

PROGRESSION THROUGH CALCULATION GUIDANCE

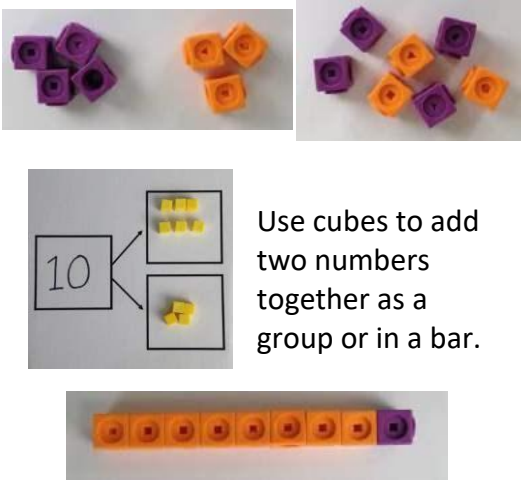
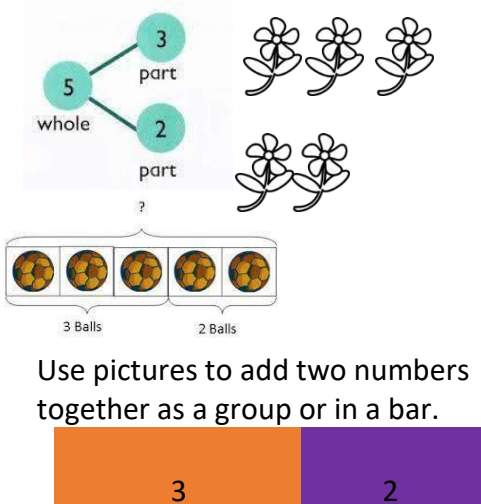
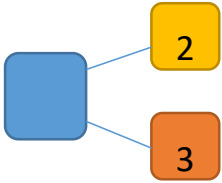
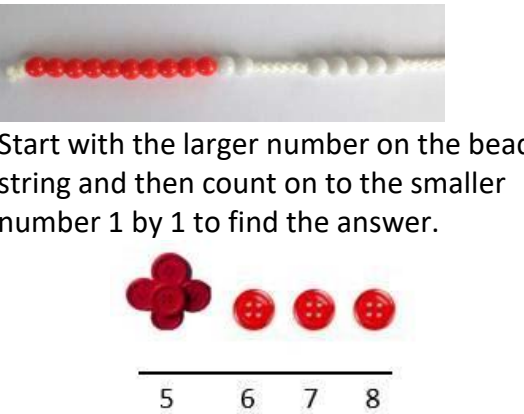

This guidance has been developed from the White Rose Calculation Policy: working document, which was written as a guide to indicate the progression through Addition, Subtraction, Multiplication and

Division in Years 1 – 6.

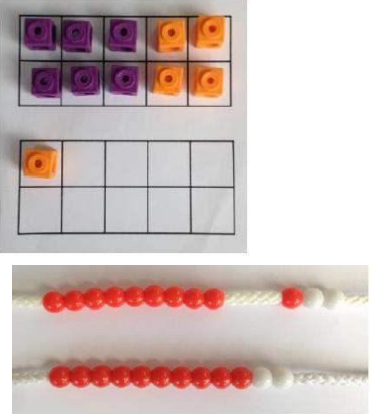
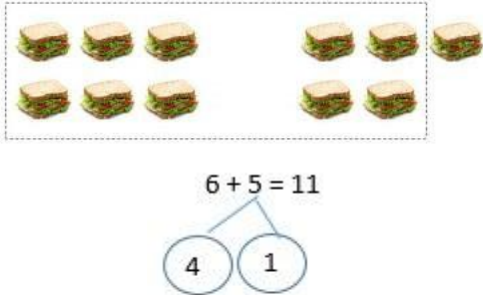
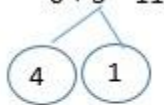
This guidance is our recommendation, in line with the Surrey Plus Maths Hub Primary Subject Knowledge Enhancement Course content.

We welcome any suggestions to this document and are always looking to refine and improve where possible. We hope you find it useful!

CALCULATION GUIDANCE: Addition

	Objective	Concrete	Pictorial	Abstract
Year 1	Number bonds of 5, 6, 7, 8, 9 and 10	 <p>Use cubes to add two numbers together as a group or in a bar.</p>	 <p>Use pictures to add two numbers together as a group or in a bar.</p>	<p> $2 + 3 = 5$ $3 + 2 = 5$ $5 = 3 + 2$ $5 = 2 + 3$ </p>  <p>Use the part-whole diagram as shown above to move into the abstract.</p>
	Counting	 <p>Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer.</p>	<p>Use a number line to count on in ones.</p> 	$5 + 3 = 8$

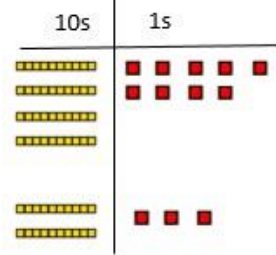
CALCULATION GUIDANCE: Addition

	Objective	Concrete	Pictorial	Abstract
Year 1	Regrouping to make 10	 <p data-bbox="622 1042 752 1070">$6 + 5 = 11$</p> <p data-bbox="407 1145 949 1214">Start with the bigger number and use the smaller number to make 10.</p>	 <p data-bbox="1164 938 1326 1061"> $6 + 5 = 11$  </p> <p data-bbox="1167 1118 1281 1145">$6 + 4 = 10$</p> <p data-bbox="1167 1179 1303 1206">$10 + 1 = 11$</p>	<p data-bbox="1547 403 1675 430">$6 + 5 = 11$</p>

CALCULATION GUIDANCE: Addition

Column method with regrouping

Make both numbers on a place value grid.



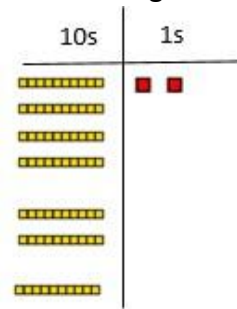
Using place value counters, children can draw the counters to help them to solve additions.

$$40 + 9$$

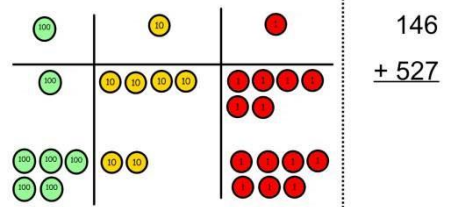
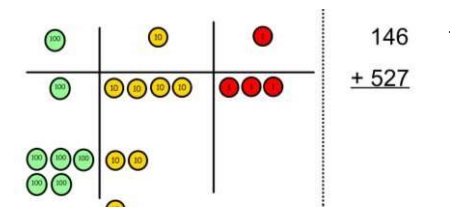
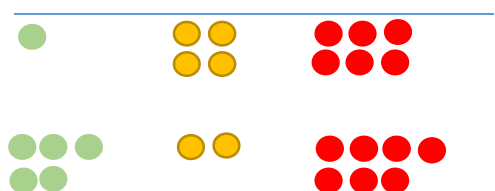
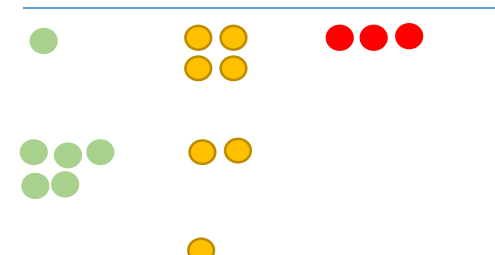
$$\underline{20 + 3}$$

$$60 + 12 = 72$$

Add up the units and exchange 10 ones for 1 ten.



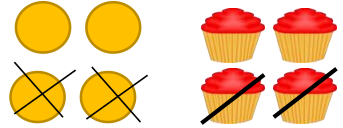
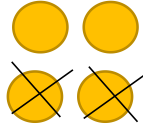

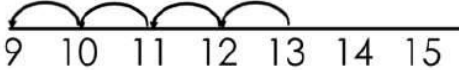
CALCULATION GUIDANCE: Addition

	Objective	Concrete	Pictorial	Abstract
Year 3/4	Column method with regrouping	<p>Make both numbers on a place value grid.</p>  <p>146 + 527</p> <p>Add up the units and exchange 10 ones for 1 ten.</p>  <p>146 + 527</p> <p>As children move on to decimals, money and decimal place value counters can be used to support learning.</p> <p>NB By Year 4 children will progress on to adding four digit numbers.</p>	<p>100s 10s 1s</p>   <p>100s 10s 1s</p> <p>Children can draw a pictorial representation of the columns and place value counters to further support their learning and understanding.</p>	<p>100 + 40 + 6 <u>500 + 20 + 7</u> 600 + 70 + 3 = 673</p> <p>As the children progress, they will move from the expanded to the compacted method.</p> <p>146 + <u>527</u> 673 1</p> <p>As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here.</p>

CALCULATION GUIDANCE: Addition

			NB Addition of money needs to have £ and p added separately.	
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.		

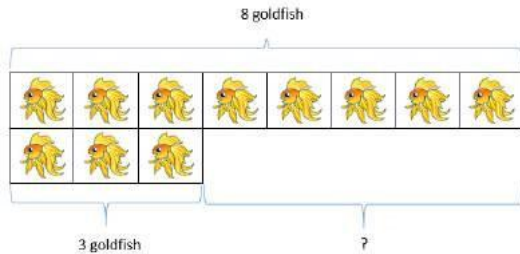
CALCULATION GUIDANCE: Subtraction

	Objective	Concrete	Pictorial	Abstract
Year 1	Taking away ones	<p>Use physical objects, counters, cubes etc. to show how objects can be taken away.</p>  <p>$4 - 2 = 2$</p>	<p>Cross out drawn objects to show what has been taken away.</p>  <p>$4 - 2 = 2$</p>	$4 - 2 = 2$
Year 1	Counting back	<p>Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones.</p>  <p>$13 - 4 = 9$</p>	<p>Count back on a number line or number track</p>  <p>Start at the bigger number and count back the smaller number, showing the jumps on the number line.</p>	<p>Put 13 in your head, count back 4. What number are you at? Use your fingers to help.</p>

CALCULATION GUIDANCE: Subtraction

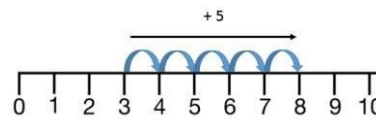
Find the difference

Compare amounts and objects to find the difference.



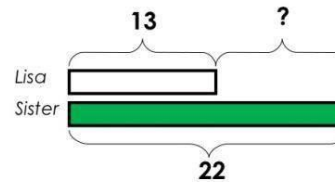
difference.

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.

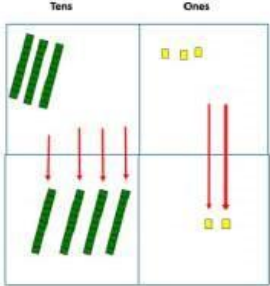
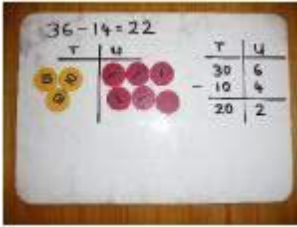
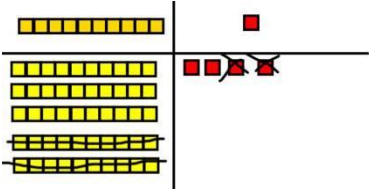
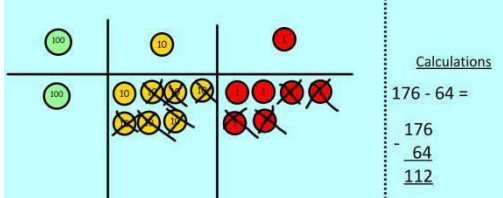
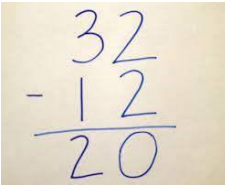
*Lisa is 13 years old. Her sister is 22 years old.
Find the difference in age between them.*



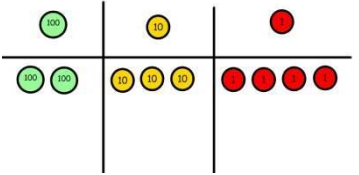
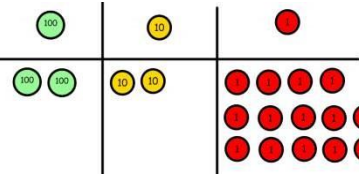
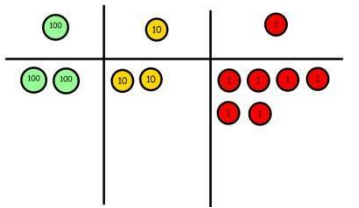
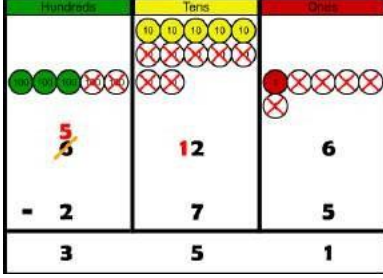
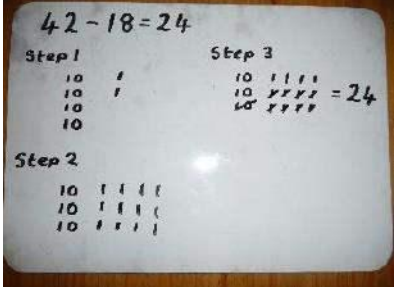
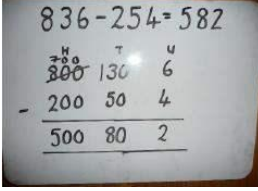
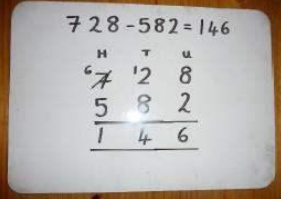
Draw bars to find the difference between 2 numbers.

Hannah has 8 goldfish.
Helen has 3 goldfish.
Find the difference between the number of goldfish the girls have.

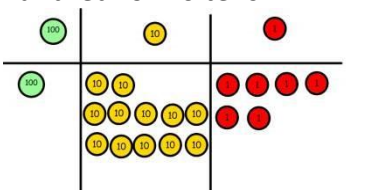
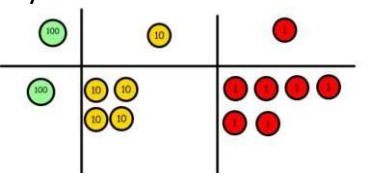
CALCULATION GUIDANCE: Subtraction

	Objective	Concrete	Pictorial	Abstract
Year 2	Column method without regrouping	<p>$75 - 42 = 33$</p>  <p>Use Base 10 to make the bigger number then take the smaller number away.</p> <p>Show how you partition numbers to subtract.</p>  <p>Again make the larger number first.</p>	 <p>Draw the Base 10 or place value counters alongside the written calculation to help to show working.</p>  <p>Calculations</p> $\begin{array}{r} 54 \\ - 22 \\ \hline 32 \end{array}$ <p>Calculations</p> $\begin{array}{r} 176 \\ - 64 \\ \hline 112 \end{array}$	<p>$47 - 24 = 23$</p> $\begin{array}{r} 40 + 7 \\ - 20 + 4 \\ \hline 20 + 3 \end{array}$ <p>This will lead to a clear written column subtraction.</p> 



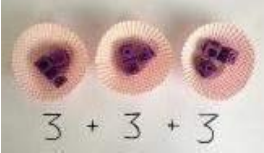

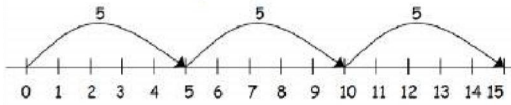

CALCULATION GUIDANCE: Subtraction

	Objective	Concrete	Pictorial	Abstract
Year 3 onwards	Column method with regrouping	<p>Use Base 10 to start with before moving on to place value counters. Start with one exchange before moving onto subtractions with 2 exchanges.</p> <p>Make the larger number with the place value counters</p>  <div style="display: flex; align-items: center;"> <div style="border-left: 1px dashed black; padding-left: 5px;"> <p>Calculations</p> $\begin{array}{r} 234 \\ - 88 \\ \hline \end{array}$ </div> </div> <p>Start with the ones, can I take away 8 from 4 easily? I need to exchange 1 of my tens for 10 ones.</p>  <div style="display: flex; align-items: center;"> <div style="border-left: 1px dashed black; padding-left: 5px;"> <p>Calculations</p> $\begin{array}{r} 234 \\ - 88 \\ \hline \end{array}$ </div> </div> <p>Now I can subtract my ones.</p>  <div style="display: flex; align-items: center;"> <div style="border-left: 1px dashed black; padding-left: 5px;"> <p>Calculations</p> $\begin{array}{r} 234 \\ - 88 \\ \hline \end{array}$ </div> </div>	 <p>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.</p> <p>When confident, children can find their own way to record the exchange/regrouping.</p> <p>Just writing the numbers as shown here shows that the child understands the method and knows when to exchange/regroup.</p> 	 <p>Children can start their formal written method by partitioning the number into clear place value columns.</p>  <p>Moving forward the children use a more compact method.</p> <p>This will lead to an understanding of subtracting any number including decimals.</p> $\begin{array}{r} 5 \quad 12 \quad 1 \\ 2 \quad \cancel{6} \quad \cancel{3} \quad . \quad 0 \\ - \quad 2 \quad 6 \quad . \quad 5 \\ \hline 2 \quad 3 \quad 6 \quad . \quad 5 \end{array}$

CALCULATION GUIDANCE: Subtraction

	Objective	Concrete	Pictorial	Abstract
Year 3 up	Column method with regrouping	<p>Now look at the tens, can I take away 8 tens easily? I need to exchange 1 hundred for 10 tens.</p>  <p>Calculations</p> $\begin{array}{r} 234 \\ - 88 \\ \hline \end{array}$ <p>Now I can take away 8 tens and complete my subtraction.</p>  <p>Calculations</p> $\begin{array}{r} 234 \\ - 88 \\ \hline 146 \end{array}$ <p>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.</p>		

CALCULATION GUIDANCE: Multiplication

	Objective	Concrete	Pictorial	Abstract
Year 1/2	Repeated addition	  	<p>There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there?</p>  	<p>Write addition sentences to describe objects and pictures.</p>  $2 + 2 + 2 = 6$
		Use different objects to add equal groups.		

CALCULATION GUIDANCE: Multiplication

Arrays- showing commutative multiplication

Create arrays using counters/cubes to show multiplication sentences.

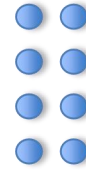


Draw arrays in different rotations to find **commutative** multiplication sentences.



$$2 \times 4 = 8$$

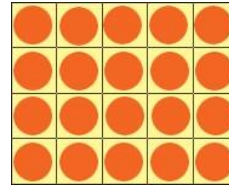
$$4 \times 2 = 8$$



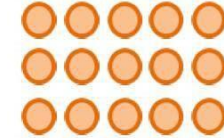
$$2 \times 4 = 8$$

$$4 \times 2 = 8$$

Link arrays to area of rectangles.



Use an array to write multiplication sentences and reinforce repeated addition.



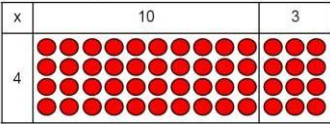
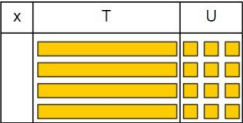
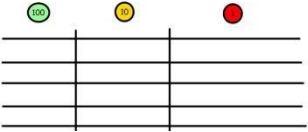
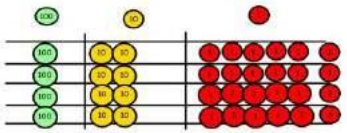
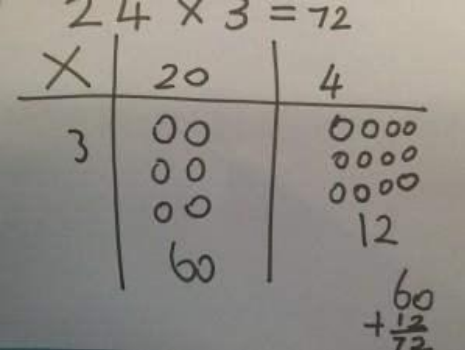
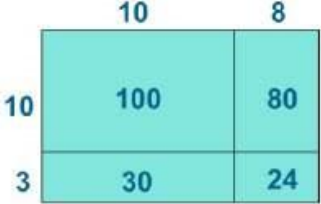
$$5 + 5 + 5 = 15$$

$$3 + 3 + 3 + 3 + 3 = 15$$

$$5 \times 3 = 15$$

$$3 \times 5 = 15$$

CALCULATION GUIDANCE: Multiplication

	Objective	Concrete	Pictorial	Abstract																					
Year 3/4	Grid method	<p>Show the link with arrays to first introduce the grid method.</p>  <p>4 rows of 10 4 rows of 3</p> <p>Move on to using Base 10 to move towards a more compact method.</p>  <p>4 rows of 13</p> <p>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.</p>  <p>Calculations 4 x 126</p> <p>Fill each row with 126.</p>  <p>Calculations 4 x 126</p> <p>Add up each column, starting with the ones making any exchanges needed.</p>	<p>Children can represent the work they have done with place value counters in a way that they understand.</p> <p>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.</p> 	<p>Start with multiplying by one digit numbers and showing the clear addition alongside the grid.</p> <table border="1" data-bbox="1563 406 1892 502"> <tr> <td>x</td> <td>30</td> <td>5</td> </tr> <tr> <td>7</td> <td>210</td> <td>35</td> </tr> </table> <p>$210 + 35 = 245$</p> <p>Moving forward, multiply by a 2 digit number showing the different rows within the grid method.</p>  <table border="1" data-bbox="1563 1061 1982 1260"> <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>	x	30	5	7	210	35	X	1000	300	40	2	10	10000	3000	400	20	8	8000	2400	320	16
x	30	5																							
7	210	35																							
X	1000	300	40	2																					
10	10000	3000	400	20																					
8	8000	2400	320	16																					

CALCULATION GUIDANCE: Multiplication

The diagram illustrates the multiplication of 126 by 4 using base ten blocks and a place value chart. On the left, a place value chart shows 1 hundred block, 2 ten rods, and 6 one units. To its right, a place value chart shows 4 hundreds, 0 tens, and 4 ones. Below the first chart is the equation $\times 126 = 504$.

Objective

Concrete

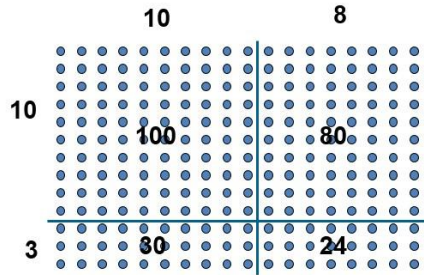
Pictorial

Abstract

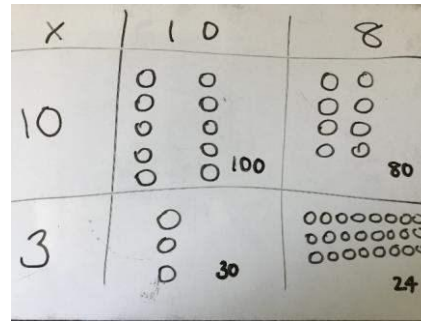
CALCULATION GUIDANCE: Multiplication

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.

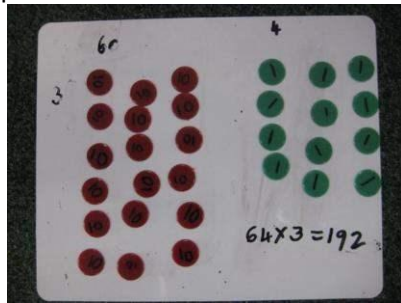
$$\begin{array}{r}
 18 \\
 \times 13 \\
 \hline
 24 \text{ (3 x 8)} \\
 30 \text{ (3 x 10)} \\
 80 \text{ (10 x 8)} \\
 \hline
 100 \text{ (10 x 10)} \\
 234
 \end{array}$$

CALCULATION GUIDANCE: Multiplication

Year 5/6

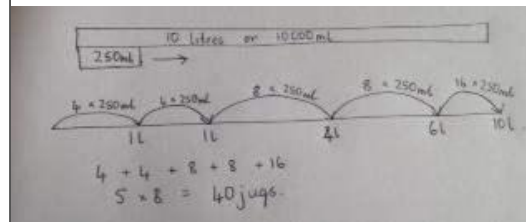
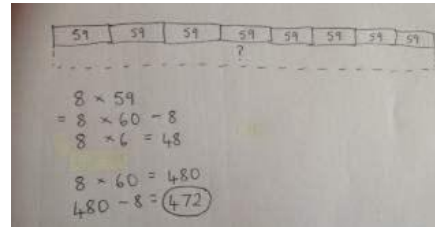
Compact method

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.



Start with long multiplication, reminding the children about lining up their numbers clearly in columns.


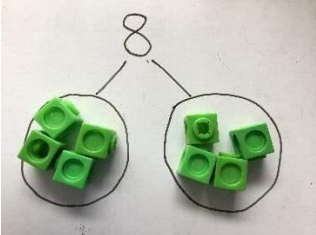
If it helps, children can write out what they are solving next to their answer.

$$\begin{array}{r}
 74 \\
 \times 63 \\
 \hline
 212 \\
 440 \\
 \hline
 4662
 \end{array}$$

This moves to the more compact method.

$$\begin{array}{r}
 74 \\
 \times 63 \\
 \hline
 212 \\
 440 \\
 \hline
 4662
 \end{array}$$

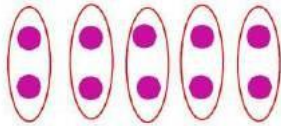
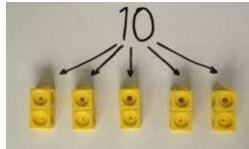
CALCULATION GUIDANCE: Division

	Objective	Concrete	Pictorial	Abstract
Year 1/2	Sharing	I have 8 cubes, can you share them equally between two people?	<p>Children use pictures or shapes to share quantities.</p>  <p>$8 \div 2 = 4$</p>	<p>Share 8 buns between two people. $8 \div 2 =$</p>  <p>4</p>

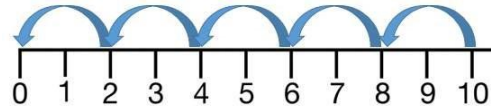
CALCULATION GUIDANCE: Division

Grouping

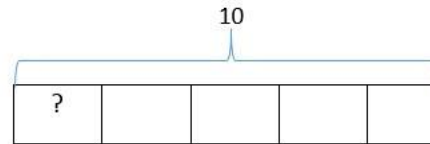
Divide quantities into equal groups.
Use cubes, counters, objects or place value counters to aid understanding.



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



$$10 \div 5 = ?$$

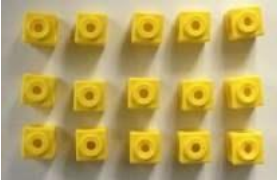
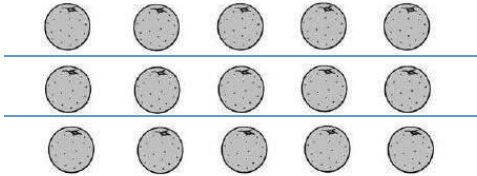
$$5 \times ? = 10$$

group.

$$10 \div 5 = 2$$

Divide 10 into 5 groups. How many are in each group?

CALCULATION GUIDANCE: Division

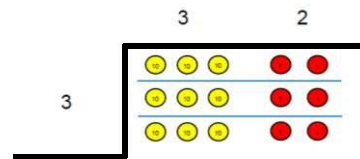
	Objective	Concrete	Pictorial	Abstract
Year 3/4	Division with arrays	<p>Link division to multiplication by creating an array and thinking about the number sentences that can be created.</p>  <p>Eg $15 \div 3 = 5$ $5 \times 3 = 15$ $15 \div 5 = 3$ $3 \times 5 = 15$</p>	<p>Draw an</p>  <p>array and use lines to split the array into groups to make multiplication and division sentences.</p>	<p>Find the inverse of multiplication and division sentences by creating four linking number sentences.</p> <p>$5 \times 3 = 15$ $3 \times 5 = 15$ $15 \div 5 = 3$ $15 \div 3 = 5$</p>

CALCULATION GUIDANCE: Division

Short division

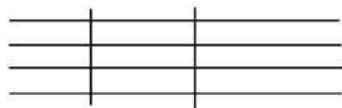
Use place value counters to divide using the short division method alongside.

$$96 \div 3$$



$$42 \div 3$$

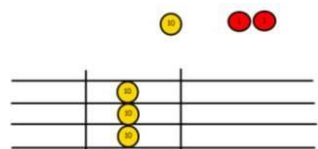
Start with the biggest place value.



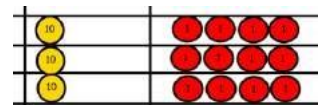
We are

sharing 40 into three groups. We can put 1 ten in each group and we have 1 ten left over.

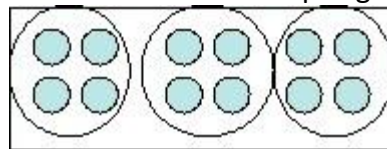
We exchange this ten for 10 ones and then share the ones equally among the groups. We



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.

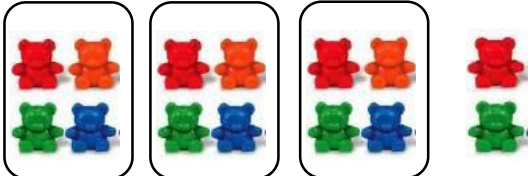
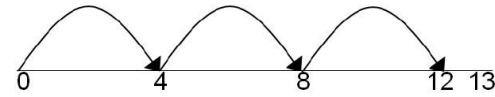
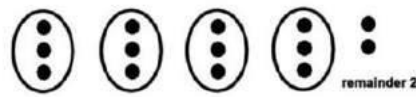
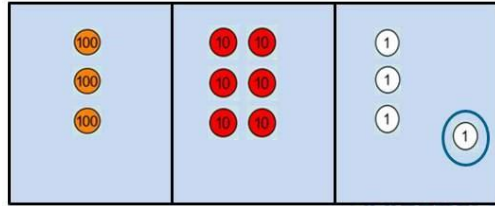


Encourage them to move towards counting in multiples to divide more efficiently.

Begin with divisions that divide equally with no remainder.

$$\begin{array}{r} 218 \\ 3 \overline{) 872} \end{array}$$

CALCULATION GUIDANCE: Division

	Objective	Concrete	Pictorial	Abstract
Year 5/6	Division with remainders	$14 \div 3 =$ 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. $\begin{array}{ccccccc} 29 \div 8 = 3 \text{ REMAINDER } 5 \\ \uparrow \quad \uparrow \quad \uparrow \quad \quad \quad \uparrow \\ \text{dividend} \quad \text{divisor} \quad \text{quotient} \quad \quad \quad \text{remainder} \end{array}$
	Short division with remainders	$364 \div 3 =$ $\begin{array}{r} 121 \text{ rem } 1 \\ 3 \overline{) 364} \end{array}$ 		Move onto divisions with a remainder. Once children understand remainders, begin to express as a fraction or decimal according to the context. $\begin{array}{r} 86 \text{ r } 2 \\ 5 \overline{) 432} \end{array}$ $\begin{array}{r} 186 \frac{1}{5} \\ 5 \overline{) 931} \end{array}$ $\begin{array}{r} 14.6 \\ 35 \overline{) 511.0} \end{array}$

CALCULATION GUIDANCE: Division

	Objective	Concrete	Pictorial	Abstract
Year 6	Long division			<p>Children will use long division to divide numbers with up to 4 digits by 2 digit numbers.</p> $ \begin{array}{r} 015 \\ 32 \overline{) 487} \\ \underline{-0} \\ 48 \\ \underline{-32} \\ 167 \\ \underline{-160} \\ 7 \end{array} $ $ \begin{array}{r} 17 \text{ r } 19 \\ 31 \overline{) 546} \\ \underline{31} \\ 236 \\ \underline{217} \\ 19 \end{array} $