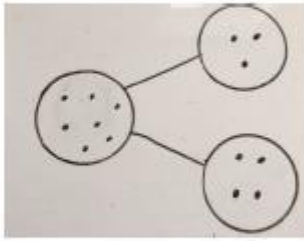
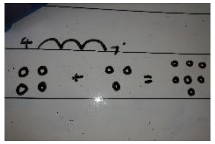
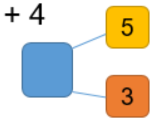
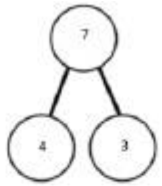
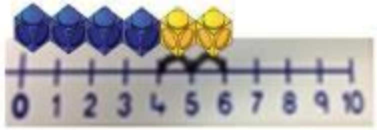
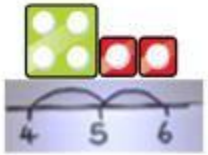
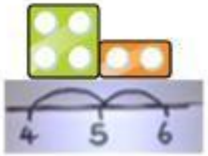
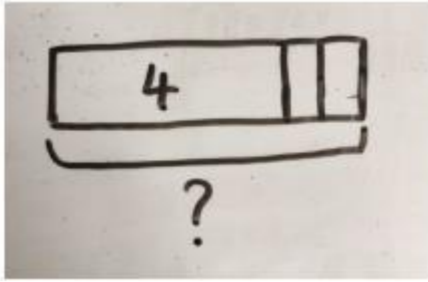
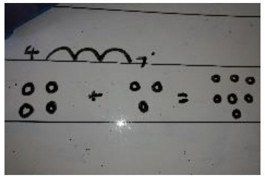
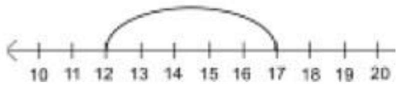
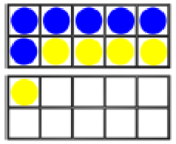
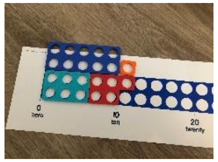
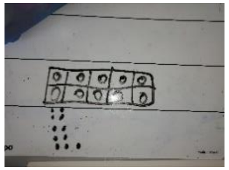
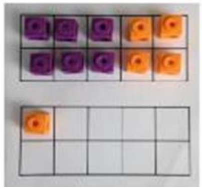
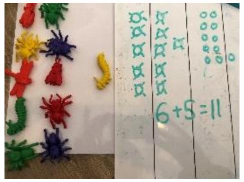
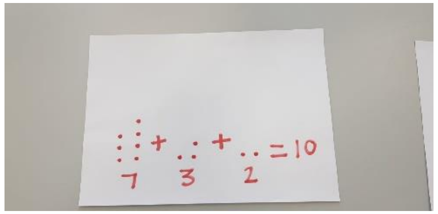
Bridgelea Primary School Calculation Policy

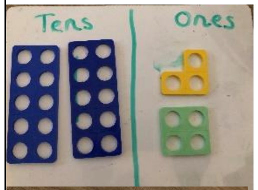
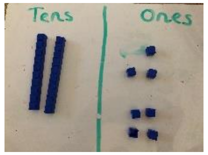
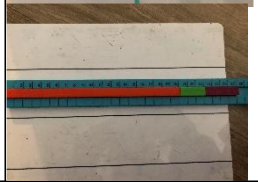
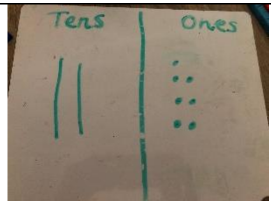
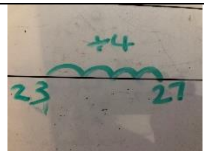
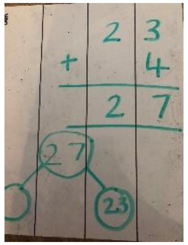
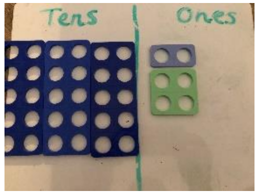
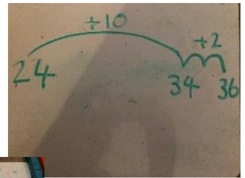
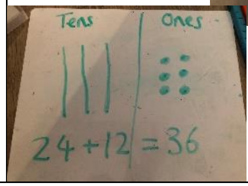
This calculation policy has been written to reflect the Concrete, Pictorial, Abstract (CPA) approach to teaching and learning in primary mathematics, this is captured in the Numicon Teaching Handbooks, the Long Term Plans and Bridgelea Maths Curriculum documentation. Wherever possible, children are taught to work with concrete resources alongside pictorial methods. In all lessons there should be examples of CPA embedded throughout for children to have experiences of working across all three.

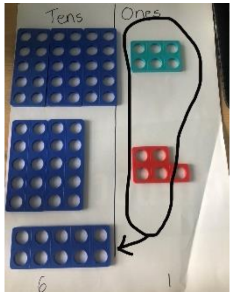
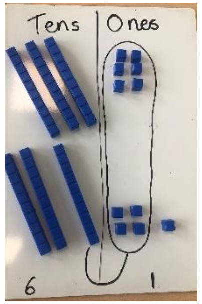
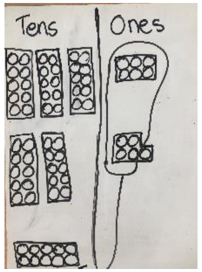
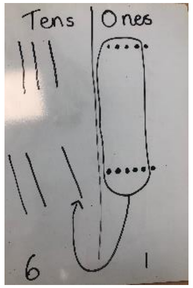
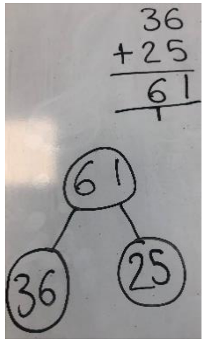
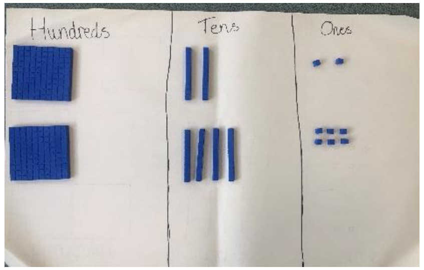
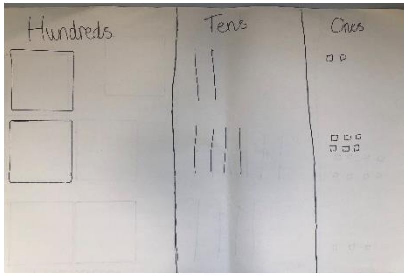
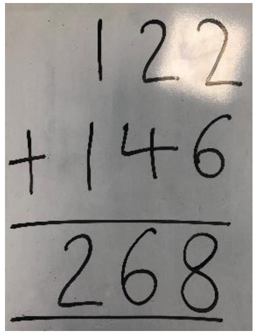
Addition methods

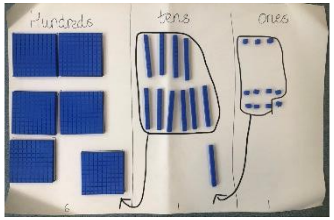
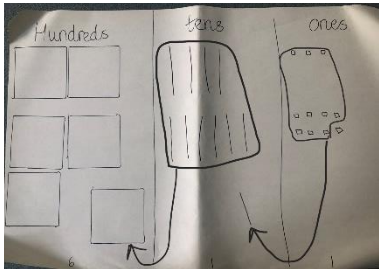
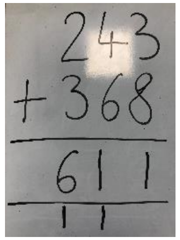
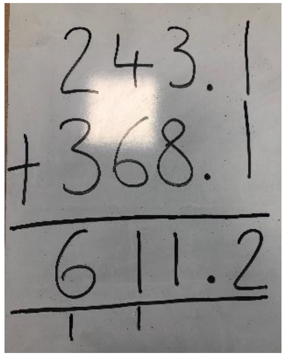
Objective	Concrete	Pictorial	Abstract
Combining two parts to make a whole Part whole model	  	Represent the cubes using dots.  	4+3=7 Four and 3 are parts and the whole is seven. 4 + 3 = 7 10= 6 + 4   Use the part-part whole diagram as shown above to move into the abstract.

Starting at the bigger number and counting on	Counting on using number lines using concrete resources.    Cuisenaire rods 	A bar model to encourage counting on rather than counting all.  Blank number lines 	Start at the bigger number and count on in ones or in one jump to find the answer. 12 + 5 = 17  The abstract number line: What is 2 more than 4? What is the sum of 2 and 4? What is the total of 4 and 2? 4 + 2 
Regrouping to make 10	Ten frames  		Develop an understanding of equality. For example… $6 + \square = 11$ $6 + 5 = 5 + \square$ $6 + 5 = \square + 4$

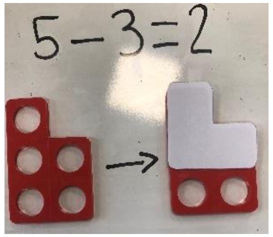
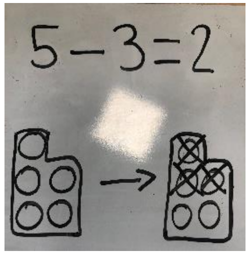
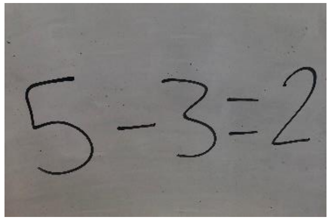
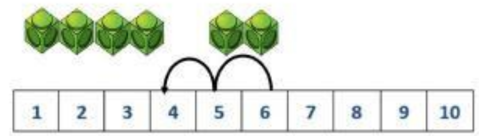
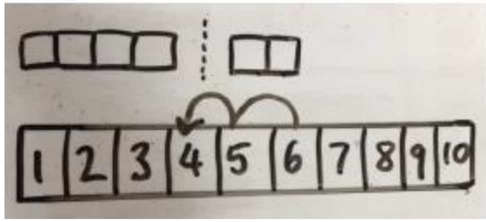
	Start with the largest number and use the smaller number to make 10.   Use  coins throughout	Use pictures of objects and regroup or partition the smaller number to make up 10. 	6 + 5 = 11 If I start at six, how many more do I need to make 10? How many more do I add on now? An apple is 6 pence and a banana is 5p. How much money do I need to buy an apple and a banana?
Adding three single digits	6 + 1 + 4= Following on from making 10, make 10 with two of the digits if possible. Next, add the remaining digit. 	Draw pictures to represent the three groups of objects to be added. Draw a final picture to show the groups combined to create a total. 	Look for pairs of numbers that make 10 (if possible) and then add the remaining digit. $\underbrace{4 + 7 + 6}_{10} = \boxed{10} + \boxed{7}$ $= \boxed{17}$

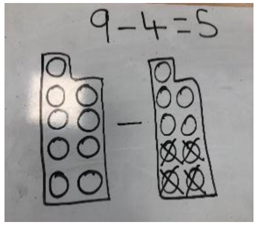
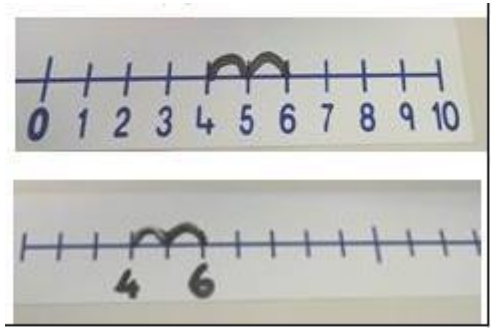
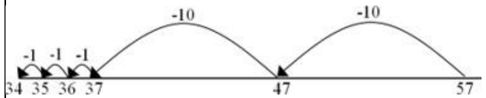
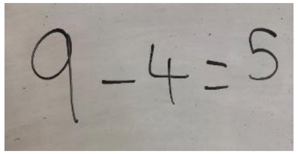
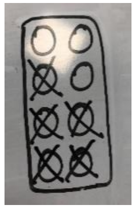
Adding tens/ones to ones	Continue to develop the understanding of partitioning and place value. 23+5=	Pictorially represent the base 10 or other concrete resources e.g lines for tens and dots for ones.	41+8 1+8 = 9 40+9=49
			
Adding tens/ones to tens/ones Column method - no regrouping	24+12 = Add together the ones **first** and then add the tens. Use base 10 blocks, rods and shapes. Use coins to enhance. 	Once secure with concrete resources and moving equipment practically, draw images to solve additions. 	Written methods e.g. 24 + 12 = 24 + 12 ____ ____ Draw number lines, part-whole models, bar model etc.

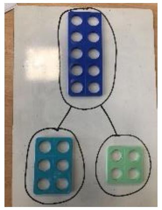
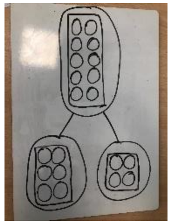
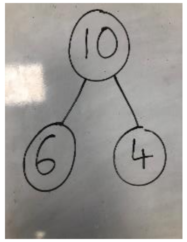
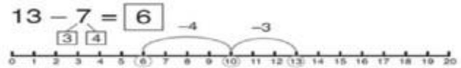
Adding tens/ones to tens/ones Column method – regrouping	Continue to develop the understanding of partitioning and place value. 36+25  	Represent the base 10 in a place value chart.  	Look for ways to make 10.  36 + 25= 1 5 30 + 20 = 50 5 + 5 = 10 50 + 10 + 1 = 61 Formal method: 36 +25 61 1
	122+146 		Formal methods: 

Adding hundreds/tens/o nes to tens/ones Or hundreds/tens/o nes to hundreds/tens/o nes etc Column method – regrouping	When there are 10 ones in the ones column, we exchange for 1 ten. When there are 10 tens in the tens column, we exchange for 1 hundred.  Make both numbers on a place value grid.	Children represent the counters in a place value chart, circling when they make an exchange. 	Formal methods:  You may start by partitioning the numbers before moving on to clearly show the exchange below the addition.
	243.1 +368.1		Formal methods: 

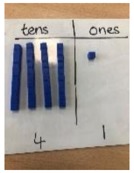
Subtraction

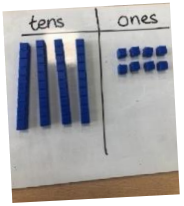
Objective	Concrete	Pictorial	Abstract
Taking away and removing objects from a whole	Use physical objects to show how obects can be taken away. Ten frames, Numicon, cubes, counters, beanbags etc could be used.  	Draw the concrete resources or objects they are using and cross out the correct amount. The bar model can also be used.  	
Counting back	Using numberlines or tracks. 6 - 2 = 4  	Represent what they see pictorially.  	Represent the calculation on a number line or track and show jumps. Encourage to use an empty number line.

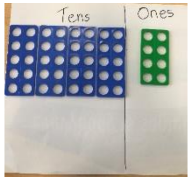
	Use counters and move them away from the group as you take them away, counting backwards as you go.   	 	 This can progress to counting back using 2 digit numbers.  
Finding the difference	Use any concrete resources such as Numicon, cubes, Cuisenaire rods or other objects. Calculate the difference between 8 and 5. 	Draw the cubes or other resources used or use the bar model to illustrate what they need to calculate. 	Find the difference between 8 and 5. 8 – 5, the difference is $\boxed{}$

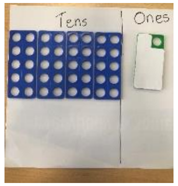
Part part whole model	Link to adition – use the part whole model to help explain the inverse between addition and subtraction. 	Use a pictorial representation of objects to show the part part whole model. 	Move to using numbers within the part part whole model.   Start at 13. Take away 3 to reach 10. Then take away the remaining 4 so you have taken away 7 altogether. You have reached your answer.

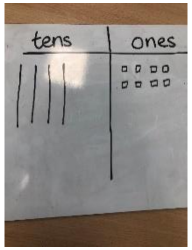
<table>
<tr>
<td>Column method – no regrouping</td>
<td>Using Base 10
48 – 7

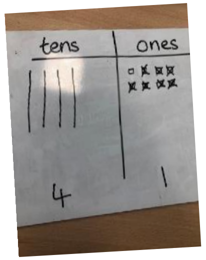
Use Base 10 or place value counters to make the bigger number and then take the smaller number away.


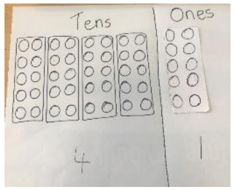


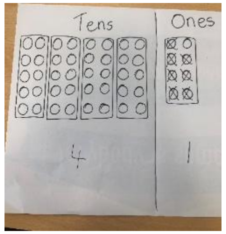




</td>
<td>Represent method pictorially.


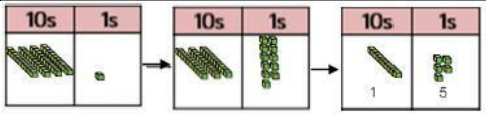
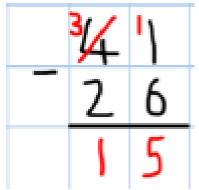




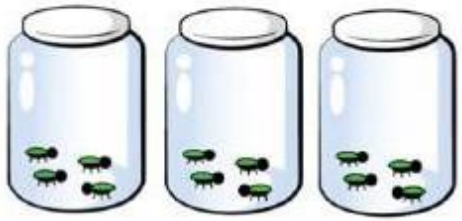
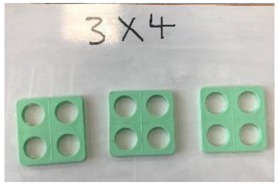
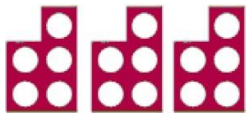
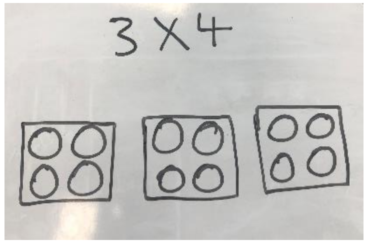
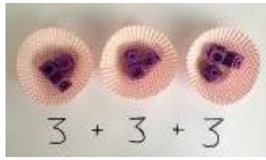


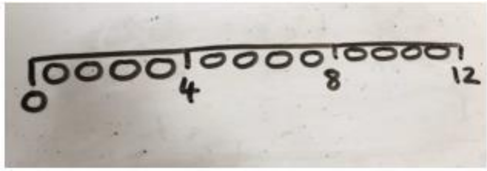
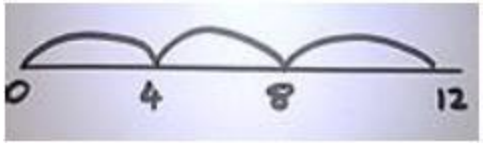
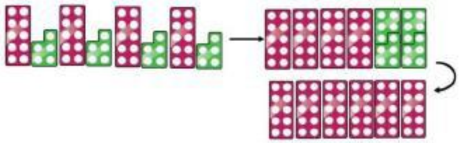
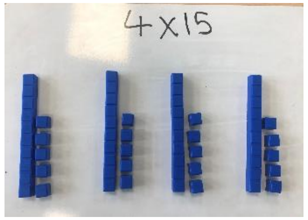
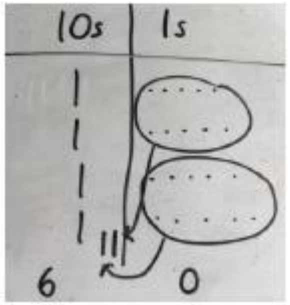
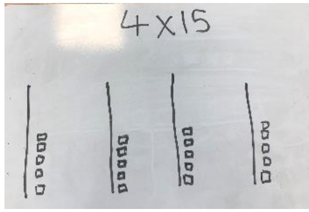
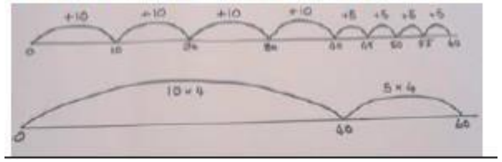
</td>
<td>Column method or counting back.
$$\begin{array}{rr} & 4\ 8 \\ - & 7 \\ \hline & 4\ 1 \end{array}$$
$47 - 24 = 23$
$$\begin{array}{r} 40 + 7 \\ -\ 20 + 4 \\ \hline 20 + 3 \end{array}$$
</td>
</tr>
<tr>
<td>Column method - regrouping</td>
<td>Using Base 10 and having to exchange.

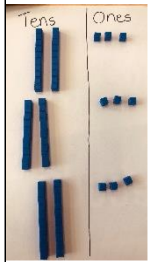
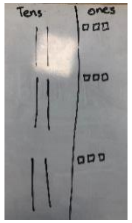
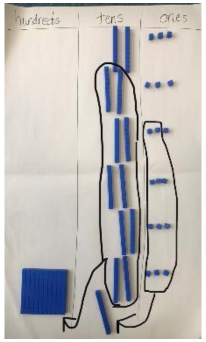
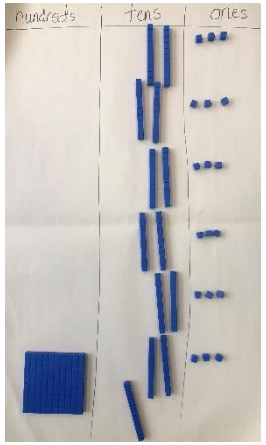
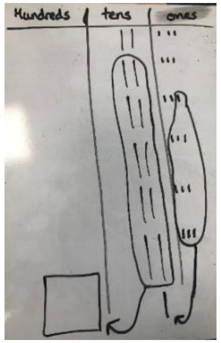
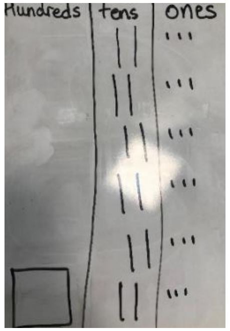
41 – 26</td>
<td>Represent the Base 10 pictorially, remembering to show the exchange.</td>
<td>Formal column method. Children must understand that when they</td>
</tr>
</table>

	 Then move on to place value counters. Start with one exchange before moving on to subtractions with two exchanges.	 Examples drawing counters on a place value grid	have exchanged the 10 they still have 41 because 41 = 30 + 11 

Multiplication strategies

Objective	Concrete	Pictorial	Abstract
Repeated grouping/ repeated addition	3 x 4 4 + 4 + 4 There are 3 equal groups with 4 in each group.    	Represent the practical resources in a picture and use a bar model.  	3 x 4 =12 4 + 4 + 4 = 12 Write addition sentences to describe objects and pictures.  

Using number lines for repeated groups	Number line to show repeated groups. 3 x 4   Cuisenaire rods may also be used.	Represent pictorially alongside a number line. 	Abstract number line showing three jumps of four. 3 x 4 = 12 
Partitioning	Partition to multiply using Numicon, Base 10 or Cuisenaire rods. 4 x 15  	Represent the concrete manipulatives pictorially.  	Demonstrate the steps taken. 4 x 15 10 5 10 x 4 = 40 5 x 4 = 20 40 + 20 = 60 A number line can also be used 

Formal column method	Use place value counters or Base 10.  3 x 23	Represent the counter pictorially.  	Children record in ways to show understanding.
	It is important that the ones are multiplied first and the answer noted down before multiplying the tens.   	  	3×23 → 20 3 $3 \times 20 = 60$ $3 \times 3 = 9$ $60 + 9 = 69$ $\begin{array}{r} 23 \\ \times\ \ 3 \\ \hline 69 \\ \hline \end{array}$ $6 \times 23 =$ $\begin{array}{r} 23 \\ \times\ \ 6 \\ \hline 138 \\ \hline {\scriptstyle 1\ 1} \end{array}$ When starting to multiply by 3 digit x 3 digit and 4 digit by 2 digit etc, they should be confident with the abstract.

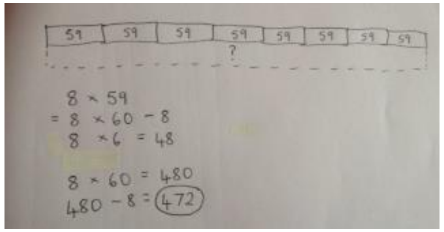
If required, children can write out what they are solving next to their answer,

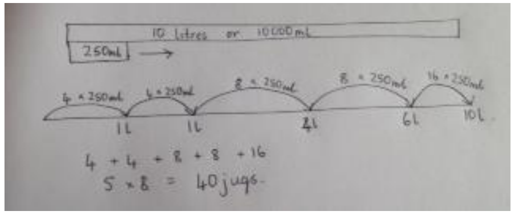
$$\begin{array}{rl} 32 & \\ \times\ \underline{24} & \\ 8 & (4 \times 2) \\ 120 & (4 \times 30) \\ 40 & (20 \times 2) \\ \underline{600} & (20 \times 30) \\ 768 & \end{array}$$

This moves to a more compact method.

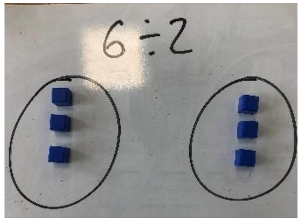
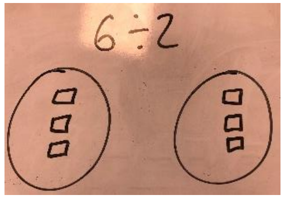
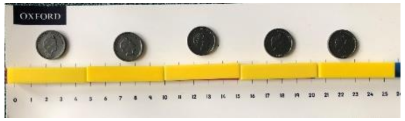
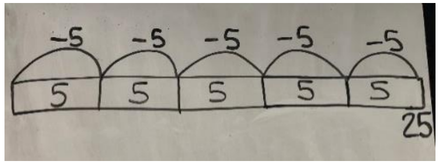
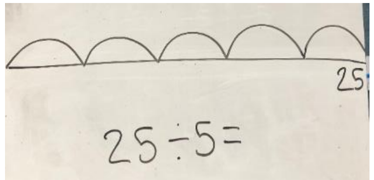
$$\begin{array}{r} {}^{2}\ {}^{3}\ \ {}^{1}\ \ \\ 1342 \\ \times\ \ \ 18 \\ \hline 13420 \\ 10736 \\ \hline 24156 \\ \hline {}^{1}\ \ \ \ \ \end{array}$$

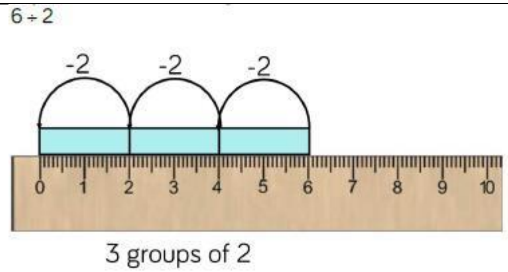
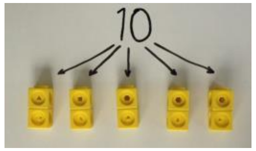
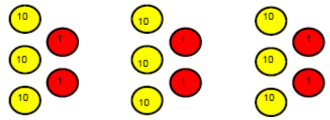
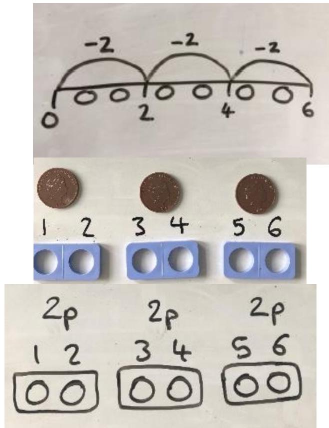
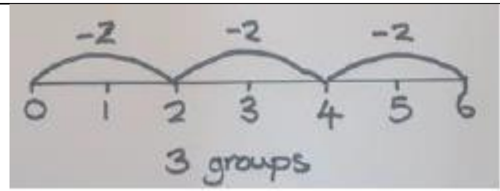
Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.

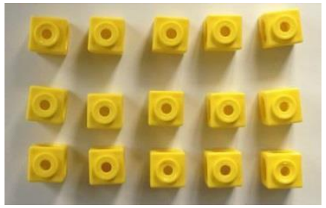
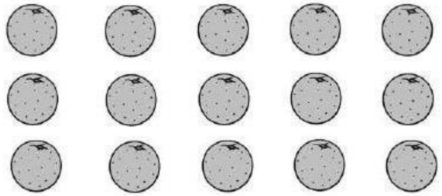
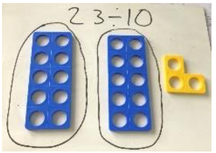
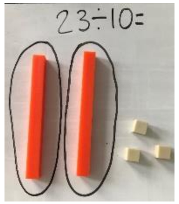
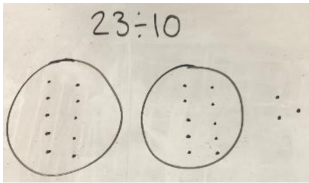
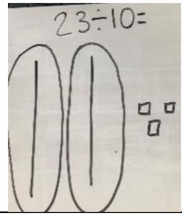
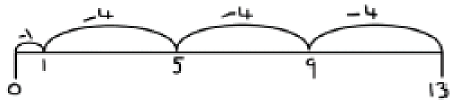


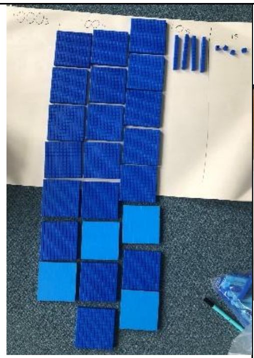
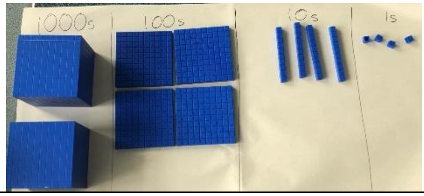
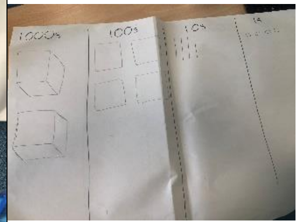
			10 litres or 10000ml 250ml 4 × 250ml 4 × 250ml 8 × 250ml 8 × 250ml 16 × 250ml 1L 1L 4L 6L 10L 4 + 4 + 8 + 8 + 16 5 × 8 = 40 jugs.

Division

Objective	Concrete	Pictorial	Abstract
Sharing	Sharing using a range of concrete objects. 	Represent the sharing pictorially. 	$6 \div 2 = 3$ 3 | 3 Children should also be encouraged to use 2 times table facts in this case.
Repeated subtraction/ grouping	Using Cuisenaire rods above a ruler. 	Represent repeated subtraction pictorially. 	Abstract number ine to represent the equal groups that have been subtracted. 

	 Divide quantities into equal groups. Use concrete resources or place value counters to aid understanding.   $96 \div 3 = 32$ 		 Think of the bar as a whole. Split into the number of groups you are dividing by and work out how many would be within each group. This could be done with counters on a bar model first.

Division with Arrays	Link division to multiplication by creating an array and thinking about the calculations that can be created.  Eg 15 ÷ 3 = 5 5 x 3 = 15 15 ÷ 5 = 3 3 x 5 = 15	Draw an array and use lines to split the array into groups to make multiplication and division calculations. 	Find the inverse of the multiplication and division sentences by creating four linking calculations. 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7
Division with remainders	2 digit divided by 1 digit using lollipop sticks, Cuisenaire rods etc. Divide objects between groups and see how many are left over.  	Represent the lollipop sticks pictorially. Draw dots and group them to divide an amount and clearly show a remainder.  	13 ÷ 4 – 3 remainder 1 Children should be encouraged to use their times table facts; they could also represent repeated addition on a number line. '3 groups of 4, with 1 left over' 

Division using dienes	  	Represent the dienes pictorially. 	Complete calculations using the scaffold.