'Growing together, Learning forever'

Woodstone Community Primary School
Calculation Guidance

Date: June 2022

Date for review: June 2025

The following guidance supports the White Rose Maths scheme of learning which is used for both planning and delivery of Maths across the school. Progression within each area of calculation is in line with the programmes of study in the 2014 National Curriculum. This calculation policy should be used to support children to develop a deep understanding of number and calculation. This policy has been designed to teach children key mathematical concepts through the use of concrete, pictorial and abstract representations.

- **Concrete representation**— a pupil is first introduced to an idea or skill using real objects. This is a 'hands on' component and is a foundation for conceptual understanding.
- **Pictorial representation** – 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.
- **Abstract representation**—a pupil is now capable of representing problems by using mathematical notation with concrete or pictorial representations to support, for example 12 x 2 = 24.

It is important that conceptual understanding, supported by the use of representation, is secure for all procedures. Reinforcement is achieved by going back and forth between these representations.

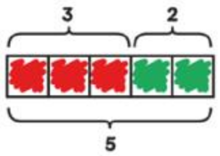
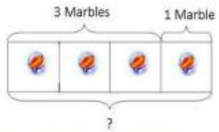
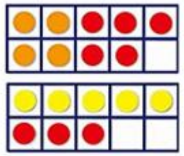
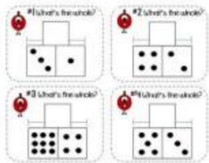
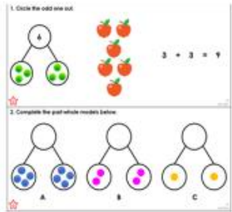
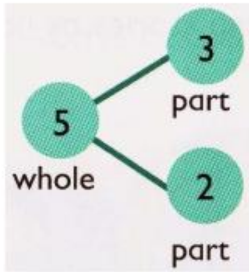
Mathematics Mastery

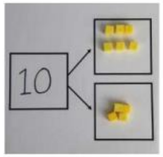
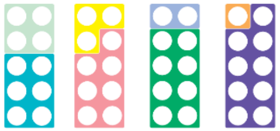
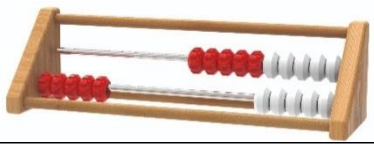
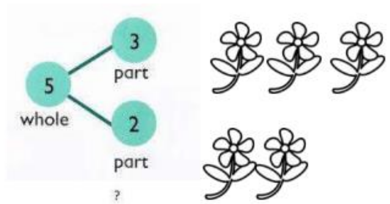
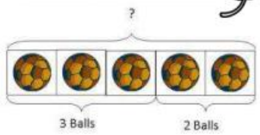
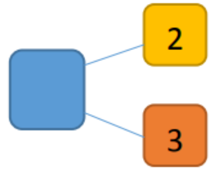
At the centre of the mastery approach to the teaching of mathematics is the belief that all children have the potential to succeed. They should have access to the same curriculum content and, rather than being extended with new learning, they should deepen their conceptual understanding by tackling challenging and varied problems. Similarly, with calculation strategies, children must not simply rote learn procedures but demonstrate their understanding of these procedures through the use of concrete materials and pictorial representations.

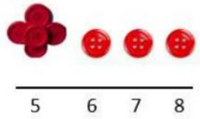
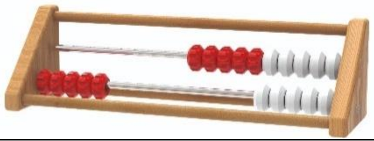
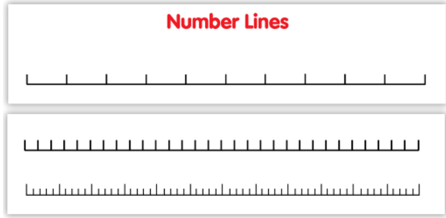
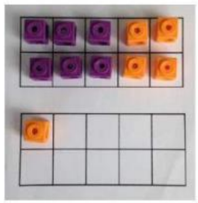
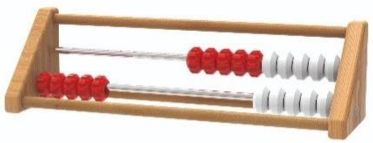
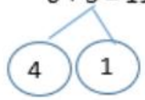
How to use the policy:

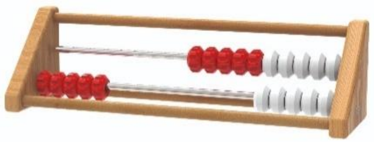
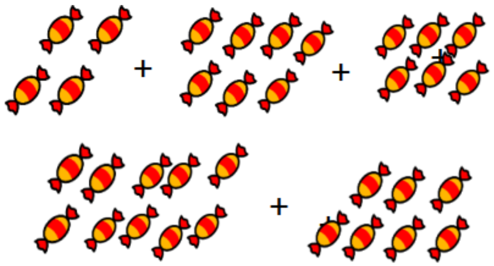
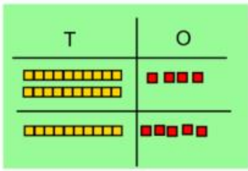
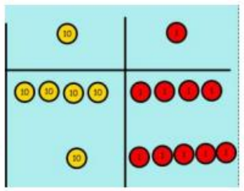
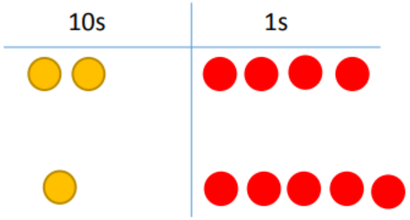
This mathematics policy is a guide for all staff at Woodstone Primary School and has been adapted from work by the NCETM. Teachers can use any teaching resources that they wish to use and the policy does not recommend one set of resources over another, rather that, a variety of resources are used. For each of the four rules of number, different strategies are laid out, together with examples of what concrete materials can be used and how, along with suggested pictorial representations. The principle of the concrete-pictorial-abstract (CPA) approach [Make it, Draw it, Write it] is intended to ensure children have a true understanding of a mathematical concept; they need to master all three phases within a year group's scheme of work.

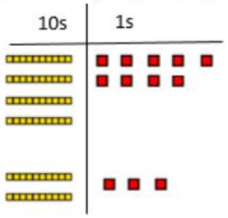
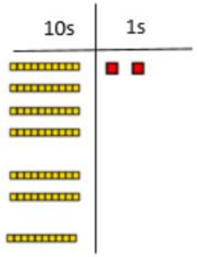
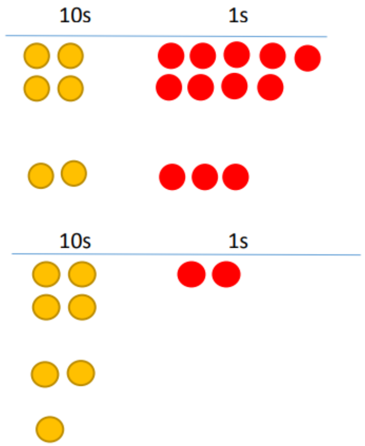
Calculation Guidance – Addition

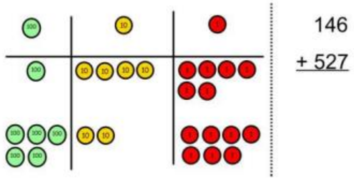
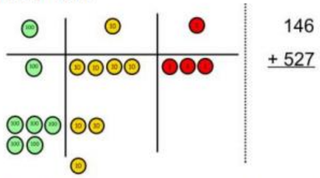
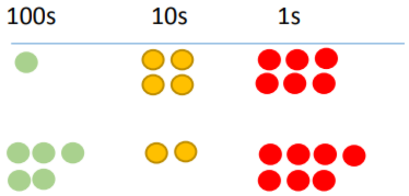
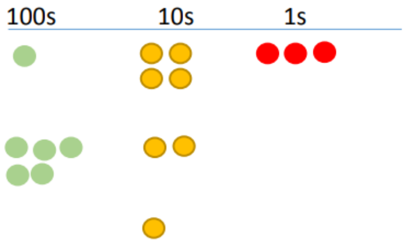
Year Group	Objective	Concrete	Pictorial	Abstract
Reception	Composition of numbers to 10 Recall number bonds to 5 and 10	   Use toys and general classroom resources for children to physically manipulate, group/regroup.  Use specific maths resources such as counters, snap cubes, Numicon etc.    Use visual supports such as ten frames, part part whole and addition mats, with the physical objects and resources that can be manipulated.	  Two groups of pictures so children are able to count the total.   Bar model using visuals, pictures/icons or colours.  Use visual supports such as ten frames, part part whole and addition mats with pictures/icons.  	A focus on symbols and numbers to form a calculation. $5+2=7$  * No expectation for children to be able to record a number sentence/addition calculation

Year 1	Number bonds of 5,6,7,8,9 and 10	 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. 	$2 + 3 = 5$ $3 + 2 = 5$ $5 = 3 + 2$ $5 = 2 + 3$  Use the part-part-whole diagram as shown above to move into the abstract.

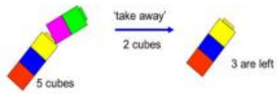
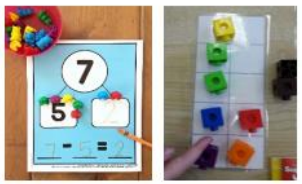
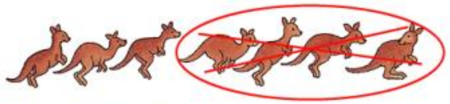
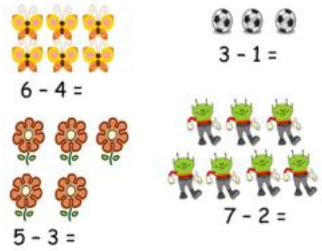
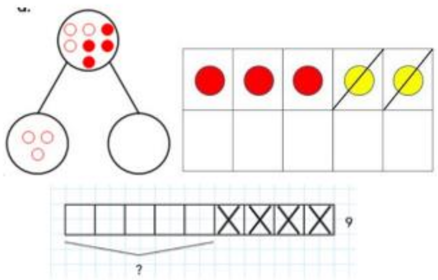
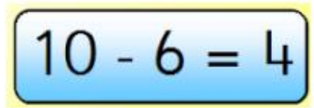
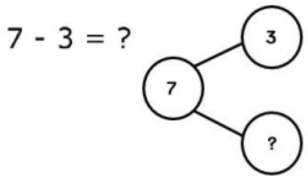
	Counting	 Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer.   Use toys and general classroom resources for children to physically manipulate, group/regroup. 	Use a number line to count on in ones.  	5 + 3 = 8 
	Regrouping to make 10	  6 + 5 = 11 Start with the bigger number and use the smaller number to make 10. 	 6 + 5 = 11  6 + 4 =10 10 + 1 = 11	Verbal word problems 6 + 5 = 11

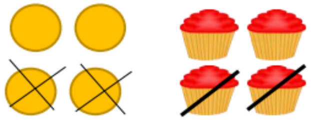
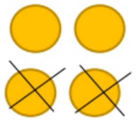
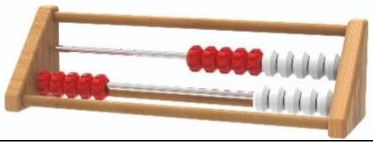
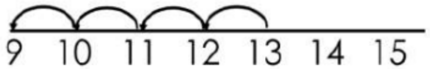
Year 2	Adding 3 single digit numbers	4 + 7 + 6= 17 Put 4 and 6 together to make 10. Add on 7.  Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit. 	 Add together three groups of objects. Draw a picture to recombine the groups to make 10.	$\underbrace{4 + 7 + 6}_{10} = \boxed{10} + \boxed{7}$ $= \boxed{17}$ Combine the two numbers that make 10 and then add on the remainder.
	Column method without regrouping	Add together the ones first, then add the tens. Use the Base 10 blocks first before moving onto place value counters. 24 + 15 =  44 + 15 = 	After physically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions.  	24 + 15 = 39 $\begin{array}{r} 24 \\ +\ 15 \\ \hline 39 \end{array}$

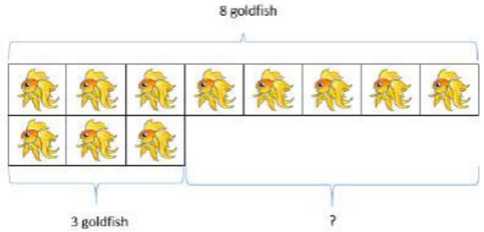
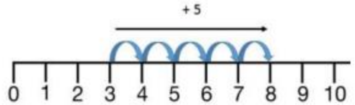
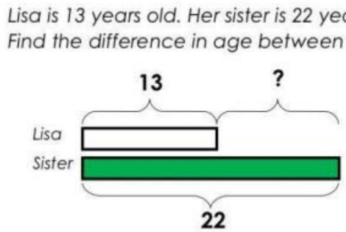
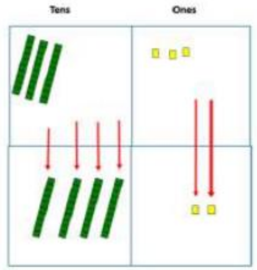
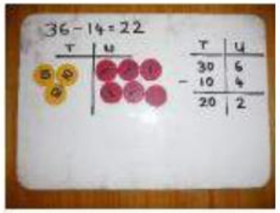
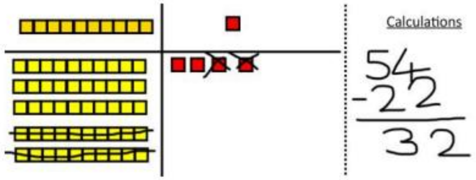
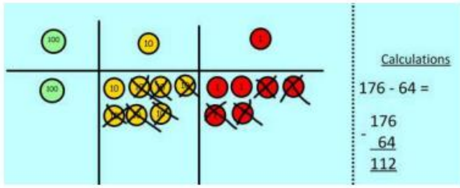
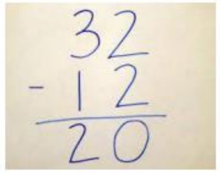
	Column method with regrouping	Make both numbers on a place value grid.  Add up the units and exchange 10 ones for 1 ten.  	Using place value counters, children can draw the counters to help them to solve additions.  	40 + 9 20 + 3 60 + 12 = 72

Year 3/4	Column method with regrouping	Make both numbers on a place value grid.  Add up the units and exchange 10 ones for 1 ten.  As children move on to decimals, money and decimal place value counters can be used to support learning. **NB** By Year 4 children will progress on to adding four digit numbers.	  Children can draw a pictoral representation of the columns and place value counters to further support their learning and understanding. **NB** Addition of money needs to have £ and p added separately.	As the children progress, they will move from the expanded to the compacted method. 146 + <u>527</u> 673 1 As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here.
Year 5/6	Column method with regrouping	Consolidate understanding using numbers with more than 4 digits and extend by adding numbers with up to 3 decimal places		

Calculation Guidance – Subtraction

Year Group	Objective	Concrete	Pictorial	Abstract
Reception	Composition of numbers to 10 Recall number bonds and subtraction facts to 5 and 10	 Use toys and general classroom resources for children to physically manipulate, group/regroup.   Use specific maths resources such as snap cubes, Numicon, bead strings etc.  Use visual supports such as ten frames, part part whole and subtraction mats, with the physical objects and resources that can be manipulated.	  A group of pictures for children to cross out or cover quantities to support subtraction.  Use visual supports such as ten frames, part part whole and bar model with pictures/icons.	A focus on symbols and numbers to form a calculation.    * No expectation for children to be able to record a number sentence/addition calculation.

Year 1	Taking away ones	Use physical objects, counters, cubes etc. to show how objects can be taken away. 4 – 2 = 2 	Cross out drawn objects to show what has been taken away. 4 – 2 = 2 	4 – 2 = 2
	Counting back	Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones.  13 – 4 = 9 	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.

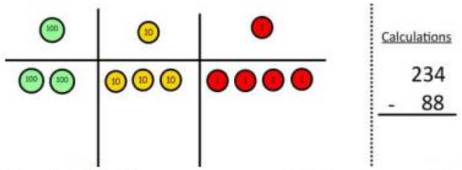
Year 2	Find the difference	Compare amounts and objects to find the difference.  Use cubes to build towers or make bars to find the difference. Use basic bar models with items to find the difference.	 Count on to find the difference.  Draw bars to find the difference between 2 numbers.	Hannah has 8 goldfish. Helen has 3 goldfish. Find the difference between the number of goldfish the girls have.
	Column method without regrouping	75 – 42 = 33  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.  	47 – 24 = 23 40 + 7 – 20 + 4 20 + 3 This will lead to a clear written column subtraction. 

Year 3/4

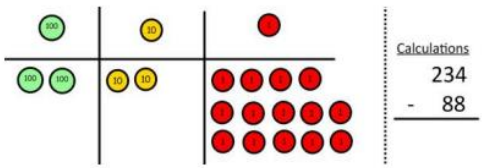
Column method with regrouping

Use Base 10 to start with before moving on to place value counters. Start with one exchange before moving onto subtractions with 2 exchanges.

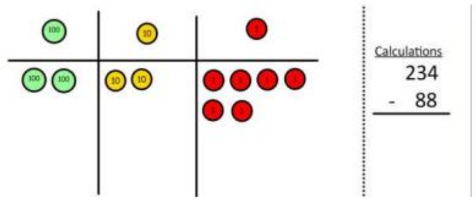
Make the larger number with the place value counters

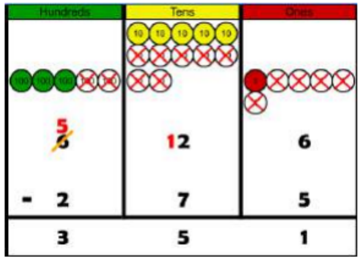


Start with the ones, can I take away 8 from 4 easily? I need to exchange 1 of my tens for 10 ones.



Now I can subtract my ones.



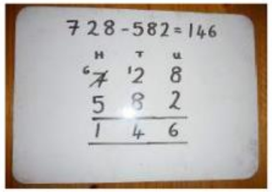


Draw the counters onto a place value grid and show what you have taken away by crossing the counters out as well as clearly showing the exchanges you make.

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.

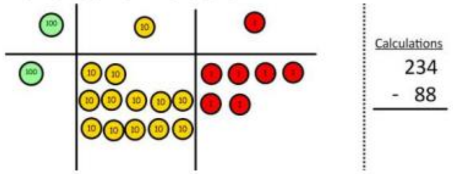
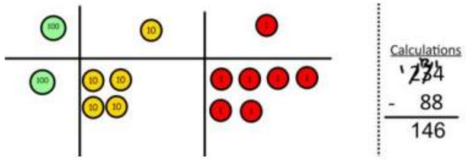
Children can start their formal written method by partitioning the number into clear place value columns.



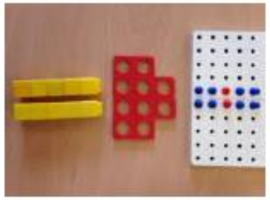
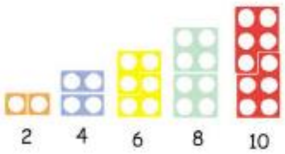
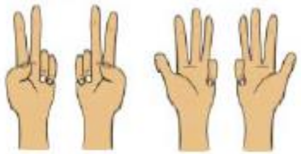
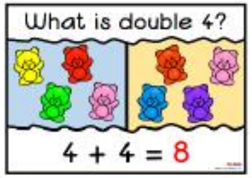
Moving forward the children use a more compact method.

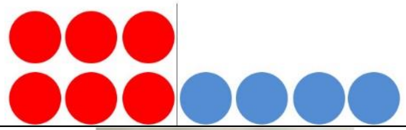
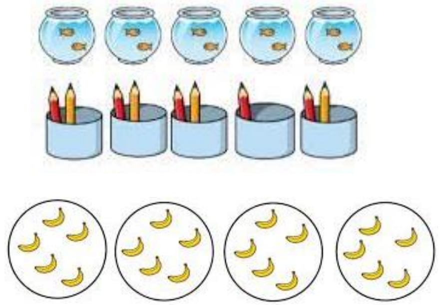
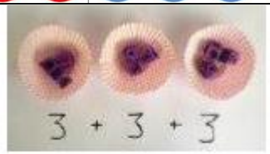
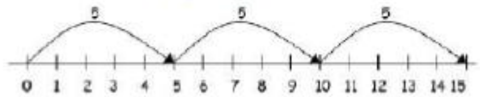
This will lead to an understanding of subtracting any number including decimals.

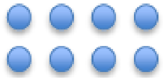
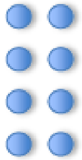
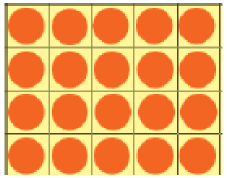
$$\begin{array}{cccccc} & & 5 & 12 & & 1 \\ & 2 & \cancel{6} & \cancel{3} & . & 0 \\ - & & 2 & 6 & . & 5 \\ \hline & 2 & 3 & 6 & . & 5 \end{array}$$

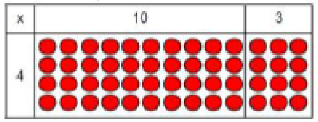
Year 5/6	Column method with regrouping	Now look at the tens, can I take away 8 tens easily? I need to exchange 1 hundred for 10 tens.  Now I can take away 8 tens and complete my subtraction.  Show children how the concrete method links to the written method alongside your working. Cross out the numbers when exchanging and show where we write our new amount.		

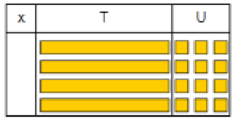
Calculation Guidance – Multiplication

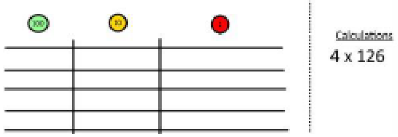
Year Group	Objective	Concrete	Pictorial	Abstract
Reception	Automatically recall doubling facts Explore odds and evens	   Counting and other maths resources for children to make 2 equal groups.    Physical and real life examples that encourage children to see concept of doubling as adding two equal groups.	    Pictures and icons that encourage children to see concept of doubling as adding two equal groups.	Abstract representations are introduced in Year 1

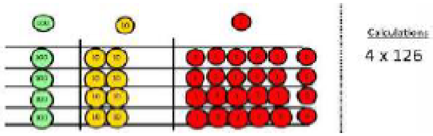
Year 1/2	Equal/unequal groups	 		3 + 3 = 6 – equal groups 3 + 2 + 1 = 6 – unequal groups
	Repeated addition	   Use different objects to add equal groups.	There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there?  2 + 2 + 2 = 6  5 + 5 + 5 = 15	Write addition sentences to describe objects and pictures.  2 + 2 + 2 = 6

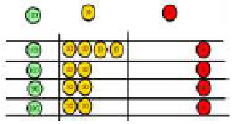
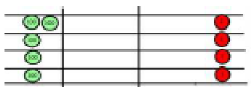
	Arrays – showing commutative multiplication	Create arrays using counters/cubes to show multiplication sentences.  	Draw arrays in different rotations to find **commutative** multiplication sentences.  $4 \times 2 = 8$ $2 \times 4 = 8$  $2 \times 4 = 8$ $4 \times 2 = 8$ Link arrays to area of rectangles. 	Use an array to write multiplication sentences and reinforce repeated addition.  $5 + 5 + 5 = 15$ $3 + 3 + 3 + 3 + 3 = 15$ $5 \times 3 = 15$ $3 \times 5 = 15$

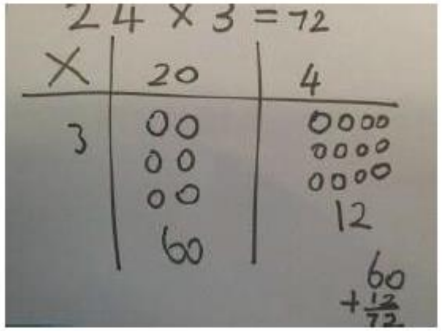
<table>
<tr>
<td>Year 3/4</td>
<td>Grid method</td>
<td>Show the link with arrays to first introduce the grid method.


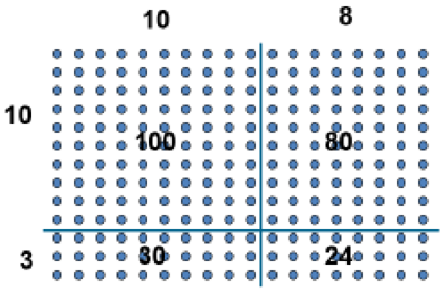
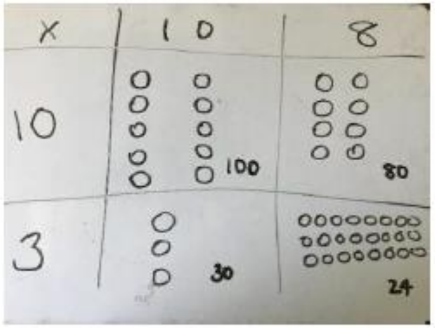
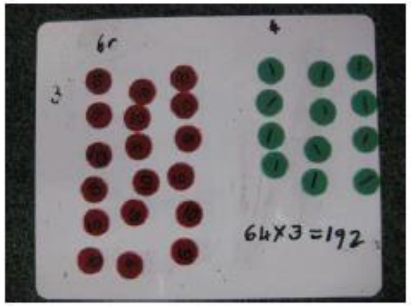
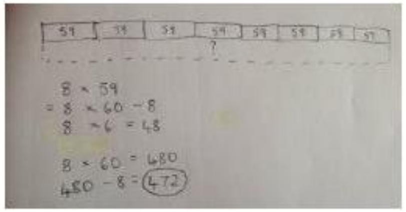
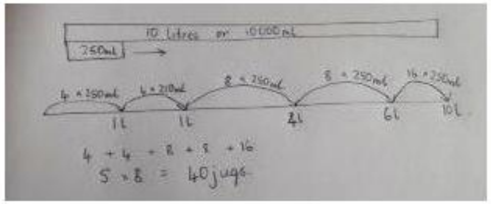
4 rows of 10
4 rows of 3
Move on to using Base 10 to move towards a more compact method.


4 rows of 13
Move on to place value counters to show how we are finding groups of a number.We are multiplying by 4 so we need 4 rows.


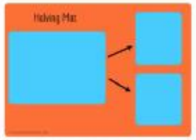
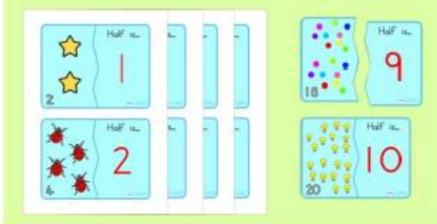
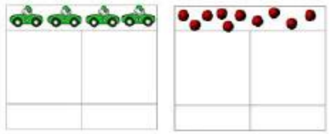
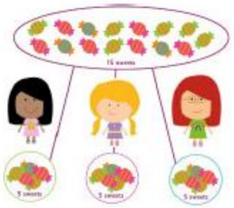
Fill each row with 126.


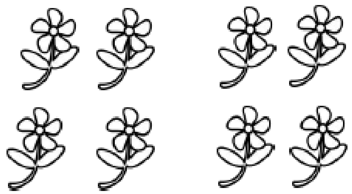
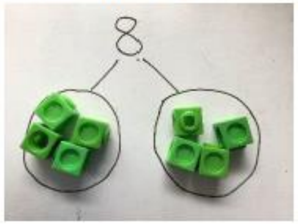
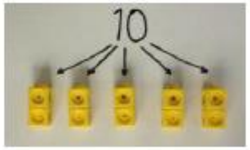
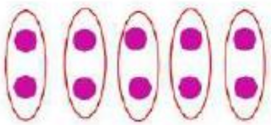
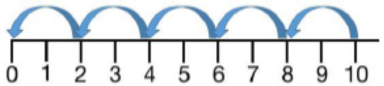
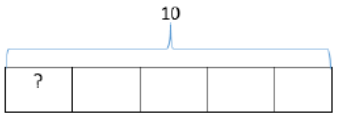
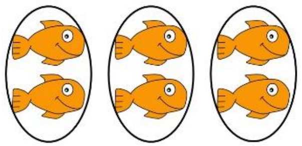
Add up each column, starting with the ones making any exchanges needed.
 
4 × 126 = 504</td>
<td>Children can represent the work they have done with place value counters in a way that they understand.

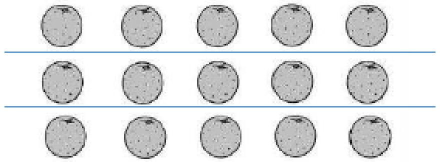
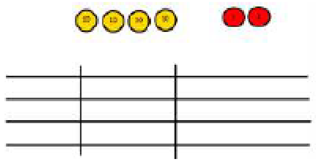
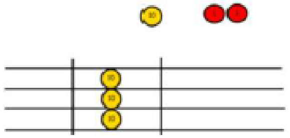
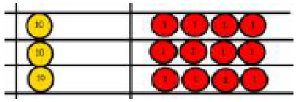
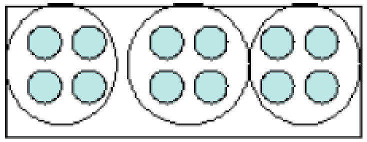
They can draw the counters, using colours to show different amounts or just use circles in the different columns to show their thinking as shown below.

</td>
<td>35
x 7
245
3</td>
</tr>
</table>

Year 5/6	Expanded method	Show the link with arrays to first introduce the expanded method.  	 	Start with long multiplication, reminding the children about lining up their numbers clearly in columns. 18 x 13 24 (3 x 8) 30 (3 x 10)) 80 (10 x 8) 100 (10 x 10) 234
	Compact method	Children can continue to be supported by place value counters at the stage of multiplication.  It is important at this stage that they always multiply the ones first and note down their answer followed by the tens which they note below.	Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.  	1342 x 18 13420 10736 24156

Calculation Guidance – Division

Year Group	Objective	Concrete	Pictorial	Abstract
Reception	Explore how quantities can be distributed equally	   Children have the opportunity to physically cut objects, food or shapes in half.  Counting and other maths resources for children to share into two equal groups.   Use visual supports such as halving mats and part part whole, with the physical objects and resources that can be manipulated.  Counting and other maths resources for children to explore sharing between 3 or more.	 Pictures and icons that encourage children to see concept of halving in relation to subitising, addition and subtraction knowledge. i.e. Knowing 4 is made of 2 groups of 2, so half of 4 is 2.  Bar model with pictures or icons to support understanding of finding 2 equal parts of a number, to further understand how two halves make a whole.  Pictures for children to create and visualise 3 or more equal groups.	Abstract representations are introduced from Year 1

Year 1/2	Sharing	I have 8 cubes, can you share them equally between two people?	Children use pictures or shapes to share quantities.  8 ÷ 2 = 4	Share 8 buns between two people. 8 ÷ 2 = 4 
	Grouping	Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.  	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.  10 ÷ 5 = ? 5 x ? = 10 	10 ÷ 5 = 2 Divide 10 into 5 groups. How many are in each group?

Year 3/4	Division with 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. 5 x 3 = 15 3 x 5 = 15 15 ÷ 5 = 3 15 ÷ 3 = 5
	Short division	42 ÷ 3 Start with the biggest place value. We are sharing 40 into three groups. We can put 1 ten in each group and we have 1 ten left over.  We exchange this ten for 10 ones and then share the ones equally among the groups.  We look at how many are in each group. 	Students can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.  Encourage them to move towards counting in multiples to divide more efficiently.	Begin with divisions that divide equally with no remainder. $\begin{array}{r\|l} & 2\;\;1\;\;8 \\ \hline 4 & 8\;\;{}^{3}7\;\;2 \end{array}$

Year 5/6	Division with remainders			Complete written divisions and show the remainder using r. 29 ÷ 8 = 3 REMAINDER 5 dividend divisor quotient remainder
	Short division with remainders			Move onto divisions with a remainder. Once children understand remainders, begin to express as a fraction or decimal according to the context. 8 6 r 2 5 │ 4 3 ³2 1 8 6 1/5 5 │9 ⁴3 ³1 1 4 . 6 3 5 │ 5 1 ¹⁶1 . ²¹0

<table>
<tr>
<td></td>
<td>Long division</td>
<td></td>
<td></td>
<td>Children will use long division to divide numbers with up to 4 digits by 2 digit numbers.

015
32 ⟌ 487
-0
48
-32
167
-160
7

17 r 19
31 ⟌ 546
31
236
217
19</td>
</tr>
</table>