Calculation Policy 2023-24

The aim of this policy is to ensure all children leave our school with a secure understanding of the four operations and can confidently use both written and mental calculation strategies in a range of contexts. This policy sets out the progression of strategies and written methods which children will be taught as they develop their understanding of the four operations. Strategies are set out in a concrete, pictorial, abstract approach to develop children's deep understanding and mastery of mathematical concepts. Progression within each area of calculation is in line with the Early Years Framework and the programme of study in the 2014 National Curriculum.

Concrete representation (the 'doing' stage') - a pupil is first introduced to an idea or skill by acting it out with real objects. This is a 'hands on' component using real objects and is a foundation for conceptual understanding.

Pictorial representation (the 'seeing' stage) - a pupil has sufficiently understood the 'hands on' experiences performed and can now relate them to representations, such as a diagram or picture of the problem. This may also include drawing representations to aid calculation.

Abstract representation (the 'symbolic' stage) - a pupil is now capable of representing problems by using mathematical notation, for example 12 x 2 = 24. It is important that conceptual understanding, supported using representation, is secure for all procedures. Reinforcement is achieved by going back and forth between these representations.

The strategies are separated into the 4 operations for ease of reference. However, addition and subtraction, and multiplication and division will be taught together to ensure that children are making connections and seeing relationships in their mathematics. Mastery is for all, and children will be supported to gain depth of understanding within the strategy through the CPA approach and not learn strategies as a procedure.

Mathematical vocabulary

The 2014 National Curriculum places great emphasis on the importance of pupils using the correct mathematical language as a central part of their learning. Children will be unable to articulate their mathematical reasoning if they lack the mathematical vocabulary required to do so. It is therefore, essential that teaching using the strategies outlined in this policy is accompanied by the use of appropriate mathematical vocabulary. New vocabulary should be introduced in a suitable context (for example, with relevant real objects, apparatus, pictures or diagrams) and explained carefully. High expectations of the mathematical language used are essential, with teachers modelling and only accepting what is correct.

End of Year Expectations in Calculation

Foundation Stage	Year 1	Year 2
• have a deep understanding of number to 10, including the composition of each number; • subitise (recognise quantities without counting) up to 5; • automatically recall (without reference to rhymes, counting or other aids) number bonds up to 5 (including subtraction facts) and some number bonds to 10, including double facts. • verbally count beyond 20, recognising the pattern of the counting system; • compare quantities up to 10 in different contexts, recognising when one quantity is greater than, less than or the same as the other quantity; • explore and represent patterns within numbers up to 10, including evens and odds, double facts and how quantities can be distributed equally.	• read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs • represent and use number bonds and related subtraction facts within 20 • add and subtract one-digit and two-digit numbers to 20, including zero • solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = ? – 9. • solve one-step problems involving multiplication and division, by calculating the answer using concrete objects • solve one-step problems involving multiplication and division using pictorial representations and arrays with the support of the teacher	• solve problems with addition and subtraction: using concrete objects and pictorial representations, including those involving numbers, quantities and measures applying their increasing knowledge of mental and written methods • recall and use addition and subtraction facts to 20 fluently • derive and use related facts up to 100 • add and subtract numbers using concrete objects, pictorial representations, and mentally, including: - a two-digit number and ones a two-digit number and tens two two-digit numbers - adding three one-digit numbers • show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot • recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems • recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers • calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs • show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot • solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts

EYFS

In FS1 & FS2 we teach a mathematically rich curriculum that embeds mathematical thinking and talk. It is important that children develop a deep understanding of numbers to 10. Much time is spent on subitising, counting on and back, composition of numbers, sorting and matching, comparing and ordering.

Addition

Children are introduced to the concepts of addition and subtraction through practical games, activities, stories and rhymes.

Combining 2 groups

Children begin to combine 2 groups to find how many altogether. They should be given opportunities to do this in many contexts using real objects.
E.g. There are 3 frogs on the log and 4 in the pool. How many frogs altogether?
Encourage the children to subitise where possible although they may need to count in ones to find how many altogether.

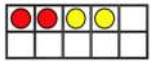
Tell your partner about the flowers. How many purple flowers can you see? How many blue flowers?
How many flowers altogether?

Adding more

The children will use real objects to see that the quantity of a group can be changed by adding more. The first, then, now structure can be used to create mathematical stories in meaningful contexts.
At first, the children may need to re-count all of the items to see how many they have altogether.
E.g. 1, 2, 3, 4... 5, 6, 7 When they are ready, support them to count on E.g. 4... 5, 6, 7
Encourage the children to represent the number stories using 10 frames, number tracks and their fingers.

Use first, then, now to tell simple maths stories to practise adding more in real life contexts.

First there were 2 people on the bus.
Then 2 more people got on the bus.
Now there are 4 people on the bus.



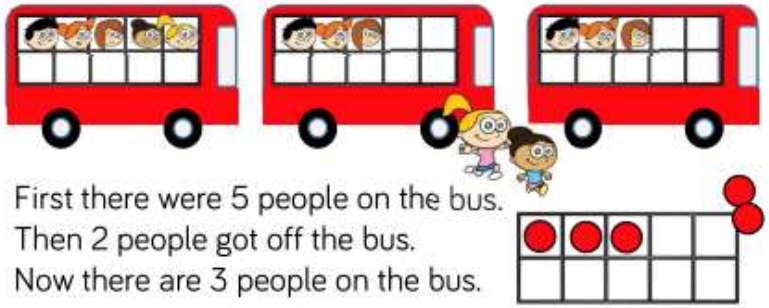
Subtraction

Children are introduced to the concepts of addition and subtraction through practical games, activities, stories and rhymes.

The children use real objects to see that the quantity of a group can be changed by taking items away. The first, then, now structure can again be used to create mathematical stories in meaningful contexts. Encourage the children to count out all of the items at the start, take away the required amount practically, and then subitise or recount to see how many are left.

Continue to encourage the children to represent the number stories using 10 frames, number tracks and their fingers.

Use first, then, now to tell simple maths stories to practise taking away in familiar contexts.

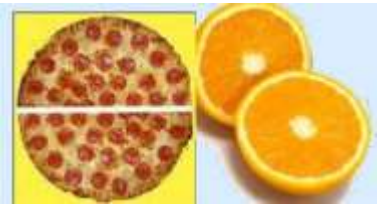


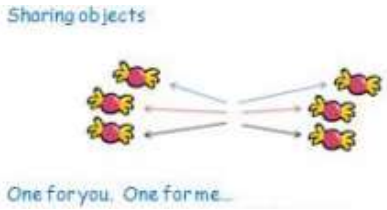
Division (sharing and grouping)

Sharing

The children will probably already have some experience of sharing and will be quick to point out when items are not shared fairly. During snack time or group activities, encourage them to check that the items are shared equally and that everyone has the same. The children should also be given opportunities to recognise and make equal groups. For example can you put 3 crackers on each plate or plant 2 flowers into each pot.
What groups do they notice on a bead string?
The children will notice that sometimes there are items left over when they share or group. Encourage them to come up with their own suggestions for how to resolve this.

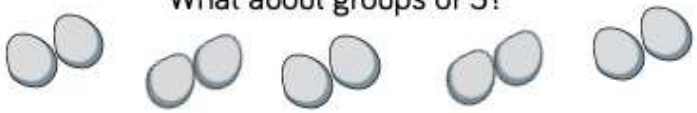
Finding half





Grouping

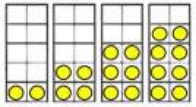
Provide opportunities for children to group objects in different contexts.
Can they give each gingerbread man 3 buttons?
Can they give each child 5 carrot sticks during snack.
Can they arrange their pebbles into groups of 2?
What about groups of 3?



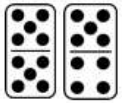
Multiplication

Doubling

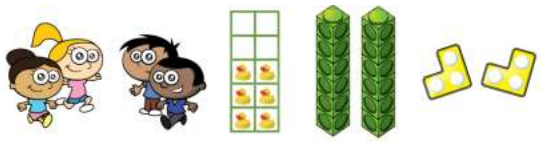
The children will learn that double means 'twice as many'. They should be given opportunities to build doubles using real objects and mathematical equipment. Building numbers using the pair-wise patterns on 10 frames helps the children to see the doubles. Mirrors and barrier games are a fun way for children to see doubles as they build and to explore early symmetry. Encourage children to say the doubles as they build them, e.g. Double 2 is 4
Provide examples of doubles and non-doubles for the children to sort and explain why.



Pair-wise pattern

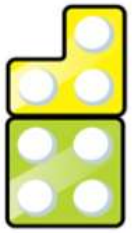
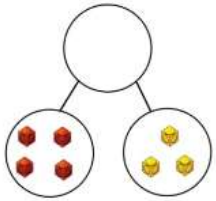
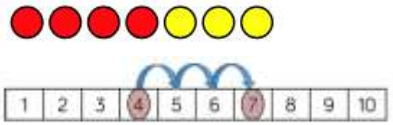
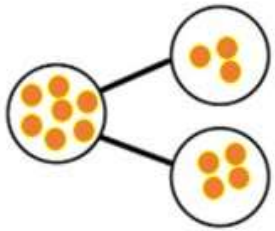
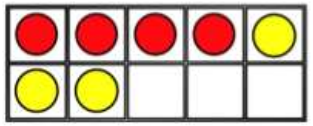
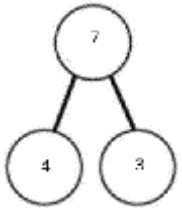
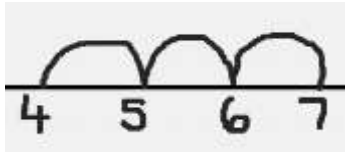


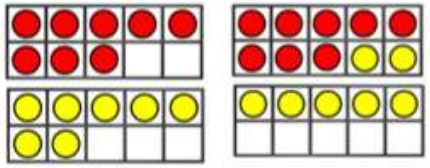
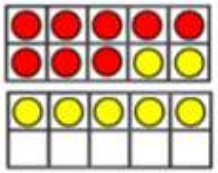
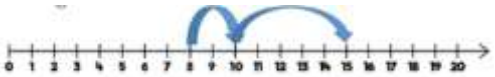
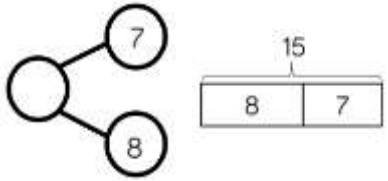
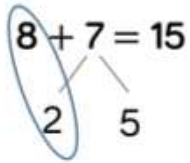
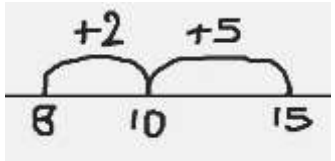
Explore different ways to build/make doubles.

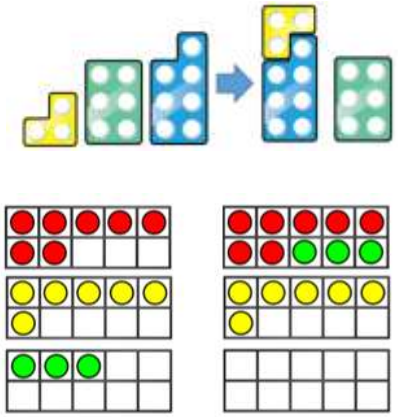
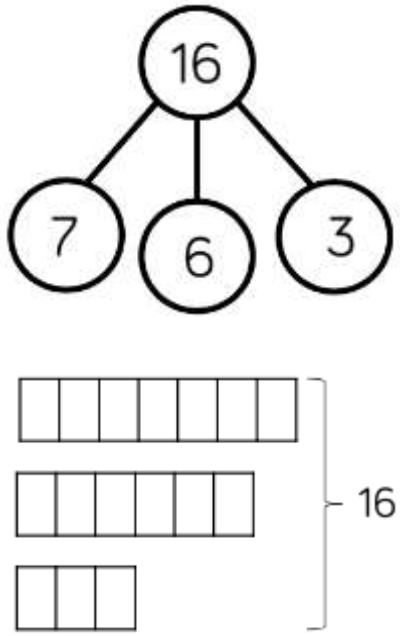


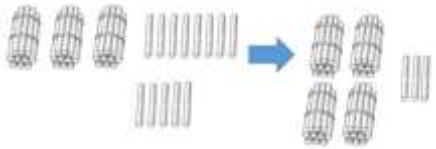
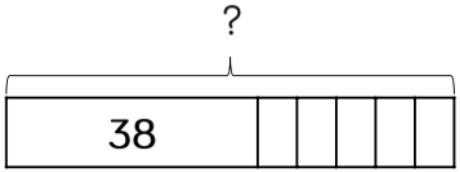
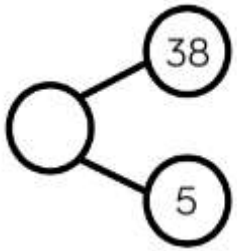
KEY STAGE 1

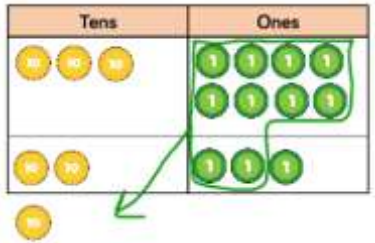
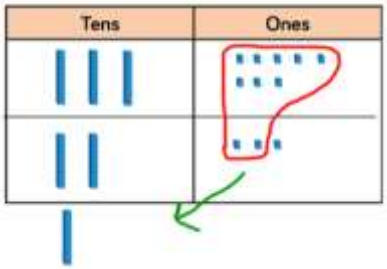
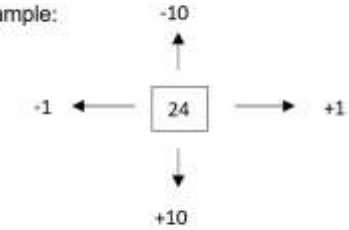
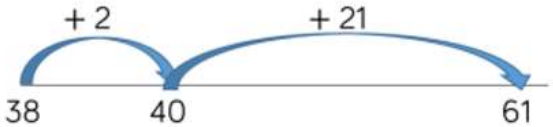
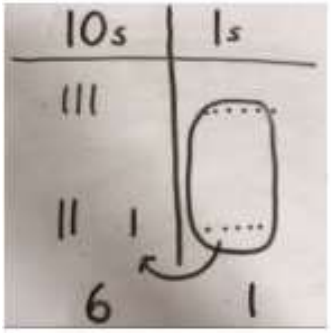
Addition

	Skill		Concrete	Pictorial	Abstract (with written working out as necessary)
YEAR 1	Add 1-digit numbers within 10	When adding numbers to 10, children can explore both aggregation and augmentation. The part-whole model, discrete and continuous bar model, number shapes and ten frame support aggregation. The combination bar model, ten frame, bead string and number track all support augmentation.	  Use cubes or counters on a part whole model to combine two amounts.  Start with the bigger number and count on in ones. 	Start at the bigger number on the number line and count on in ones. Use resources on number line to begin with.  Draw a part whole model or tens frame.  	Use the part-whole diagram to move into the abstract.  4 + 3 = 7 7= 4 + 3 Draw a blank number line. What is 3 more than 4? What is the total of 4 and 3? 

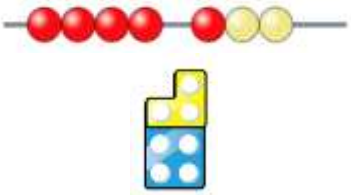
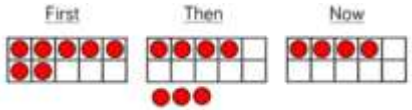
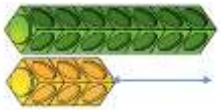
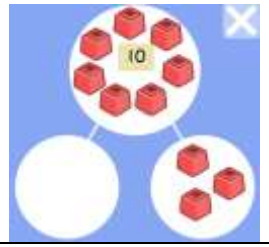
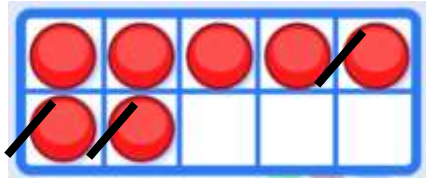
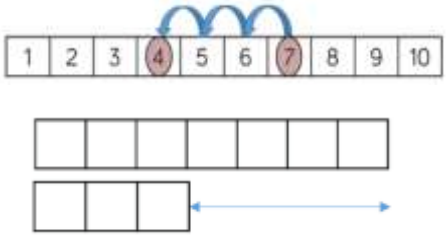
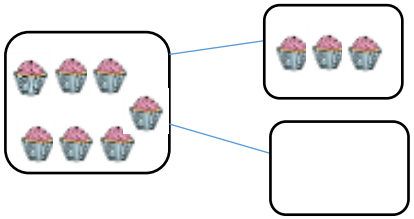
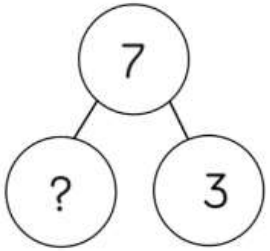
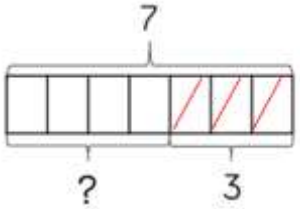
YEAR 1/2	Add 1 and 2-digit numbers to 20	When adding one-digit numbers that cross 10, it is important to highlight the importance of ten ones equalling one ten. Different manipulatives can be used to represent this exchange. Use concrete resources alongside number lines to support children in understanding how to partition their jumps.	Start with the bigger number and use the smaller number to make 10. 	Draw pictures to represent the concrete. Partition the smaller number and combine with the greater number to make ten, then count on.  Start at the bigger number on the number line and count on in ones, progressing to making jump to the next multiple of ten and adding the rest in one jump.  	 8 + 7 = 15 Draw a blank number line. 

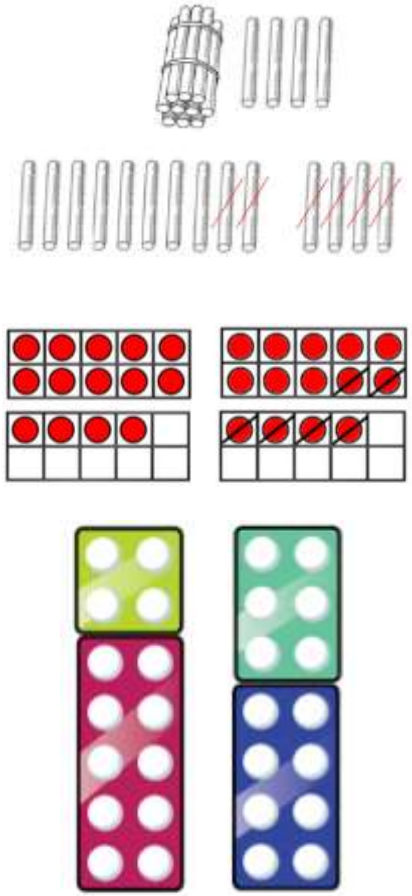
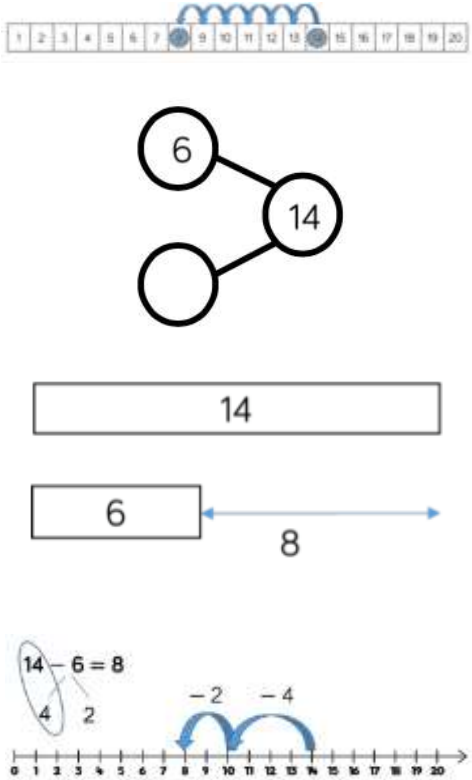
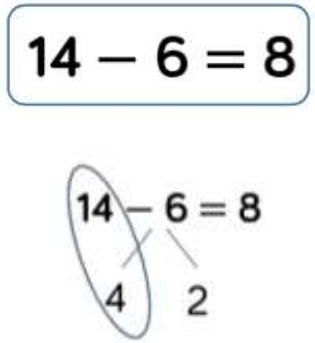
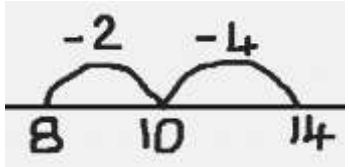
YEAR 2	Add three 1-digit numbers	When adding three 1-digit numbers, children should be encouraged to look for number bonds to 10 or doubles to add the numbers more efficiently. This supports children in their understanding of commutativity. Manipulatives that highlight number bonds to 10 are effective when adding three 1-digit numbers.			$7 + 6 + 3 = 16$ 10 $7 + 6 + 3 = 16$

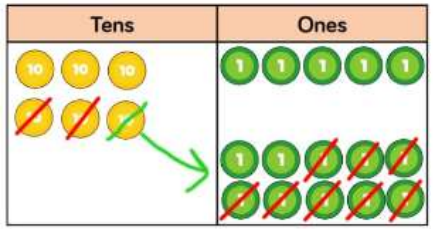
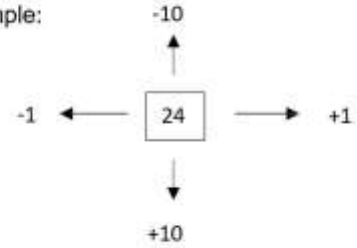
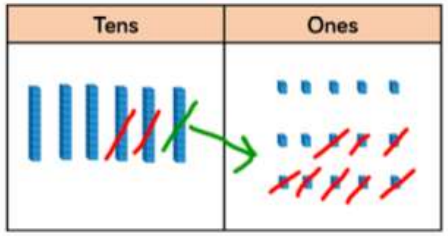
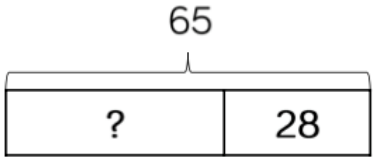
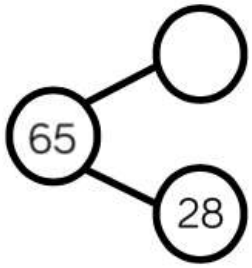
YEAR 2	Add 1 and 2-digit numbers to 100	When adding single digits to a two-digit number, children should be encouraged to count on from the larger number. They should also apply their knowledge of number bonds to add more efficiently e.g. 8 + 5 = 13 so 38 + 5 = 43. Hundred squares and straws can support children to find the number bond to 10.	Use dienes or place value counters to add. Begin with no exchange necessary and progress to exchanging. 	   	**38 + 5 = 43** Draw blank number line to aid working out if necessary, jumping to multiple of 10 to become more efficient.

YEAR 2	Add two 2-digit numbers	At this stage children can use place value charts along with dienes or place value counters as an informal column method. Children can also use a number line to count on to find the total, either adding the tens and then the ones and/or jumping to multiples of 10 to become more efficient. Once secure adding numbers that do not bridge ten, children will then add numbers that require the carrying of tens. Children will add the ones first.	 	<u>100 Square</u> Children will learn to understand the pattern of number on a 100 square. For example:  Children will learn to subtract 1/10 and add 1/10 quickly.  Children can draw a pictoral representation of the base 10 apparatus on a place value grid 36 + 25  Circle the 10 ones and show exchange by adding an extra 10 then combine all the ones and all the tens.	Children who are ready can progress to using numbers in the column method, first adding ones and then tens, recording and tens to be carried underneath the tens column. **38 + 23 = 61** 38 + 23 61 1

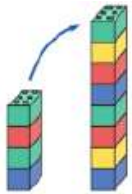
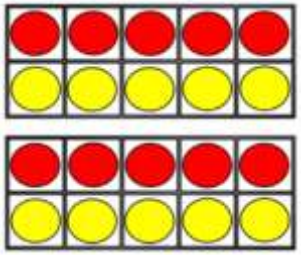
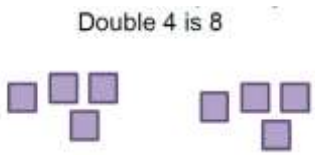
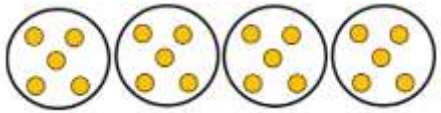
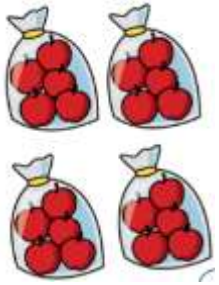
Subtraction

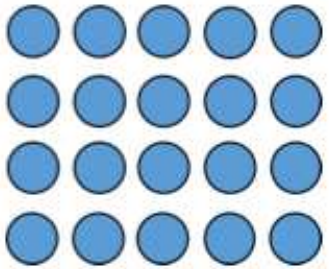
	Skill		Concrete	Pictorial	Abstract (with written working out as necessary)
YEAR 1	Subtract 1-digit numbers within 10	Part-whole models, bar models, ten frames and number shapes support partitioning. Ten frames, number tracks, single bar models and bead strings support reduction. Cubes and bar models with two bars can support finding the difference.	Use physical objects, counters, cubes etc to show how objects can be taken away.  Use tens frames and remove counters  Find the difference between 8 and 5. Use cubes to build towers to find the difference  Link to addition- use the part whole model to help explain the inverse between addition and subtraction.  	Draw representation of concrete and cross out to take away.  Count back on a number line to take away. Explore counting on to find the difference.  Use a pictorial representation of objects to show the part whole model. 	Use the part-whole diagram and bar models to move into the abstract.   Put the number in your head and count back. $7 - 3 = 4$

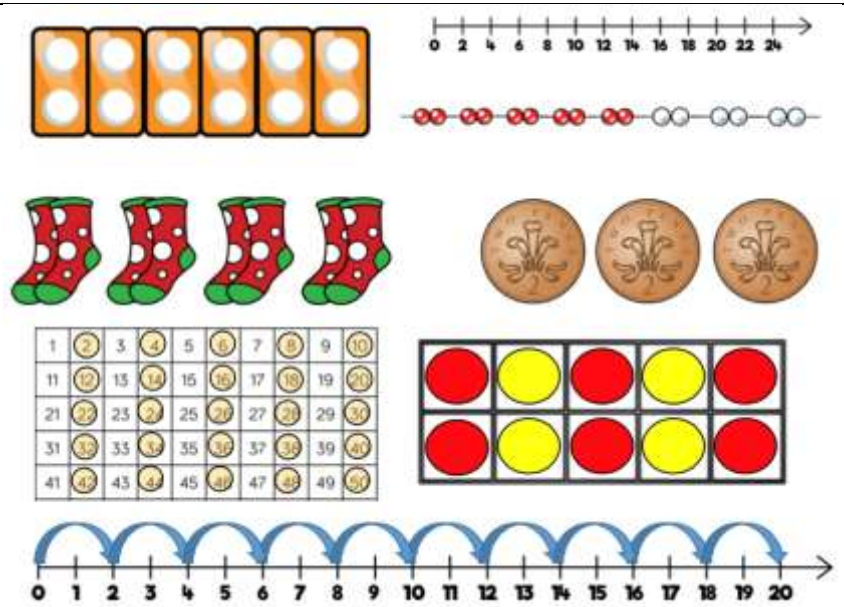
YEAR 1/2	Subtract 1 and 2-digit numbers to 20	When subtracting one-digit numbers that cross 10, it is important to highlight the importance of ten ones equalling one ten. Children should be encouraged to find the number bond to 10 when partitioning the subtracted number. Ten frames, number shapes and number lines are particularly useful for this.			 Draw a blank number line to aid working out if helpful, jumping to 10 to become more efficient. 

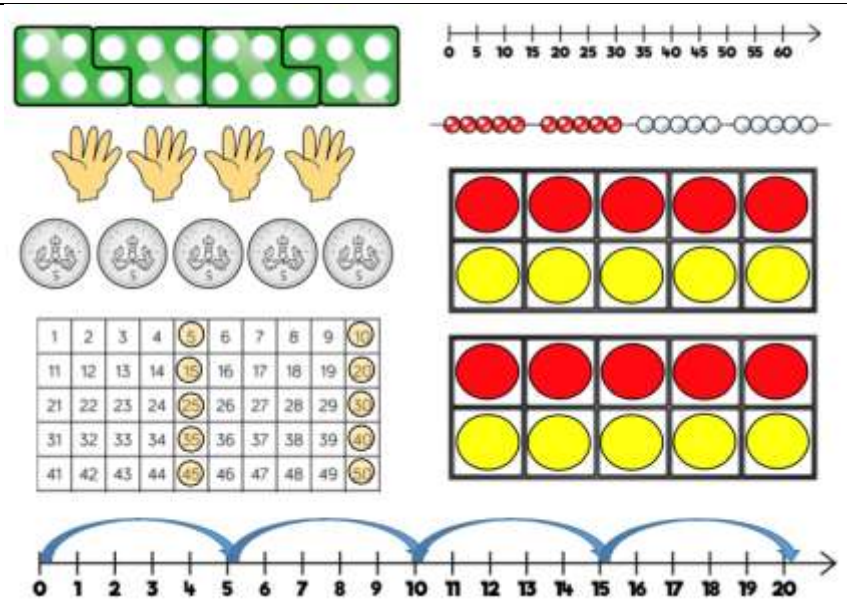
YEAR 2	Subtract 1 and 2-digit numbers to 100	At this stage children can use hundred squares and number lines to count back. T Children use partitioning to take the subtrahend away from the minuend. They then progress onto place value charts with base 10 or place value counters as a precursor to column method.	Use dienes or place value counters to make the minuend, then take the subtrahend away. Teach without regrouping first, then when children are confident, with regrouping.  	100 Square Children will learn to understand the pattern of number on a 100 square and will link this to their addition learning. For example:  Children will learn to subtract 1/10 and add 1/10 quickly. Children draw base 10 or place value counters on a place value chart, showing exchange if necessary.  	65 – 28 = 37 Once secure and if children show a clear understanding and mental recall of subtraction number facts, children will represent steps taken. 65 - 20 = 45 45 - 8 = 37  

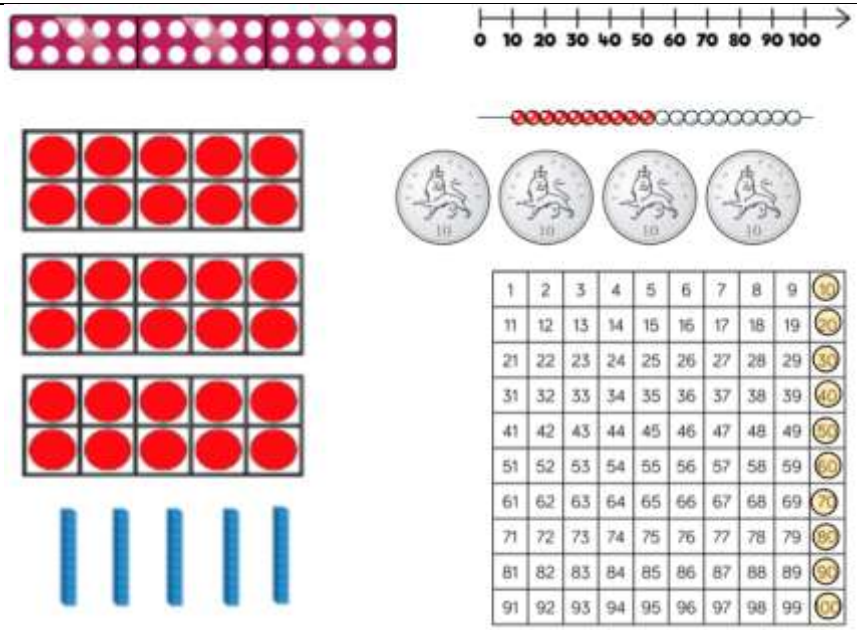
Multiplication

	Skill		Concrete	Pictorial	**Abstract (with written working out as necessary)**
YEAR 1/2	Solve 1-step problems using multiplication	With the support of the teacher, children chant in multiples. The teacher may use a counting stick to support this process. The children learn the 'song' of counting in sets of 2, 5 and 10 (later, 3) and listen to patterns. Children represent multiplication as repeated addition in many different ways. In Year 1, children use concrete and pictorial representations to solve problems. They are not expected to record multiplication formally. In Year 2, children are introduced to the multiplication symbol.	Doubling Practical activities doubling a number – touching fingers on each hand, using objects.  Repeated addition 	Draw pictures to double a number.   	4 = 4 = 8 2 x 4 = 8 One bag holds 5 apples. How many apples do 4 bags hold? 5 + 5 + 5 + 5 = 20

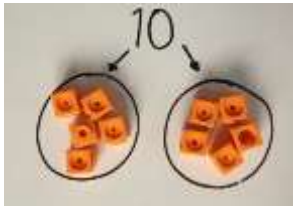
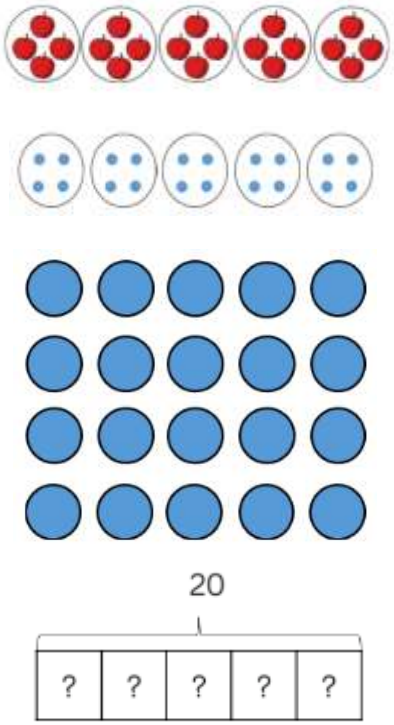
			Arrays (showing commutative multiplication) 		$4 \times 5 = 20$ $5 \times 4 = 20$

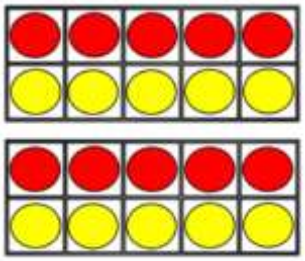
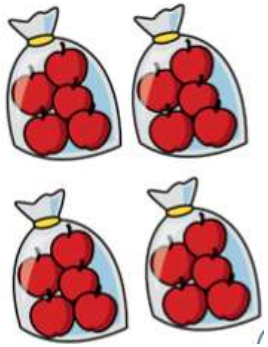
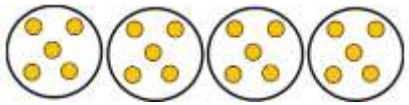
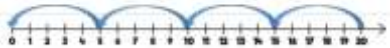
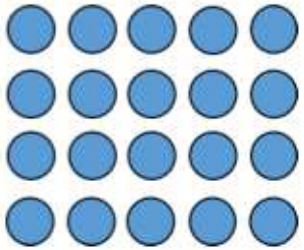
YEAR 2	2 times table	Encourage daily counting in multiples both forwards and backwards. This can be supported using a number line or a hundred square. Look for patterns in the two times table, using concrete manipulatives to support. Notice how all the numbers are even and there is a pattern in the ones. Use different models to develop fluency.		1 x 2 = 2 2 x 2 = 4 and so on

YEAR 2	5 times table	Encourage daily counting in multiples both forwards and backwards. This can be supported using a number line or a hundred square. Look for patterns in the five times table, using concrete manipulatives to support. Notice the pattern in the ones as well as highlighting the odd, even, odd, even pattern.		1 x 5 = 5 2 x 5 = 10 and so on

YEAR 2	10 times table	Encourage daily counting in multiples both forwards and backwards. This can be supported using a number line or a hundred square. Look for patterns in the ten times table, using concrete manipulatives to support. Notice the pattern in the digits- the ones are always 0, and the tens increase by 1 ten each time.		1 x 10 = 10 2 x 10 = 20 and so on

Division

	Skill		Concrete	Pictorial	Abstract (with written working out as necessary)
YEAR 1/2	Solve 1-step problems with division (sharing)	Children solve problems by sharing amounts into equal groups. In Year 1, children use concrete and pictorial representations to solve problems. They are not expected to record division formally. In Year 2, children are introduced to the division symbol.	 		There are 20 apples altogether. They are shared equally between 5 bags. How many apples are in each bag? $20 \div 5 = 4$

YEAR 1/2	Solve 1-step problems with division (grouping)	Children solve problems by grouping and counting the number of groups. Grouping encourages children to count in multiples and links to repeated subtraction on a number line. They can use concrete representations in fixed groups such as number shapes which helps to show the link between multiplication and division.	  	   	There are 20 apples altogether. They are put in bags of 5. How many bags are there? $20 \div 5 = 4$ Children would be encouraged to count in multiples of 5 until they reach 20. 5, 10, 15, 20 1 2 3 4 How many times did we count in 5? 4 times.

Glossary

Addend - A number to be added to another.

Aggregation - combining two or more quantities or measures to find a total.

Augmentation - increasing a quantity or measure by another quantity.

Commutative – numbers can be added in any order.

Difference – the numerical difference between two numbers is found by comparing the quantity in each group.

Exchange – Change a number or expression for another of an equal value.

Minuend – A quantity or number from which another is subtracted.

Partitioning – Splitting a number into its component parts.

Reduction – Subtraction as take away.

Subitise – Instantly recognise the number of objects in a small group without needing to count.

Subtrahend - A number to be subtracted from another.

Sum - The result of an addition.

Total – The aggregate or the sum found by addition.