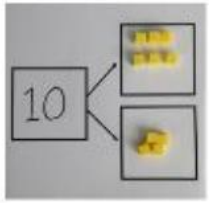
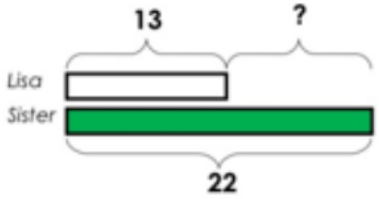
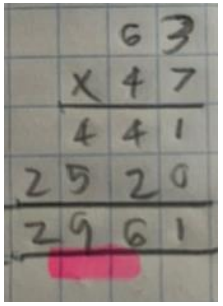
Tregolls Academy – Calculation Policy

At Tregolls Academy we value inclusivity and diversity and so this document is not grouped into year groups. Whilst the national curriculum dictates what year groups are taught which content, it is important to think of Maths as a continuum, where children progress in stages according to their understanding, rather than their age. Some children may require concrete representations regularly regardless of their abilities in other areas, whereas others may be able to progress to pictorial and abstract quicker than others.

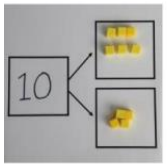
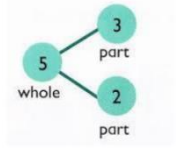
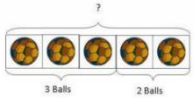
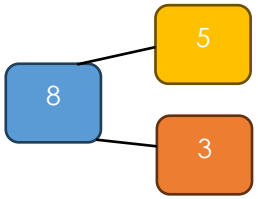
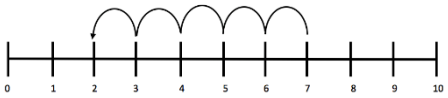
A child's understanding of any of the objectives should be taught or modelled in order:

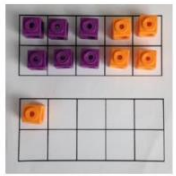
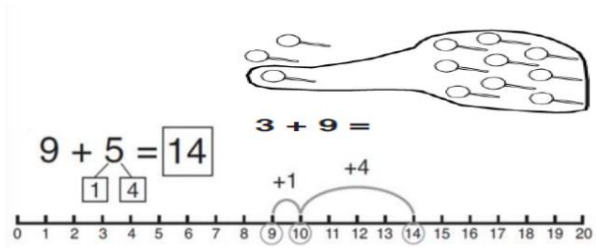
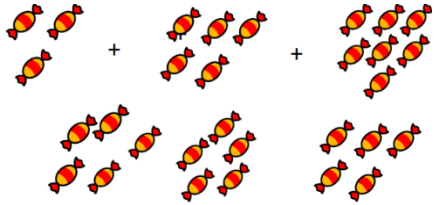
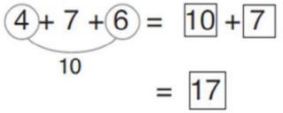
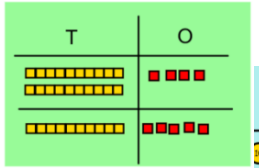
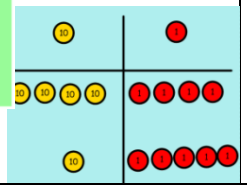
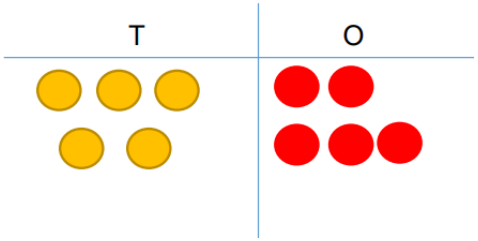
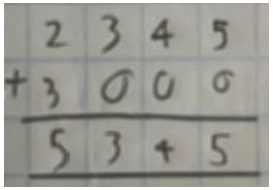
Concrete	Pictorial	Abstract
Hands on, practical application.	**Drawn models with representations of concepts.**	**The use of symbols to represent a concept.**
   Use cubes to add two numbers together as a group or in a bar.	*Comparison bar models* Lisa is 13 years old. Her sister is 22 years old. Find the difference in age between them. 	5 + 12 = 17 

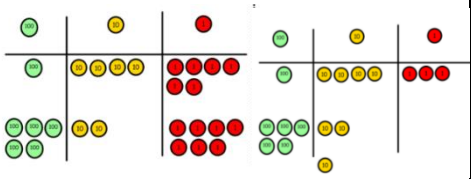
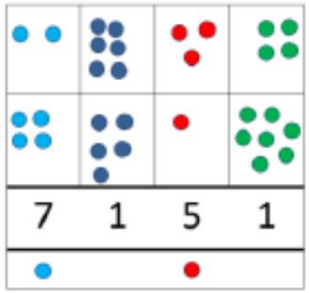
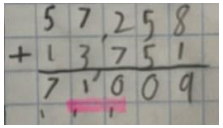
it is important to recognise that children of all year groups and abilities are able to access concrete apparatus to further their understanding. Difficult concepts can be made much simpler with diagnostic and effective use of resources.

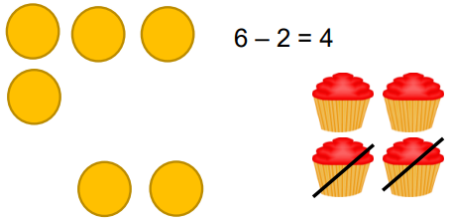
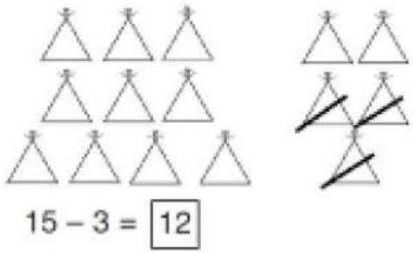
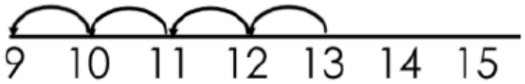
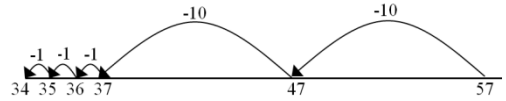
Addition

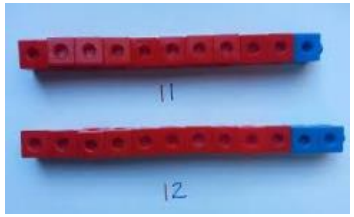
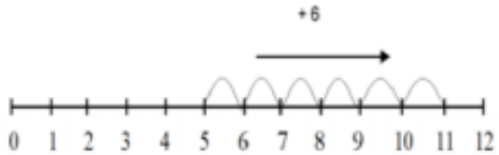
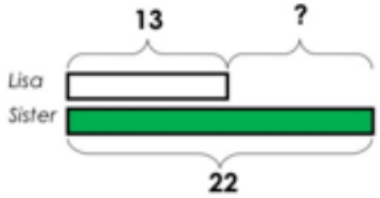
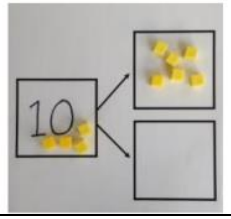
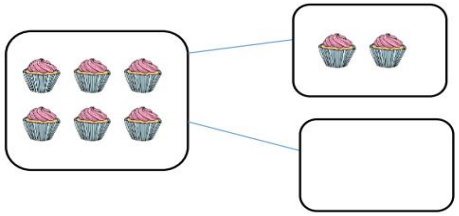
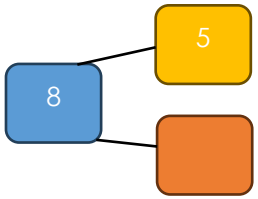
Key vocabulary: sum, total, parts and wholes, plus, add, altogether, more, 'is equal to' 'is the same as'.

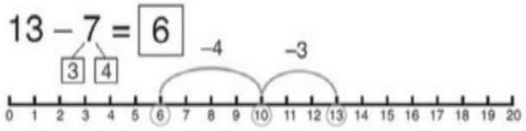
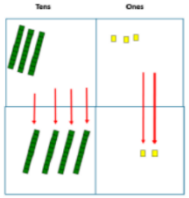
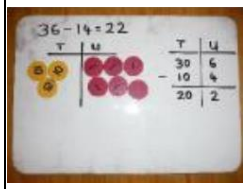
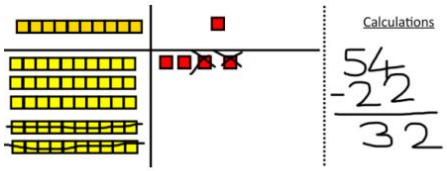
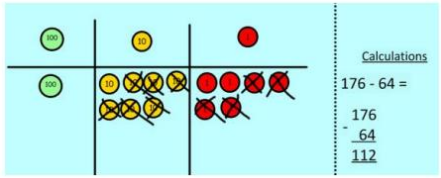
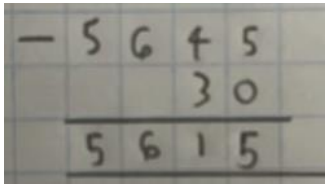
Objective and Strategies	Concrete	Pictorial	Abstract
Combining two parts to make a whole: part-hole model	   Use cubes to add two numbers together as a group or in a bar. 	Use pictures to add two numbers together as a group or in a bar.    	Use the part-whole model diagram (as shown below) to move into the abstract. 
Starting at the bigger number and counting on	 Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer.	Start at the larger number on the number line and count on in ones or in one jump to find the answer. 	Place the larger number in your head and count on the smaller number to find your answer. 5 + 12 = 17

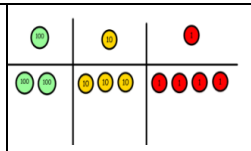
Regrouping to make 10	Start with the bigger number and use the smaller number to make 10.  6 + 5 = 11  6 + 5 = 11	Use pictures or a number line. Regroup or partition the smaller number to make 10. 	7 + 4 = 11 If I am at seven, how many more do I need to make 10. How many more do I add on now?
Adding three single digits	Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit.  4 + 7 + 6= 17 Put 4 and 6 together to make 10. Add on 7.	Add together three groups of objects. Draw a picture to recombine the groups to make 10. 	Combine the two numbers that make 10 and then add on the remainder. 
Column Method – no regrouping	Add together the ones first then add the tens. Use the Base 10 blocks first before moving onto place value counters.  24 + 15 = 39 	After practically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions. 	

Column Method - regrouping	Make both numbers on a place value grid. Add up the units and exchange 10 ones for 1 ten. Add up the rest of the columns, exchanging the 10 counters from one column for the next place value column until every column has been added. This can also be done with Base 10 to help children clearly see that 10 ones equal 1 ten and 10 tens equal 100. 146 + 527 = 653  As children move on to decimals, money and decimal place value counters can be used to support learning. £23.59 + £7.55 = £31.14	Children can draw a pictorial representation of the columns and place value counters to further support their learning and understanding.  	Start by partitioning the numbers before moving on to clearly show the exchange below the addition.  As the children move on, introduce decimals with the sane number of decimal places and different. Money can be used here. 23.361 9.080 59.770 + 1.300 93.511 2 1 2

Subtraction			
Key vocabulary: take away, less than, the difference, subtract, minus, fewer, decrease.			
Objective and Strategies	**Concrete**	**Pictorial**	**Abstract**
Taking away ones	Use physical objects, counters, cubes etc to show how objects can be taken away. 	Cross out drawn objects to show what has been taken away. 	18 – 3 = 15 8 – 2 = 6
Counting back	Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones.  Use counters and move them away from the group as you take them away counting backwards as you go. 	Count back on a number line or number track.  Start at the bigger number and count back the smaller number showing the jumps on the number line. 	Put 13 in your head, count back 4. What number are you at? Use your fingers to help.

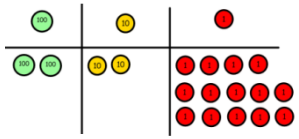
		This can progress all the way to counting back using 2 digit numbers.	
Find the difference	Compare amounts and objects to find the difference. Use cubes to build towers or make bars to find the difference. 	Count on to find the difference.  Draw bars to find the difference between 2 numbers. 	Hannah has 23 sandwiches; Helen has 15 sandwiches. Find the difference between the number of sandwiches.
Part-whole model	Link to addition- use the part whole model to help explain the inverse between addition and subtraction. If 10 is the whole and 6 is one of the parts. What is the other part? 	Use a pictorial representation of objects to show the part-whole model. 	Move to using numbers within the part-whole model. 

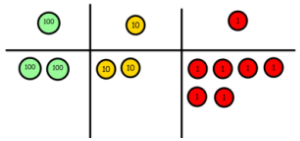
Make 10	14 – 9 = Make 14 on the ten frame. Take away the four first to make 10 and then takeaway one more so you have taken away 5. You are left with the answer of 9. 	Start at 13. Take away 3 to reach 10. Then take away the remaining 4 so you have taken away 7 altogether. You have reached your answer. 	16 – 8 = How many do we take off to reach the next 10? How many do we have left to take off?
Column Method – without regrouping	Use Base 10 to make the bigger number then take the smaller number away.   Show how you partition numbers to subtract. Again make the larger number first.	Draw the Base 10 or place value counters alongside the written calculation to help to show working.  	Clear written column subtraction. 
Column Method – with regrouping	Use Base 10 to start with before moving on to place value counters. Start with one exchange before moving onto subtractions with 2 exchanges. Make the larger number with the place value counters.	Draw the counters onto a place value grid and show what you have taken away by crossing the counters out as well as clearly showing the exchanges you make.	Children can start their formal written method by partitioning the number into clear place value columns.



Start with the ones, can I take away 8 from 4 easily? I need to exchange one of my tens for ten ones.

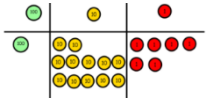
Now, I can subtract my ones.



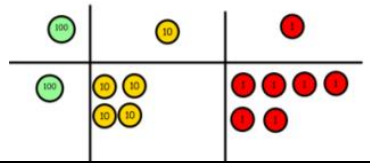


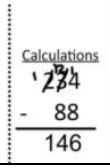
Now, look at the tens, can I take away 8 tens easily? I need to exchange one hundred for ten tens.

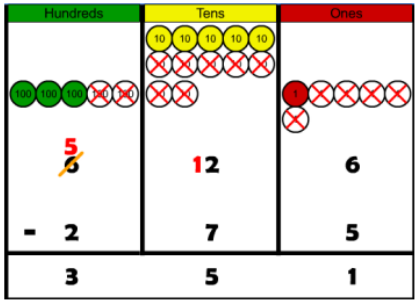
Now, I can take away my 8 tens and complete my subtraction.



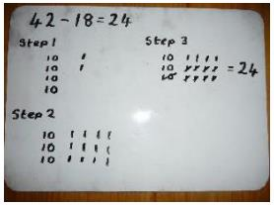
Show children how the concrete method links to the written method alongside your working. Cross out the numbers when exchanging and show where we write our new amount.

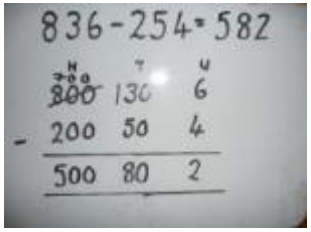




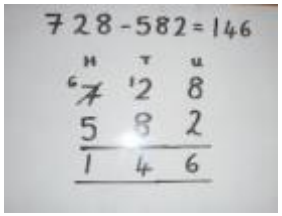


When confident, children can find their own way to record the exchange/regrouping. Just writing the numbers as shown here shows that the child understands the method and knows when to exchange/regroup.





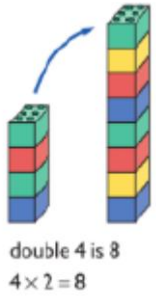
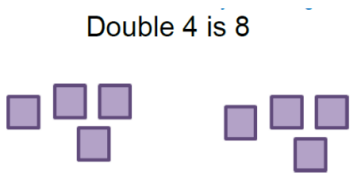
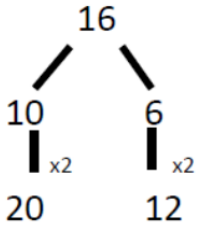
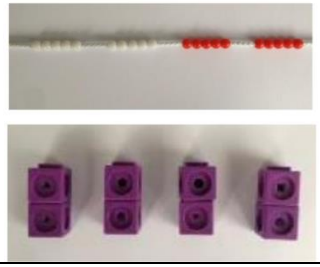
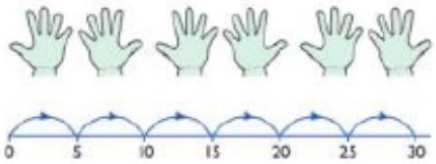
Moving forward the children use a more compact method.

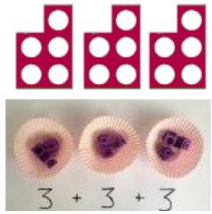
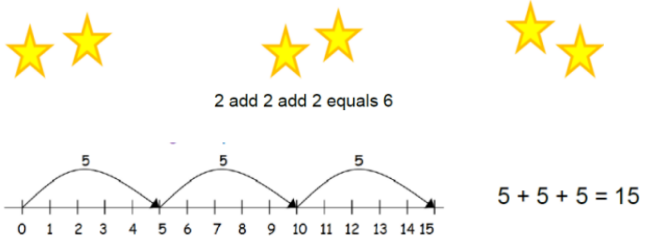
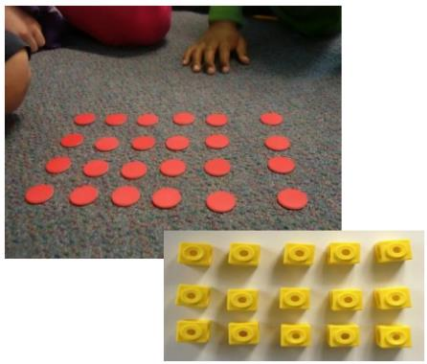
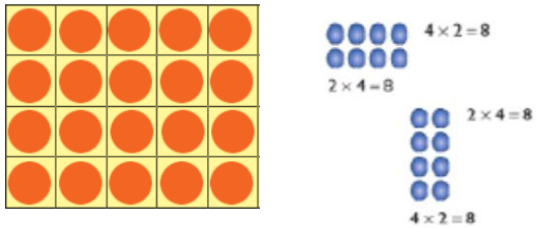


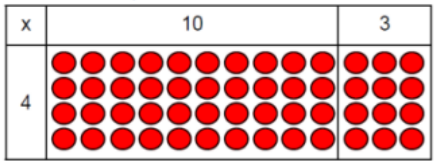
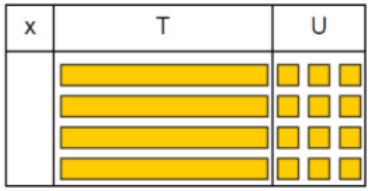
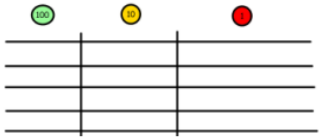
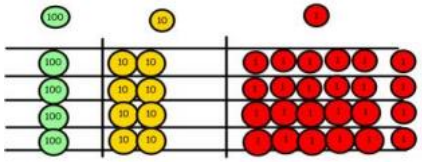
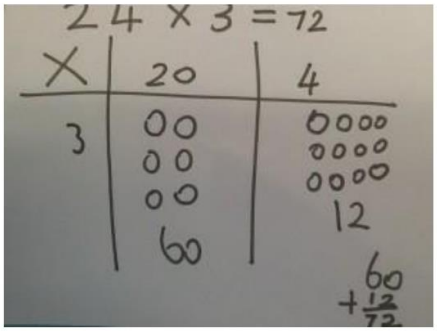
This will lead to an understanding of

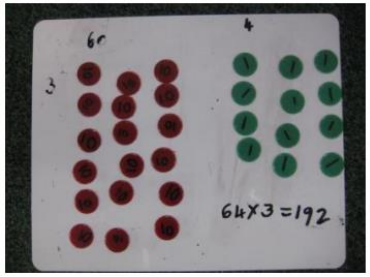
$$\begin{array}{r} {\scriptstyle 5\ \ 12\ \ 1} \\ 2\ \not{6}\ \not{3}\ .\ 0 \\ -\ \ \ 2\ 6\ .\ 5 \\ \hline 2\ 3\ 6\ .\ 5 \end{array}$$

subtracting any number including decimals.

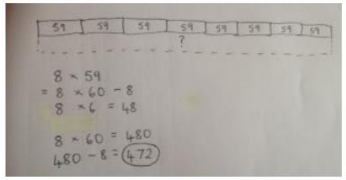
Multiplication			
Key vocabulary: double, times, multiplied by, the product of, groups of, lots of, equal groups.			
Objective and Strategies	**Concrete**	**Pictorial**	**Abstract**
Doubling	Use practical resources to show how to double a number.  	Draw pictures to show how to double a number.  	Partition a number and then double each part before recombining it back together. 
Counting in multiples	Count in multiples supported by concrete objects in equal groups. 	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. 2, 4, 6, 8, 10 5, 10, 15, 20, 25 , 30

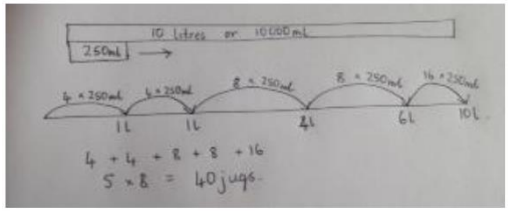
Repeated addition	  Using different objects to add equal groups.	There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there?  	Write addition sentences to describe objects and pictures. 
Arrays – showing commutative multiplication	Create arrays using counters/cubes to show multiplication sentences. 	Draw arrays in different rotations to find commutative multiplication sentences. Link arrays to area of rectangles.  	Use an array to write multiplication sentences and reinforce repeated addition.  5 + 5 + 5 = 15 3 + 3 + 3 + 3 + 3 = 15 5 x 3 = 15 3 x 5 = 15
Grid method	Show the link with arrays to first introduce the grid method.	Children can represent the work they have done with place value counters in a way that they understand. They can draw the counters, using colours to show different amounts or just use circles in the different columns to show their thinking as shown below.	Start with multiplying by one digit numbers and showing the clear addition alongside the grid.

	 Move on to using Base 10 to move towards a more compact method.  Move on to place value counters to show how we are finding groups of a number.  Add up each column, starting with the ones making any exchanges needed. 	 	<table><tr><td>×</td><td>30</td><td>5</td></tr><tr><td>7</td><td>210</td><td>35</td></tr></table> 210 + 35 = 245 Moving forward, multiply by a 2 digit number showing the different rows within the grid method. <table><tr><td></td><td>10</td><td>8</td></tr><tr><td>10</td><td>100</td><td>80</td></tr><tr><td>3</td><td>30</td><td>24</td></tr></table> <table><tr><td>X</td><td>1000</td><td>300</td><td>40</td><td>2</td></tr><tr><td>10</td><td>10000</td><td>3000</td><td>400</td><td>20</td></tr><tr><td>8</td><td>8000</td><td>2400</td><td>320</td><td>16</td></tr></table>
Column Method	Children can continue to be supported by place value counters at this stage of multiplication.	Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.	Start with long multiplication, reminding the children about lining up their numbers clearly in columns.



It is important at this stage that they always multiply the one first and note down their answer followed by the tens which they note below.

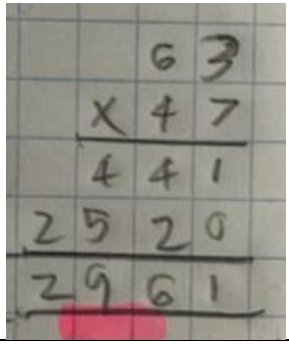


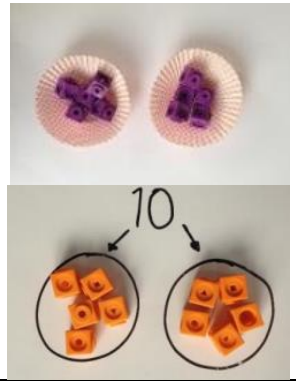
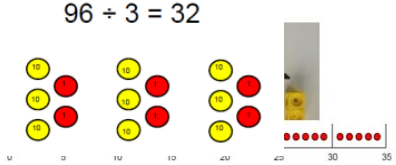
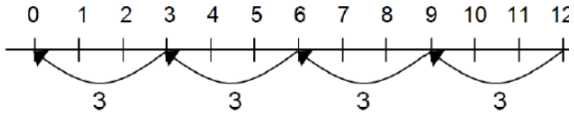


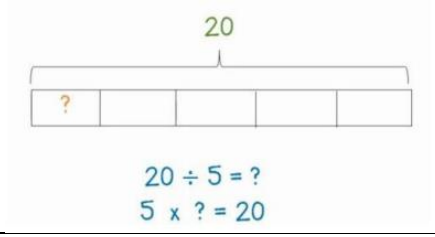
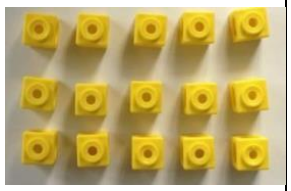
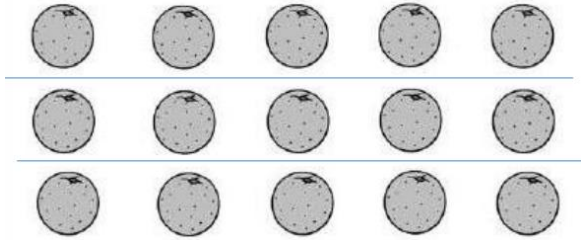
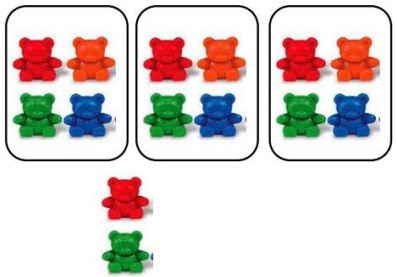
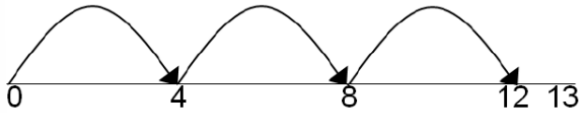
If it helps, children can write out what they are solving next to their answer.

32
x 24
8 (4 x 2)
120 (4 x 30)
40 (20 x 2)
600 (20 x 30)
768

This moves to the more compact method.



Division			
Key vocabulary: share, group, divide, divided by, half.			
Objective and Strategies	**Concrete**	**Pictorial**	**Abstract**
Sharing objects into groups	Sharing concrete resources into equal groups.  	Children use pictures or shapes to share quantities.  8 ÷ 2 = 4	Share 9 buns between three people. 9 ÷ 3 = 3
Division as grouping	Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding. 96 ÷ 3 = 32  	Use a number line to 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?

			
Division within arrays	Link division to multiplication by creating an array and thinking about the number sentences 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 sentences. 	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	14 ÷ 3 = Divide objects between groups and see how much is left over. 	Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder.  Draw dots and group them to divide an amount and clearly show a remainder. 	Complete written divisions and show the remainder using r.