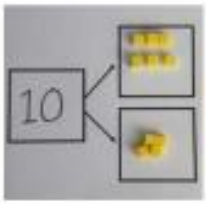
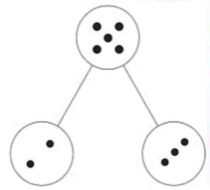
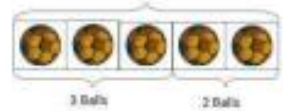
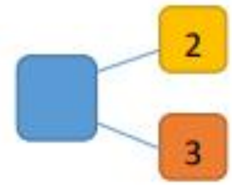
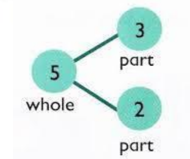
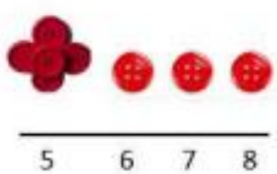
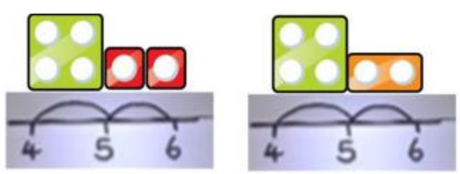
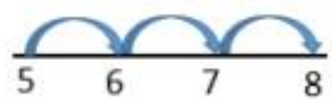
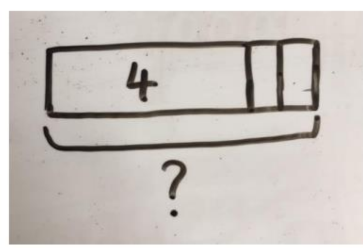
Garfield School Calculation Policy

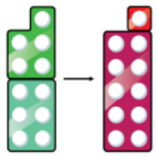
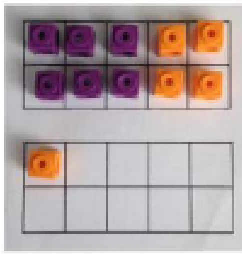
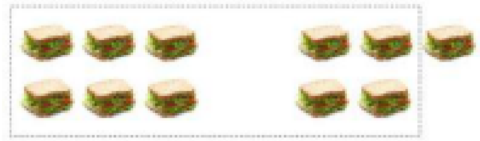
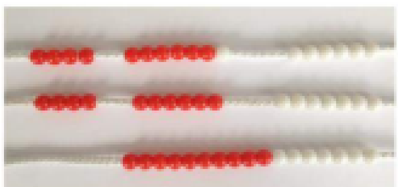
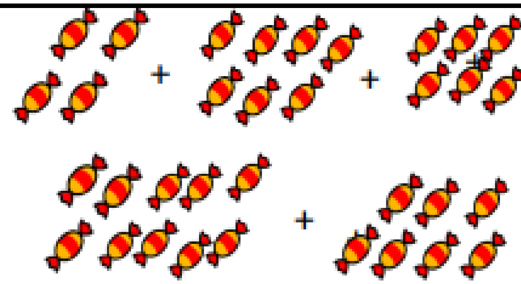
- Garfield School follows the White Rose Maths scheme.
- This policy mostly uses strategies taken from the White Rose Maths Scheme although a few areas have been altered in line with previous good practice taught at Garfield.
- This calculation policy follows the CPA learning approach (Concrete, Pictorial and Abstract).
- Concrete means to use physical objects to solve maths problems.
- Pictorial is to use drawings or picture representations.
- Abstract is to solve maths problems using only numbers.
- In KS1 the majority of calculations taught involve concrete methods and children gradually become more familiar with pictorial and some simple abstract representations.
- The methods outlined for the earlier years in KS2 (years 3 and 4) are more pictorial, i.e., they break down the calculations so that the children understand how they are manipulating the numbers to calculate the answer. Children gradually learn how to relate these pictorial representations to more abstract calculations.
- The children move on to more formal abstract calculations in years 5 and 6.
- In Year 2, pupils are taught the 2, 5 and 10 times tables. In Year 3, the 3, 4 and 8 times tables are introduced and by the end of Year 4, pupils are expected to know all of the times tables up to 12 by 12. At the end of Year 4, pupils have to take part in a National Multiplication Check.

Calculation Guidance: Addition

Key language: sum, total, parts and wholes, plus, add, altogether, more, ‘is equal to’ ‘is the same as’.

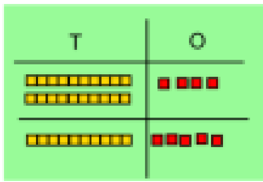
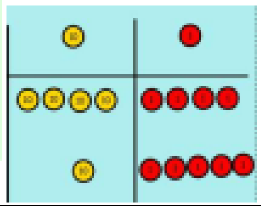
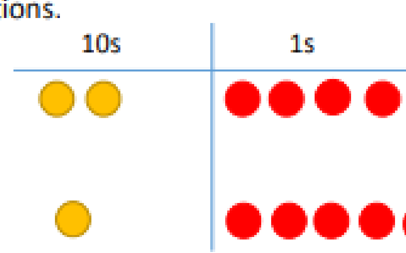
	Objective	Concrete	Pictorial	Abstract
Year 1	Number bonds of 5, 6, 7, 8, 9 and 10	  Use cubes to add two numbers together as a group or in a bar. 	   Use pictures to add two numbers together as a group or in a bar.  	$2 + 3 = 5$ $3 + 2 = 5$ $5 = 3 + 2$ $5 = 2 + 3$  Use the part-part-whole diagram as 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 a number line to count on in ones.  A bar model which encourages the children to count on, rather than count all.  	$5 + 3 = 8$ 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? $4 + 2$ 

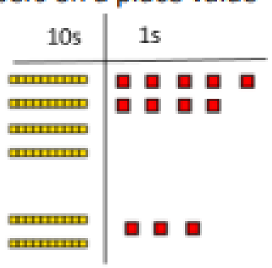
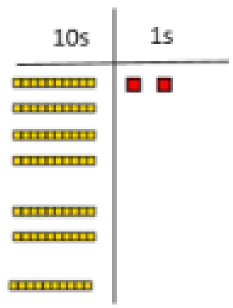
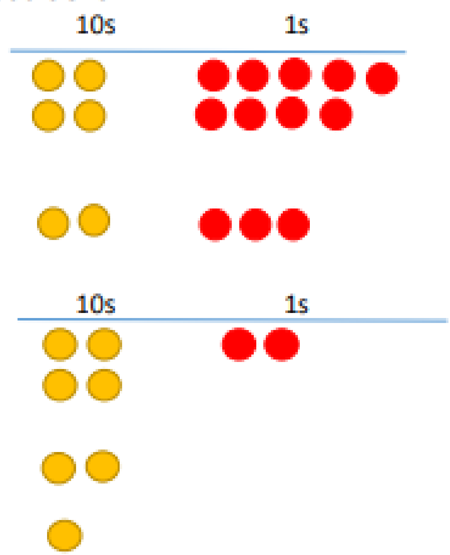
Calculation Guidance: Addition

	Objective	Concrete	Pictorial	Abstract
Year 1	Regrouping to make 10	  6 + 5 = 11 Start with the bigger number and use the smaller number to make 10.	 6 + 5 = 11 4 1 6 + 4 =10 10 + 1 = 11	6 + 5 = 11 Children to develop an understanding of equality e.g. $6 + \square = 11$ $6 + 5 = 5 + \square$ $6 + 5 = \square + 4$
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.

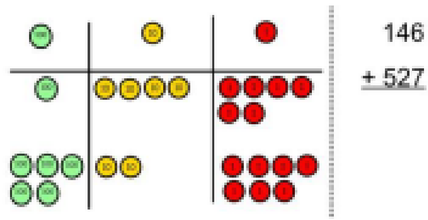
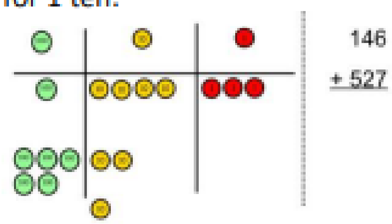
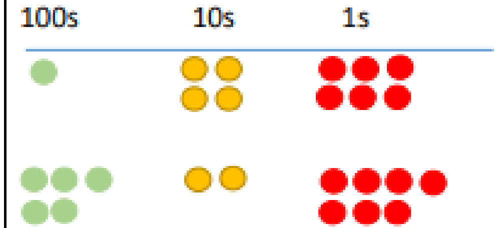
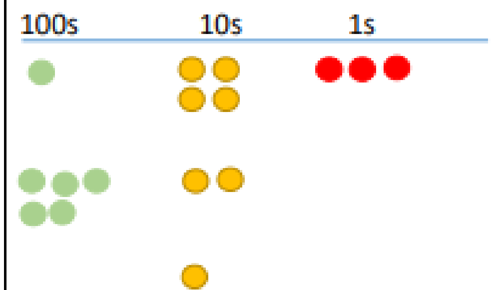
Calculation Guidance: Addition

	Objective	Concrete	Pictorial	Abstract

Year 2	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
				
				  24
				+ 15
				  39

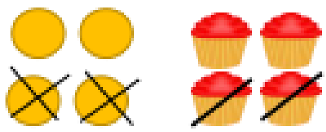
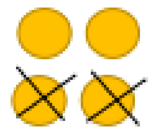
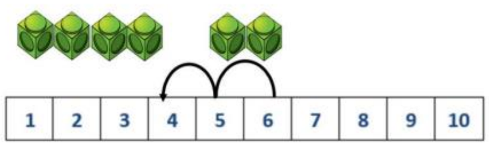
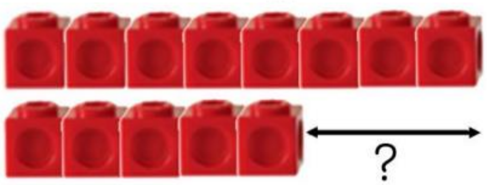
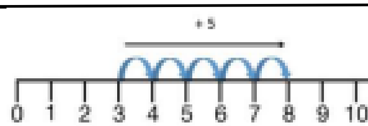
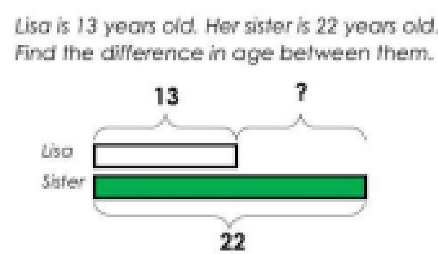
	Column method with regrouping	Make both numbers on a place value grid.  Add up the units and exchange 10 ones for 1 ten. 	Using place value counters, children can draw the counters to help them to solve additions. 	40 + 9 20 + 3 60 + 12 = 72

Calculation Guidance: Addition

	Objective	Concrete	Pictorial	Abstract
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.	100 + 40 + 6 <u>500 + 20 + 7</u> 600 + 70 + 3 = 673 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.		

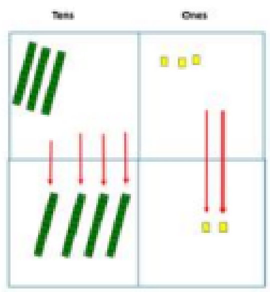
Calculation Guidance: Subtraction

Key language: take away, less than, the difference, subtract, minus, fewer, decrease

	Objective	Concrete	Pictorial	Abstract
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	**Counting back** (using number lines or number tracks) children start with 6 and count back 2. 6 - 2 = 4 	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.
	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.

Calculation Guidance: Subtraction

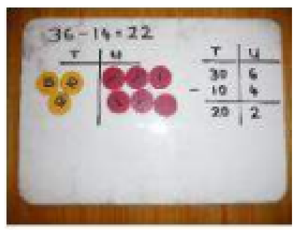
<table>
<tr><th></th><th>Objective</th><th>Concrete</th><th>Pictorial</th><th>Abstract</th></tr>
<tr>
<td>Year 2</td>
<td>Column method without regrouping</td>
<td>
75 – 42 = 33



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.



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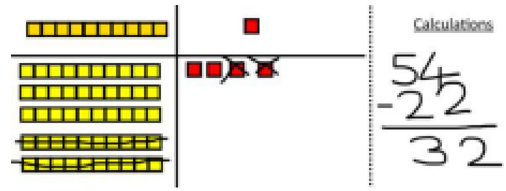
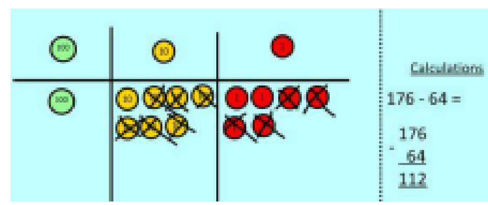
<td>


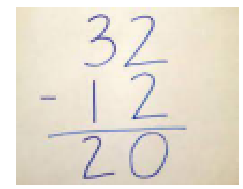
Draw the Base 10 or place value counters alongside the written calculation to help to show working.



</td>
<td>
$47 - 24 = 23$

$$\begin{array}{r} 40 + 7 \\ -\ 20 + 4 \\ \hline 20 + 3 \end{array}$$

This will lead to a clear written column subtraction.

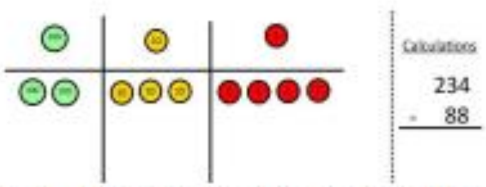


</td>
</tr>
</table>

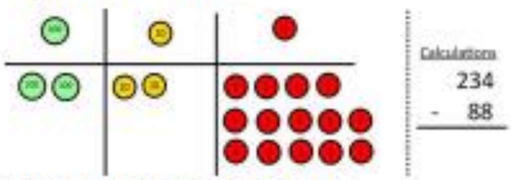
Calculation Guidance: Subtraction

<table>
<tr><th></th><th>Objective</th><th>Concrete</th><th>Pictorial</th><th>Abstract</th></tr>
<tr>
<td>Year 3 onwards</td>
<td>Column method with regrouping</td>
<td>Use Base 10 to start with before moving on to place value counters. Start with one exchange before moving onto subtractions with 2 exchanges.

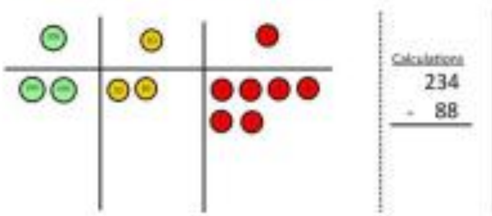
Make the larger number with the place value counters



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.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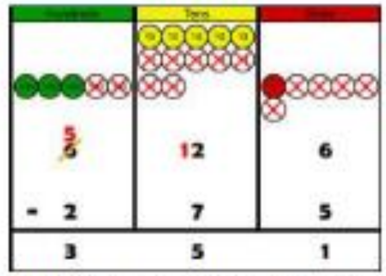
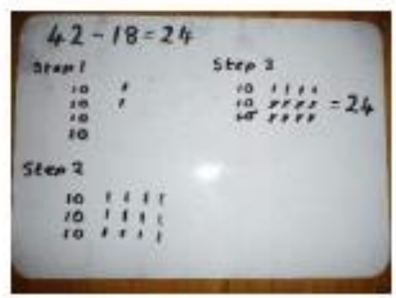
<td>

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.


</td>
<td>

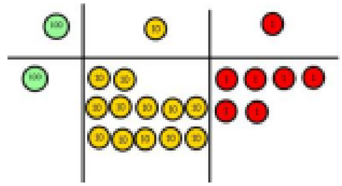
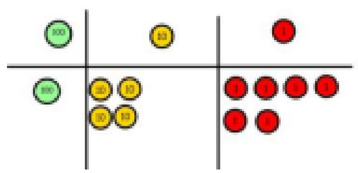
Children can start their formal written method by partitioning the number into clear place value columns.

Moving forward the children use a more compact method.

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

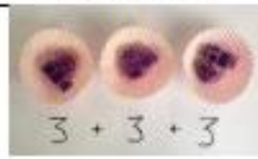
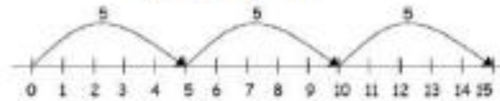
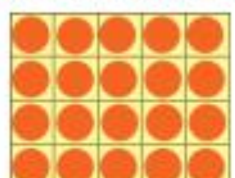
$\begin{array}{rcccc} & {}^{5}\cancel{6} & {}^{12}\cancel{3} & . & {}^{1}0 \\ 2 & 6 & 3 & . & 0 \\ - & 2 & 6 & . & 5 \\ \hline 2 & 3 & 6 & . & 5 \end{array}$</td>
</tr>
</table>

Calculation Guidance: Subtraction

	Objective	Concrete	Pictorial	Abstract
Year 3 up	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.		Calculations $\begin{array}{r} 234 \\ -\ \ 88 \\ \hline \end{array}$ Calculations $\begin{array}{r} {}^{1}\cancel{2}{}^{1}\cancel{3}4 \\ -\ \ 88 \\ \hline 146 \end{array}$ As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here.

Calculation Guidance: Multiplication

Key language: double, times, multiplied by, the product of, groups of, lots of, equal groups, repeated addition.

	Objective	Concrete	Pictorial	Abstract
Year 1/2	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 × 2 = 8 2 × 4 = 8  2 × 4 = 8 4 × 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 x 3 = 15 3 x 5 = 15

Calculation Guidance: Multiplication

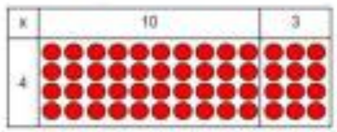
	Objective	Concrete	Pictorial	Abstract

Year 3/4

Grid method

Concrete

Show the link with arrays to first introduce the grid method.

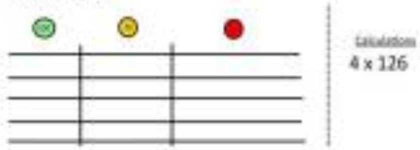


4 rows of 10
4 rows of 3

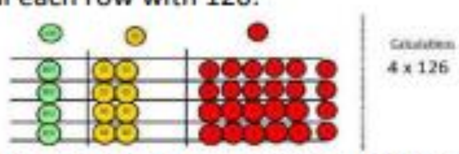
Move on to using Base 10 to move towards a more compact method.

4 rows of 13

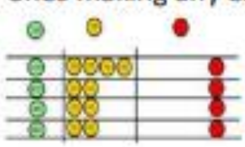
Move on to place value counters to show how we are finding groups of a number. We are multiplying by 4 so we need 4 rows.



Fill each row with 126.



Add up each column, starting with the ones making any exchanges needed.

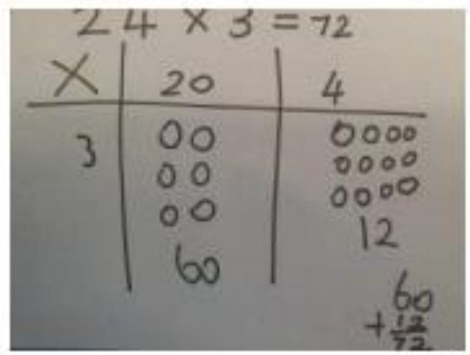


4 × 126 = 504

Pictorial

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.



Abstract

Start with multiplying by one digit numbers and showing the clear addition alongside the grid.

×	30	5
7	210	35

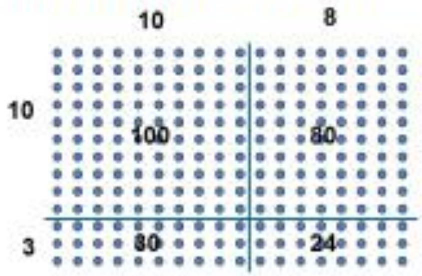
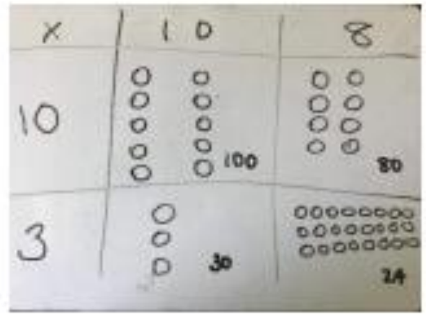
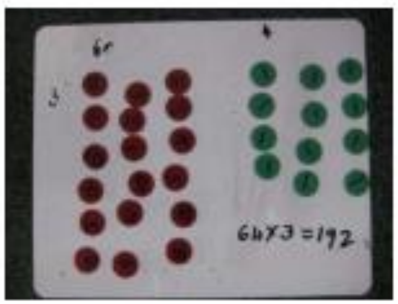
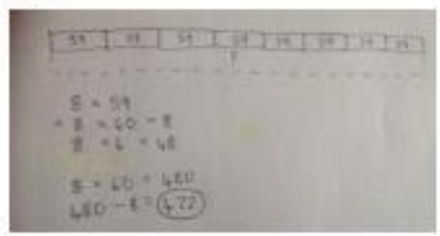
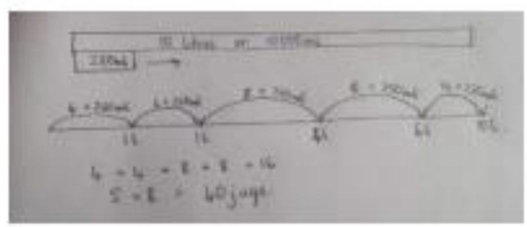
210 + 35 = 245

Moving forward, multiply by a 2 digit number showing the different rows within the grid method.

	10	8
10	100	80
3	30	24

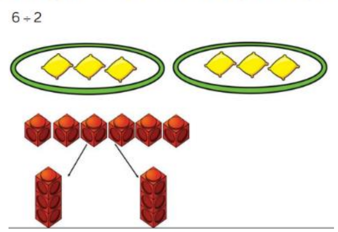
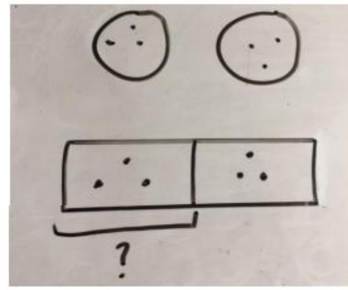
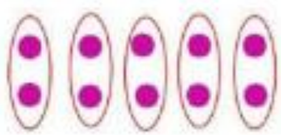
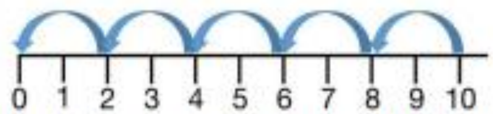
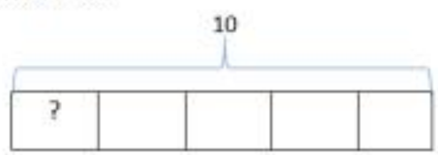
X	1000	300	40	2
10	10000	3000	400	20
8	8000	2400	320	16

Calculation Guidance: Multiplication

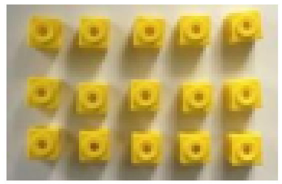
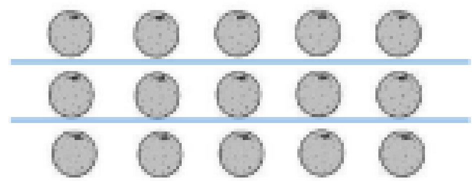
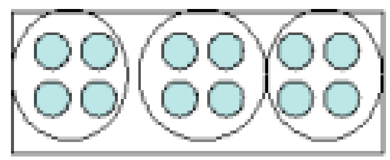
<table>
<tr><th></th><th>Objective</th><th>Concrete</th><th>Pictorial</th><th>Abstract</th></tr>
<tr><td rowspan="2">Year 5/6</td><td>Expanded method</td><td>Show the link with arrays to first introduce the expanded method.
</td><td></td><td>Start with long multiplication, reminding the children about 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</td></tr>
<tr><td>Compact method</td><td>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.</td><td>Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.

</td><td>Start with long multiplication, reminding the children about lining up their numbers clearly in columns.
If it helps, children can write out what they are solving next to their answer.
7 4
x 6 3
1 2
2 1 0
2 4 0
+ 4 2 0 0
4 6 6 2
This moves to the more compact method.
1 3 4 2
x 1 8
1 3 4 2 0
1 0 7 3 6
2 4 1 5 6</td></tr>
</table>

Calculation Guidance: Division

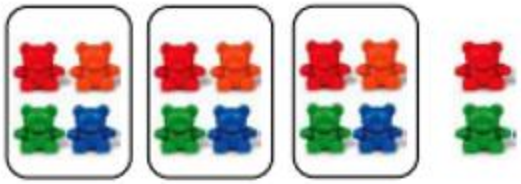
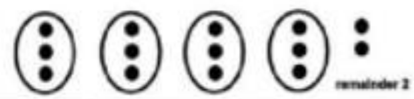
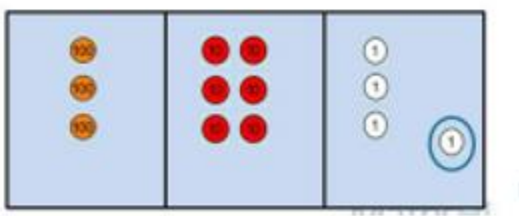
Key language: share, group, divide, divided by, half, repeated subtraction, equal groups, remainder.

	Objective	Concrete	Pictorial	Abstract
Year 1/2	Sharing	I have 6 cubes, can you share them equally between two people? 	Represent the sharing pictorially. 	$6 \div 2 = 3$  Children should also be encouraged to use their 2 times tables facts.
Year 1/2	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.  $10 \div 5 = ?$ $5 \times ? = 10$	$10 \div 5 = 2$ Divide 10 into 5 groups. How many are in each group?

Calculation Guidance: Division

	Objective	Concrete	Pictorial	Abstract
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		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. Students can then progress onto dividing using numberlines (with no remainders) Eg 15 ÷ 3 = 5 0 ---- 5 ---- 10 ---- 15 (1x5) (1x5) (1x5) = 3 lots of 5 15 ÷ 3 = 5 (as 5 x 3 = 15)	Begin with divisions that divide equally with no remainder. $\begin{array}{r} 2\ 1\ 8 \\ 4\overline{)\,8\ 7\ {}^{3}2} \end{array}$

Calculation Guidance: Division

	Objective	Concrete	Pictorial	Abstract
Year 3/4	Division with remainders	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. 29 ÷ 8 = 3 REMAINDER 5 dividend divisor quotient remainder
Year 5/6	Short division with remainders	364 ÷ 3 = 1 2 1 rem 1 3 | 3 6 4 		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 ³3 2 1 8 6 1/5 5 | 9 ⁴3 ³1 1 4 . 6 3 5 | 5 1¹⁶ 1 . ²¹0

Calculation Guidance: Division

	Objective	Concrete	Pictorial	Abstract
Year			When the divisor is greater than 10, pupils will need to use short multiplication to calculate how many times the divisor fits into the dividend.	$14 \times 4 = 56$ $61 - 56 = 5$ $14 \times 3 = 42$ $6160 \div 14 = \underline{440}$ $14 \overline{)\,6^{6}1^{5}6\,0}$ = 0 4 4 0 $16 \times 5 = 80$ $16 \times 6 = 96$ $16 \times 2 = 32$ $99 - 96 = 03$ $992 \div 16 = \underline{62}$ $16 \overline{)\,9^{9}9^{3}2}$ = 0 6 2