
$\frac{1}{100}$	0.01	1%
$\frac{1}{1000}$	0.001	0.1%
$\frac{1}{2}$	0.5	50%
$\frac{1}{4}$	0.25	25%

Rounding Decimals
Children need to know how…
- *To round decimal numbers with 1dp to the nearest one whole. (Year 4)*
- To round decimals with 2 or 3dp to the nearest whole.
- To round decimals with 2 or 3dp to the nearest tenth.

Comparing and Ordering Decimals
Children need to know how…
- *To compare decimal numbers with the same number of decimal places (up to 2 dp) using <,>, = (Year 4)*
- *To order decimal numbers with the same number of decimal places (up to 2 dp) in ascending or descending order. (Year 4)*
- To compare decimal numbers (up to 3dp) using <,>,=, including when the numbers have a different numbers of decimal places.
- To order decimal numbers (up to 3dp) in ascending and descending order, including when the numbers have a different numbers of decimal places.

Dividing to create decimal numbers
Children need to know that…
- *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. (Year 4)*
- To divide any number by 10, 100 or 1000 when the quotient has up to 3dps.

Percentages
Children need to know how…
- To recognise the % symbol and understand how this relates to 'parts out of 100'.
- To write percentages as fractions with a denominator of 100 and as a decimal.
- To write fractions and decimals with any number of tenths, hundredths and thousandths as a %.

$\frac{3}{4}$	0.75	75%
$\frac{1}{5}$	0.2	20%
$\frac{2}{5}$	0.4	40%
$\frac{3}{5}$	0.6	60%
$\frac{4}{5}$	0.8	80%

- To write fraction and decimal equivalents for $\frac{1}{2}, \frac{1}{4}, \frac{3}{4}, \frac{1}{5}, \frac{2}{5}, \frac{3}{5}, \frac{4}{5}$ as a %.
- To solve problems which require knowing fraction, decimal and percentage equivalents for any number of tenths, hundredths and thousandths.
- To solve problems which require knowing fraction, decimal and % equivalents for $\frac{1}{2}, \frac{1}{4}, \frac{3}{4}, \frac{1}{5}, \frac{2}{5}, \frac{3}{5}, \frac{4}{5}$,

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 1000 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
THOUSANDTH	One part when a whole has been divided by 1,000.	**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.
PERCENTAGE	Parts out of 100.	**%**	The symbol used to represent percentage.	**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.

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 (Year 4)*
  - *£ → p (x 100)*
  - *P → £ (÷ 100)*

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 these look like. (Year 1)*

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. (Year 4)*
- *To check the reasonableness of an answer by estimating using rounding. (Year 4)*
- *To record amounts of money using the standard decimal notation (£0.00) (Year 4)*
- *To compare and order amounts of money presented in standard decimal notation and as £___ and ___ p. (Year 4)*
- *To calculate amounts in £ and p using the four operations and fractions. (Year 4)*
- *To solve simple money problems involving decimals to 2dp using appropriate methods and operations. (Year 4)*
- To use all four operations to solve problems involving money using decimal notation, including scaling.

Children need to know when…

- *They may see and need to use notes in real life (Year 1)*
- *to choose coins or notes based on the amounts of money involved. (Year 3)*
- *a money 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)*
- ***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)*

Vocabulary

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				
Enrichment & wider development						

Year 5 - Summer 2

National Curriculum Milestones

Converting measures
Pupils should be taught to:

convert between different units of metric measure [for example, kilometre and metre; centimetre and metre; centimetre and millimetre; gram and kilogram; litre and millilitre]

understand and use approximate equivalences between metric units and common imperial units such as inches, pounds and pints

use all four operations to solve problems involving measure [for example, length, mass, volume, money] using decimal notation, including scaling

Position and direction
Pupils should be taught to:

- identify, describe and represent the position of a shape following a reflection or translation, using the appropriate language, and know that the shape has not changed.

Statistics
Pupils should be taught to:

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

Revisited knowledge
New knowledge

Domains	**Declarative Knowledge** (Substantive Knowledge)	**Procedural Knowledge** (Disciplinary Knowledge)	**Conditional Knowledge** (Knowing the when and the why)

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…
	• *A metre is a standard unit of measure used to measure moderately large distances. Distances measured in metres are written as _m. (Year 3)*
	• *A centimetre is a standard unit of measure used to measure short distances. Distances measured in centimetres are written as _cm. (Year 3)*
	• *A millimetre is a unit of measure used to measure very short distances. 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. Distances measured in kilometres are written as _km (Year 4)*
	• *The prefix kilo means one thousand. (Year 4)*
	• *The prefix milli means one thousandth (Year 4)*
	• *The prefix centi means one hundredth. (Year 4)*
	• *Conversions: (Year 4)*
	  ○ *m → km (÷ 1000); km → m (x1000)*
	  ○ *cm → m (÷100); m → cm (x100)*
	  ○ *mm →cm (÷10); cm →mm (x10)*
	  ○ *mm →m (÷1000); m →mm (x1000)*
	
	Mass - Conversions
	Children need to know that…
		Children need to know how…
		• *to convert between different units of related measure (for simple conversions – i.e. 5000 m; 7km). (Year 4)*
		• *to estimate amounts using rounding (Year 4)*
		• *to calculate with different measures selecting an appropriate operations and methods. (Year 4)*
		• *to compare different measures using <, > and =, converting if necessary. (Year 4)*
		• *to order different measures, converting if necessary. (Year 4)*
		• *to solve problems involving converting measures. (Year 4)*
		• To convert between more complex units of related metric measure using knowledge of dividing by 10, 100 and 1000.
		  ○ m → km (÷ 1000); km → m (x1000)
		  ○ cm → m (÷100); m → cm (x100)
		  ○ mm→cm (÷10); cm →mm (x10)
		  ○ mm→m (÷1000); m→mm (x1000)
		  ○ g → kg (÷ 1000); kg → g (x1000)
		  ○ ml → l (÷ 1000); l → ml (x1000)
		• To use approximate equivalences between metric units and common imperial units.
		• To use all four operations to solve problems involving measures using decimal notation, including scaling.
			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. (Year 4)*
			• *When a prefix gives you a clue about how to convert. (Year 4)*
			• To use a conversion chart/table to support converting between units.
			• To use the most appropriate unit of measure for a specific context.
			• To use a specific measurement tool for a specific context.
			• To apply knowledge of estimation to check the reasonableness of their calculations.
			• To apply their knowledge of conversion of measures to solve problems in real-life contexts.
			
			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. (Year 4)*
			• ***We have to convert measures into the same measure.*** *Different units of measure describe different sized areas. Like with fractions that have different denominators,*

- *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 (Year 4)*
- *Conversions: (Year 4)*
    - *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 = 1000ml (Year 3)*
- *The prefix milli means one thousandth (Year 4)*
- *Conversions: (Year 4)*
    - *ml → l (÷ 1,000); l → ml (x1,000)*

Metric and Imperial Measures

Children need to know that…

- The metric measurement system is a decimal-based system of measurement, commonly used across the world today which includes
    - **Length:** Metres (including centimetre, kilometre, millimetres)
    - **Mass:** Kilograms (including grams)
    - **Capacity/volume:** Litres (including millilitres)
- The imperial measurement system is an older system of standard units which is less commonly used today (but is still seen in many places). This includes
    - **Length:** inches, feet, yards and miles
    - **Mass:** ounces, pounds, stone and tons
    - **Capacity/volume:** fluid ounces, pints and gallons
- Imperial measures do not always follow a base-10 conversion system.
- Some common conversions between metric and imperial units are

Imperial unit	Number of smaller imperial units in it	Metric units (approx)
1 inch	None	2.5cm
1 foot	12 inches	30cm
1 yard	3 feet	91.4cm
1 mile	1760 yards	1.6km
1 ounce	None	28g
1 pound	16 ounces	453g
1 stone	14 pounds	6.4kg
1 pint	None	568ml
1 gallon	8 pints	4.5 litres

- Scaling is when you are given information about something and then have to apply it to a smaller or larger quantity.

comparing measures with different units would be inaccurate as the units describe different amounts. (Year 4)

- **We have separate standard measurement systems (imperial and metric).** Like with everything, time changes the conventions that we use for thinking about the world. The imperial system is an older system. As our Base 10 number system became more embedded and widely used, the world gradually transitioned to the metric system, which uses the Base 10 system at the heart. We generally use this as it allows us to communicate quickly and effectively with people across the world. However, we still use some imperial measures as they are widely used and embedded within our society.

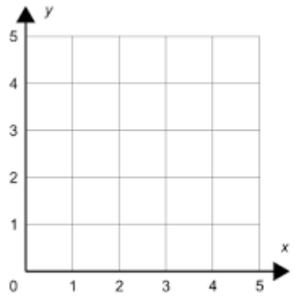
Vocabulary

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.	**IMPERIAL MEASUREMENT**	An older system of measurement unit which is not wholly based on our Base 10 number system.
METRIC MEASUREMENT	The system of measurement used across the world today. This is largely based on our Base 10 number system.	**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.	**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.
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.

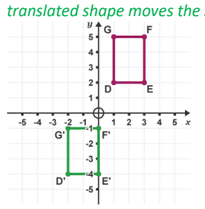
Position and Direction

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. (Year 4)*
- *Coordinate grids have two axes: a horizontal (x) axis and a vertical (y) axis. (Year 4)*
- *In a one-quadrant coordinate grid the x and y axes meet at the origin (0) and only have positive values. (Year 4)*



- *Most coordinate grids have narrow or faint horizontal and vertical lines connecting the numbers on each axis. (Year 4)*
- *Coordinate grids allow us to describe exact locations precisely: coordinates are the way of describing this location. (Year 4)*
- *Coordinates consist of 2 numbers separated by a comma. The coordinates are contained within a pair of brackets. (Year 4)*
  - *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. (Year 4)*
- *Translation is a type of transformation, where a shape or point on a coordinate grid is changed in some way. (Year 4)*
- *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. (Year 4)*



- *A translation can be described using positional language (e.g. 3 right, 2 down). (Year 4)*
- *A translation can also be given in coordinate terms (e.g. +3,-2) (Year 4)*
- *We always describe movement on the x axis first. (Year 4)*

Children need to know how…

- *To describe the position of a point or shape shown on a grid showing the first quadrant using coordinates. (Year 4)*
- *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. (Year 4)*
- *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) (Year 4)*
- *To translate a shape within the first quadrant of a coordinate grid from directions given in positional language and with coordinates. (Year 4)*
- To describe the position of a point or shape shown on a four-quadrant grid using coordinates.
- To identify and describe the position of a shape on a four-quadrant grid following a reflection.
- To reflect a shape in a horizontal or vertical mirror line.
- To identify and describe the position of a shape on a four-quadrant grid following a translation.
- To translate shape accurately on a four quadrant grid.

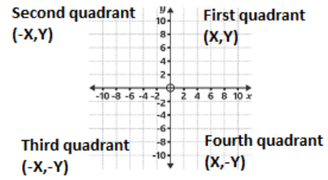
Children need to know when…

- *A number in a coordinate is referring to the x axis and when it is referring to the y axis. (Year 4)*
- *A translation has occurred. (Year 4)*
- *Jottings may help them to describe or complete a translation. (Year 4)*
- A transformation will cross the axes.
- A coordinate will need to include a negative number.
- They will need to give a location as a set of coordinates.
- To apply this knowledge to solve real-life problems including map-reading and navigation.
- To estimate distances between locations using scale.

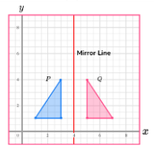
Children need to know why…

- ***The x axis is always given first.*** *This is a mathematical convention. (Year 4)*
- ***Completed polygons must be drawn with a ruler.*** *Geometric shapes are shapes with straight sides. Therefore, these must be drawn carefully. (Year 4)*
- **Shapes do not change when they are reflected and translated.** These are changes of position only.

- Our coordinate grid actually has four quadrants. This is because the X and Y axes also have negative values.
- When a point is within the negative quadrants, this will be recorded within coordinates as a negative number.



- Another type of **transformation** is reflection, where a shape is 'flipped' along a mirror line, creating a perfectly symmetrical image.
- When a shape is reflected in a mirror line, the original and reflected points will be an equal distance from the mirror line, in opposite directions.



- Shapes can be reflected along the axes of a grid, or along a specified horizontal or vertical line.
- Reflected shapes will be congruent (the same shape and size)

Vocabulary

COORDINATE GRID	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.	**X AXIS**	The horizontal axis (fixed reference line with a scale on a grid).	**Y AXIS**	The vertical axis (fixed reference line with a scale on a grid).
COORDINATE	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.	**TRANSFORMATION**	A change to the size or position of a geometric shape (such as a reflection, translation, rotation or enlargement)	**TRANSLATION**	The movement of a shape from one position to another vertically/horizontally.
REFLECTION	When a shape is 'flipped' in a mirror line, with the reflected points an equal distance from the mirror line in an opposite direction.	**FIRST QUADRANT**	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.	**ORIGIN**	The point where the x and y axis meet.
SECOND QUADRANT	The second of four parts created when an x and y axis cross. The second quadrant contains the negative X axis scale and the positive Y axis scale and is located on the top left of a four quadrant coordinate grid.	**THIRD QUADRANT**	The third of four parts created when an x and y axis cross. The second quadrant contains the negative X axis scale and the negative Y axis scale and is located on the bottom left of a four quadrant coordinate grid.	**FOURTH QUADRANT**	The fourth of four parts created when an x and y axis cross. The second quadrant contains the positive X axis scale and the negative Y axis scale and is located on the bottom right of a four quadrant coordinate grid.

Statistics

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. (Year 4)*
- *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.(Year 4)*
- To interpret means to explain the meaning of.
- An outlier is a piece of data which doesn't seem to fit the pattern observed. This can be a measurement mistake. If you choose to discount an outlier, you need to have a clear reason for why and report this.

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 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 the wide range of charts taught so far.
- To complete, read and interpret information in tables, including timetables.

Children need to know when…

- *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)*
- *to compare sets of data categorical data, to look for key differences.*
- *To compare 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.*
- To use a specific type of chart to present data.

Children need to know why…

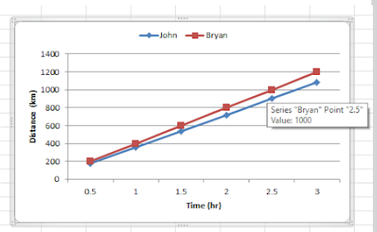
Charts previously learned:
Children need to know that…

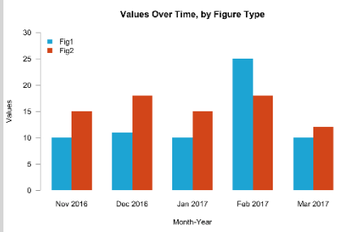
Pictograms (Year 2) *Tally charts (Year 2)* *Time graphs (Year 4)*
Bar charts (Year 3) *Tables (Year 3)*

Line Graphs
Children need to know that…

- Use an X and Y axis to organise variables.
- Often used to show a change in a continuous variable over time or distance.
- The points are joined with straight lines to show the relationship between the variables.
- Sometimes a 'line of best fit' is drawn, which is a smooth line which follows the general pattern of the data points.

Comparative Graphs
Children need to know that…





- Often used to compare the relationships between two variables across different categories (e.g. for girls/boys).
- Can be presented as a bar chart or a line graph (depending on whether the data is continuous or discrete).
- A key is provided to help the reader interpret the graph.

Timetables
Children need to know that…

- A type of table used to show when events are happening.
- Lesson timetables show the patterns of events in a school day over the course of a week.
- Bus timetables show the times at which a vehicle will arrive at specific locations.

- ***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 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**	
	OUTLIER	A data point which is significantly different to the pattern in the rest of the data, which may be a result of measurement error.				
Enrichment & wider development						