"Let your Light shine" - Matthew 5:16

The Polehampton C. of E. Schools

Infant School Calculations Policy

Review Period – As required

Document History – Approved at the … Committee

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1	Jan 2015	First Joint policy	26
2	2.9.22	Updated infant version	17

"Let your light shine" Matthew 5:16

These words of Jesus are at the heart of our school's vision. They inspire and motivate our whole school community. Jesus reminded us in Matthew's gospel that we are lights for the world. As we seek to follow him, we share his light with others and change the world!

In this policy, we "let our light shine" by ensuring calculations are taught in a clear way so children develop a secure understanding of concepts to support their mathematical development.

Mastery

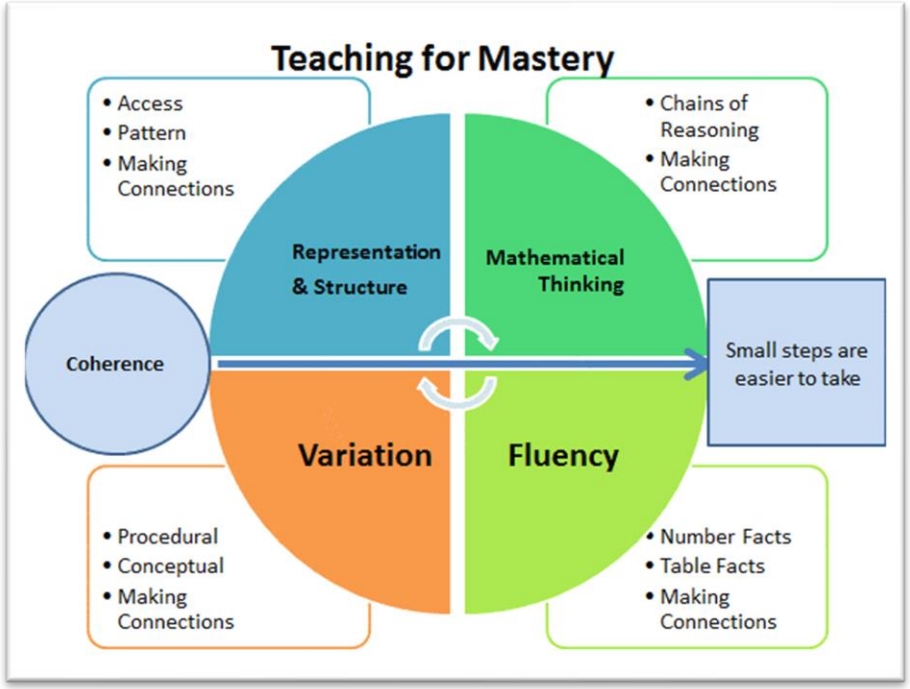
Maths mastery is a teaching and learning approach that aims for pupils to develop deep understanding of maths rather than being able to memorise key procedures or rote learning.

The end goal and expectation is for all pupils to have acquired the fundamental facts and concepts of maths for their year or key stage such that by the end of it they have achieved mastery in the maths they have been taught. At this point they are ready to move confidently on to their next stage of maths.

Mastery of a mathematical concept means a child can use their knowledge of the concept to solve unfamiliar word problems, and undertake complex reasoning, using the appropriate mathematical vocabulary.

Maths mastery is a not a quick fix to maths learning but a journey that the teacher and pupils go on together, with regular diagnostic assessment to check the pupils understanding and direct instruction that teaches to any gaps.

- Teaching for Mastery includes:
- Coherence
- Representation and Structure
- Mathematical Thinking
- Fluency
- Variation



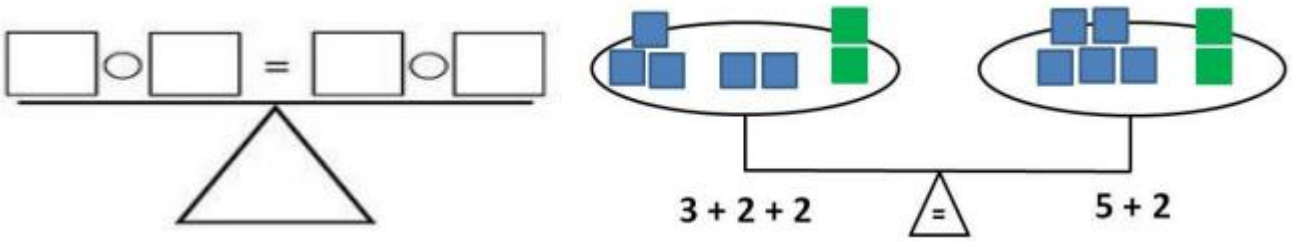
source: NCETM

Teaching equality

It is important that when teaching the 4 operations that equality (=) is also taught appropriately.

Misconceptions that = means that children must 'do something' and that it indicates that an answer is needed are common and must be addressed early on. Teachers will present children with number sentences and problems which place the = sign in different positions, different context and include missing box problems . For example, ?+4=7; 7=3+?; , or = 5+6__ 7+4.

In the concrete phase, scales and Numicon provide a useful resource to demonstrate equality. Pictorial representations of equality can be used as shown below:



Importance of 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 will 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. For example:

✓	✗
ones	units
is equal to	equals
zero	oh (the letter O)
number sentence	sum/s

We use stem sentences to show the children how to use accurate mathematical vocabulary in a highly structured sentence. This provides pupils with a way to communicate their ideas with mathematical precision as well as clarity. For example:

I can partition _____ into ____tens and _____ones.

If ___ is a factor then I can use the ____ times table.

This is the same because_____

This is different because _____.

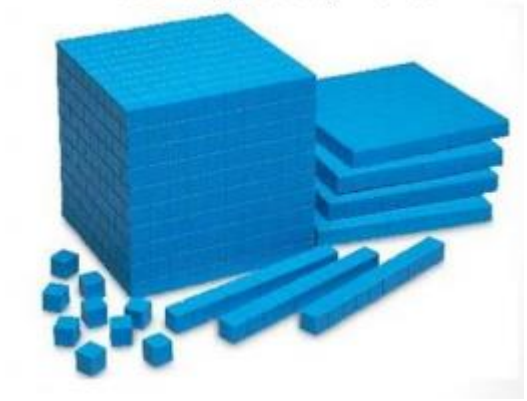
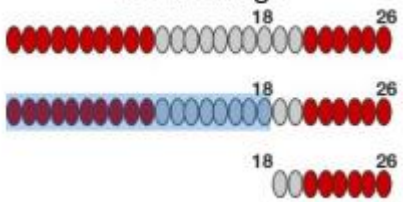
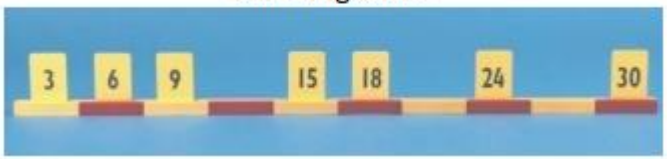
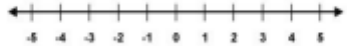
CPA approach

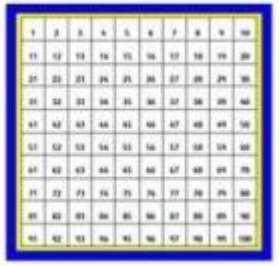
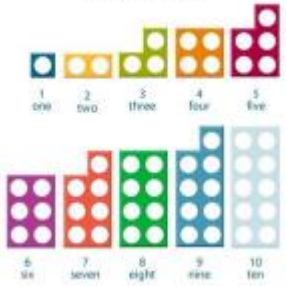
The Concrete Pictorial Abstract approach is a system of learning that uses physical and visual aids to build a child's understanding of abstract topics. Pupils are introduced to a new mathematical concept through the use of concrete resources (e.g. fruit, Dienes blocks, counters etc) and 'make it'. When they are confident with this, they can then represent their work through pictures ('draw it') and then finally 'write it' using numbers and symbols (abstract). We encourage the use of this by using make it, draw it, write it mats and grids in lessons, where the children make it using concrete manipulatives, draw it with representations and then write it using numbers.

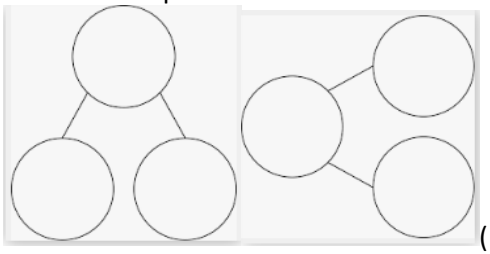
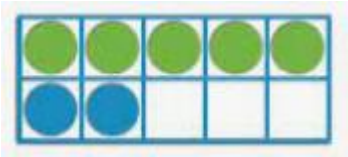
Make it	Draw it	Write it

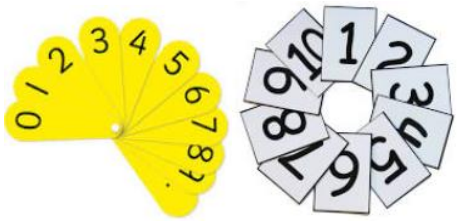
Manipulatives and representations

It is important that pupils are familiar with using many different manipulatives and representations to ensure their understanding is deep and they can transfer skills between the different representations. Children have access to Maths boxes on their tables during each Maths lesson. These boxes contain a variety of manipulatives which the children can independently select to support their learning. Below are some of the manipulatives and representations that they may use at Polehampton:

<table>
<tr>
<td>Base 10 apparatus/Dienes
  </td>
<td>Bead Strings
 
</td>
<td>Counters
  </td>
</tr>
<tr>
<td>Counting Sticks
 
</td>
<td>Cubes
  </td>
<td>Number Lines (+ blank number lines)
  </td>
</tr>
</table>

Hundred squares 	Numicon 	Dice 

Compare bears 	Arrow cards 	Part part whole models  (These can be any orientation and contain more than 2 parts)
Tens frame 	Place Value charts 	Arrays 

Rekenrek Counting Frame	Coins	Number cards
		

End of Year Expectations for calculations

EYFS	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: o a two-digit number and ones o a two-digit number and tens o two two-digit numbers o 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

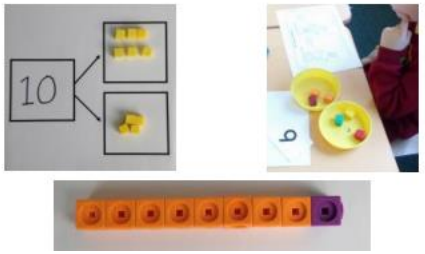
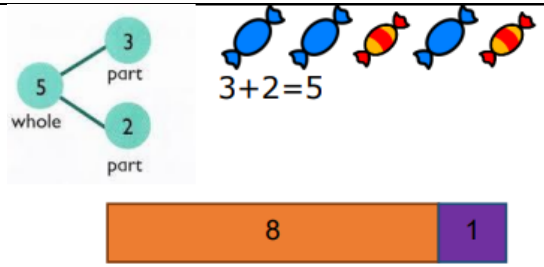
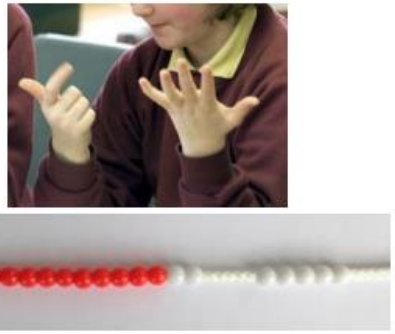
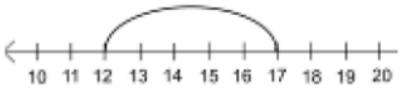
		tables, including recognising odd and even numbers • calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs • show that multiplication of two numbers can be done in any order (commutative) 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

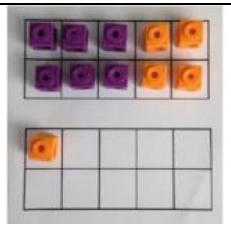
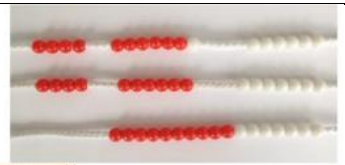
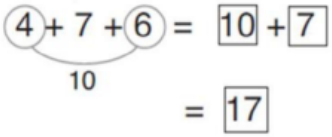
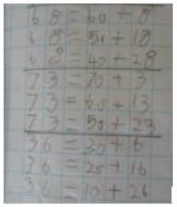
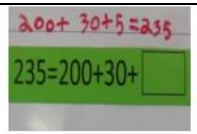
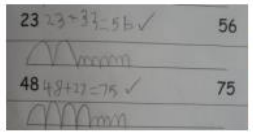
Progression in calculations

Subitising

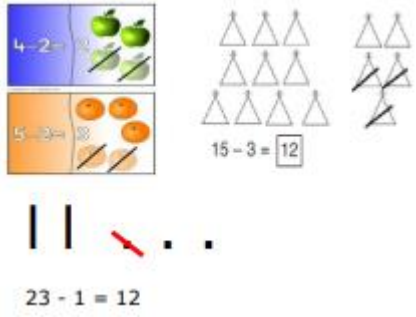
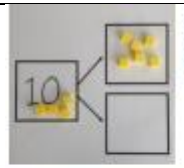
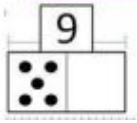
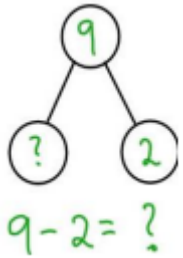
Subitising is the ability to instantly recall the number of objects or images without needing to count them individually and it is an important skill to practise and develop. Children will regularly practise subitising.

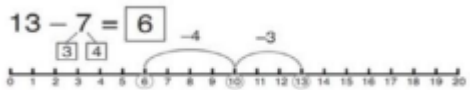
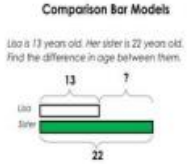
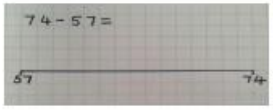
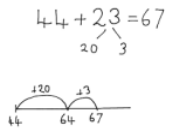
Addition

Strategies	Concrete (Make it)	Pictorial (Draw it)	Abstract (Write it)
Combining 2 groups to make a whole Counting sets of objects, combining then recounting using a 1:1 correspondence.			4 + 3 = 7 I have 4 apples and I pick 3 more, how many have I got altogether?
Counting on Pupils should be taught to start at the biggest number and count on, using this as an opportunity to Introduce the commutativity of addition.			5 + 12 = 17 Reinforce starting from the largest number. 7 + 3 = 10 Encourage recall of known number facts to develop fluency in mental calculations.

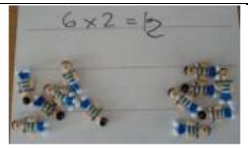
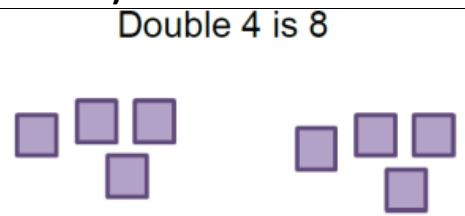
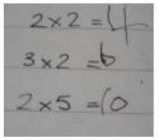
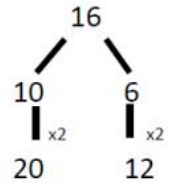
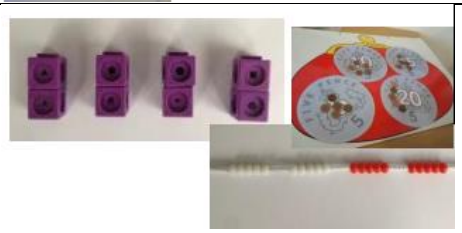
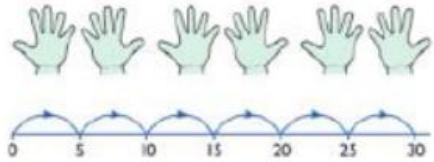
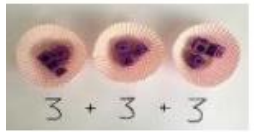
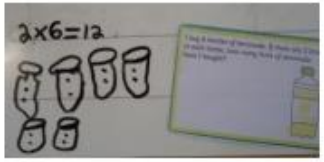
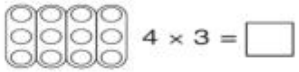
Regrouping to make 10 To move on from the previous strategy, rather than counting on, children use their number bond knowledge and bridge to 10 e.g. if 4 + 6 = 10, so 4 + 7 must equal 11.	 6+5=11 Start with the bigger number and use the smaller number to make 10.	 3 + 9 = 9 + 5 = 14 1 4 +1 +4 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	7p+4p=11p I have 7p, how much more do I need to make 10p. How much more do I add on now? If you know
Adding 3 single digits Use this method as an opportunity to develop fluent recall and application of known number facts including bonds and doubles.	  Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit.	 6 + 3 + 4 = 13	 4 + 7 + 6 = 10 + 7 10 = 17
Partitioning to add The emphasis for this strategy in KS1 is to develop a deep understanding of place value . In year 2, recording addition and subtraction informally in columns supports place value and prepares for formal written methods with larger numbers later on in KS2 . Ensure that when moving into any form of column the ones are calculated first.	 400 +30+6=436 4 3 6  22+17=39	 +10 +7 22 32 39 22+17=39  Begin with jumps of tens and ones then progress to jumps of all the tens and all the ones as children become more fluent. 44 + 23 = 67 20 3 +20 +3 44 64 67	  200+ 30+5=235 235=200+30+ 25+48=73 Informal recording in columns 20 + 5 40 + 8 60 + 13 = 73  23 56 48 75 Counting on in tens and ones to solve missing number problems

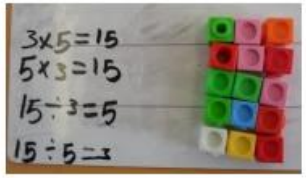
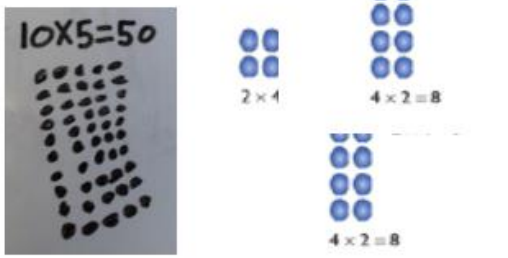
Subtraction

Strategies	Concrete (Make it)	Pictorial (Draw it)	Abstract (Write it)
Taking away ones Use physical objects to demonstrate how something can be taken away. Move on to crossing out drawn representations. This can be developed by representing a group of ten with a line and ones as dots.			18 -3= 15 8 – 2 = 6 There are 15 cakes in the shop. One cake is eaten, how many are left.
Counting back As with the previous, this strategy is used for subtracting small numbers from larger numbers and provides a good foundation for the concept of subtraction	 Use counters or objects and move away from the group as they are counted.	 13-4=9	Put 17 in your head, count back 5. What number are you at? Use your fingers to help.
Part, part, whole model This model develops knowledge of the inverse relationship between addition and subtraction and is used to find the answer to missing number problems.	 If 10 is the whole and 6 is one of the parts. What is the other part? 	  Children should be taught the skills to approach problems in a systematic way.	 I made 9 buns for the cake sale and I only had 2 left at the end. How many did I sell?

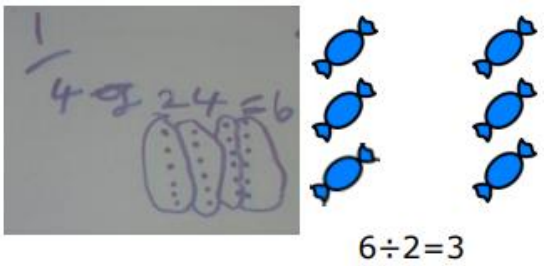
Make 10 Use this strategy to subtract a single digit number from a 2-digit number. Pupils identify how many need to be taken away to make ten first. Then they take away the rest to reach the answer.	 14-5=9 Make 14 on the ten frame or with different coloured cubes to represent the ten and the ones. Take away the four first to make 10 and then takeaway one more so you have taken away 5. You are left with the answer of 9.		15 – 7= How many do we subtract to reach the next 10? How many do we have left to subtract?
Find the difference Pupils should develop a good understanding of the meaning of 'difference', exploring the inverse relationship with addition by counting back and counting up	 Practical resources to visualise 'difference' and recognise inverse relationships e.g. 12-1=11 and 11+1=12 	  Use a blank number line to count back and count up between 2 numbers.	Lexie has 5 more strawberries than Jake. Jake has 11 cherries. How many does Lexie have? Look at the graph. Fewer children have green eyes than blue. What is the difference?
Partitioning to subtract The emphasis for this strategy in KS1 is to develop a deep understanding of place value. When not regrouping, partitioning should be developed as a mental strategy rather than formal recording in columns	  22+17=39	 22+17=39  Begin with jumps of tens and ones then progress to jumps of all the tens and all the ones as children become more fluent. 	There are 35 children in the class and 12 are boys. How many are girls? 35-12=

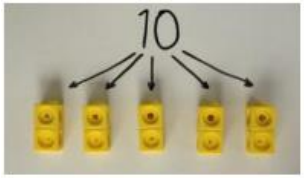
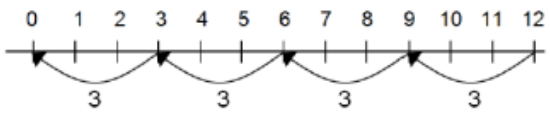
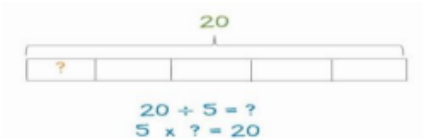
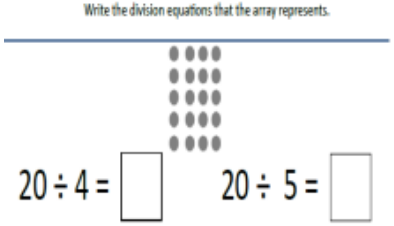
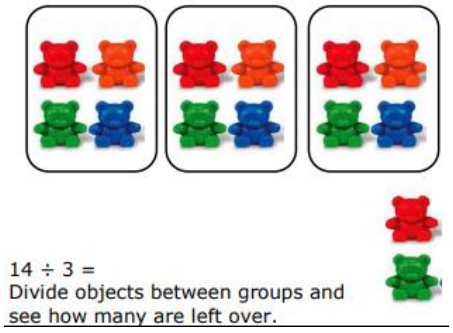
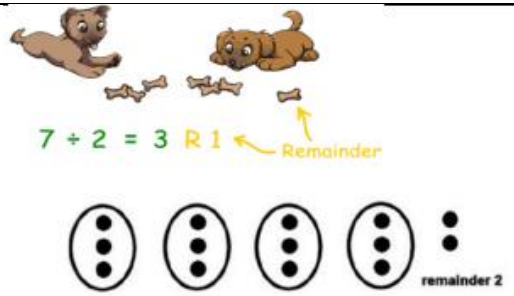
Multiplication

Strategies	Concrete (Make it)	Pictorial (Draw it)	Abstract (Write it)
Doubling Pupils should be encouraged to develop fluent mental recall of doubles and relate to the 2 x table.	  		  If I can see 10 wheels, how many bikes are there?
Counting in multiples Pupils can use their fingers as they are skip counting, to develop an understanding of 'groups of'. Children should become increasingly fluent as they practise.		Use a number line or pictures to continue support in counting in multiples. 	Count in multiples of a number aloud. Write sequences with multiples of numbers and work out missing numbers in sequences both forward and backward. If I count in 2's will I get to the number 38?
Repeated addition Pupils should apply skip counting to help find the totals of repeated additions.	 5+5+5=15  3+3+3=9	 Pupils begin to recognise the relationship between repeated addition and multiplication.  	Write addition or multiplication sentences to describe objects and pictures.  2+2+2+2+2=10 2x5=10

Arrays showing commutative multiplication Pupils should understand that an can represent different equations and that, as multiplication is commutative, the order of the multiplication does not affect the answer.	 	Draw arrays in different rotations to find **commutative** multiplication sentences. 	3 children go to the park to hunt for plne cones. They find 5 each, how many do they find altogether? 5 children eat the same number of cakes at a party. 15 cakes are eaten in total, how many did they each eat? 5+5+5=15 3x5=15 3+3+3+3+3=15 5 x 3 = 15

Division

Strategies	Concrete (Make it)	Pictorial (Draw it)	Abstract (Write it)
Sharing Here, division is shown as sharing. E.g. If we have 24 squares of chocolate and we share them between 3 people, each person will have 8 squares each.	 		Share 9 buns between three people. 9 ÷ 3 = 3 Can you make up your own 'sharing' story and record a matching equation?

Division as grouping Here, division is shown as grouping. If we have ten cubes and put them into groups of two, there are 5 groups. This is a good opportunity to demonstrate and reinforce the inverse relationship with multiplication.	 Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding	Show jumps in groups. The number of jumps equals the number of groups.   Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group.	28 ÷ 7 = 4 Divide 28 into 7 groups. How many are in each group? Max is filling party bags with sweets. He has 20 sweets altogether and decides to put 5 in every bag. How many bags can he fill?
Division within arrays Use arrays of concrete manipulatives and images of familiar objects to find division equations. Begin to use dot arrays to develop a more abstract concept of division.		 Children can draw lines to divide their array	Find the inverse of multiplication and division sentences by creating four linking number sentences. 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7
Division with a remainder This strategy provides an opportunity to reinforce prior learning of odd and even and 'multiples' when exploring how numbers can and cannot be divided into different whole numbers.			Complete written divisions and show the remainder using r.