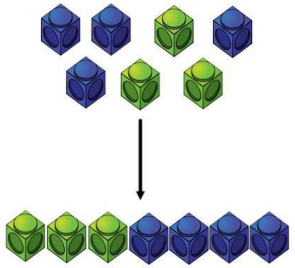
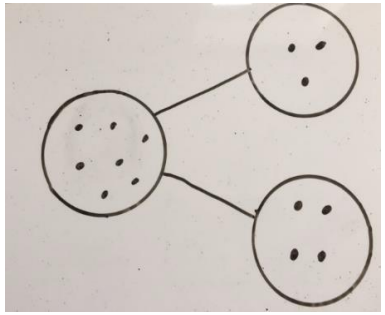
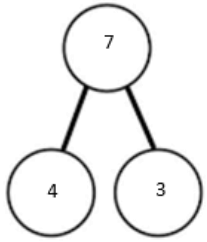
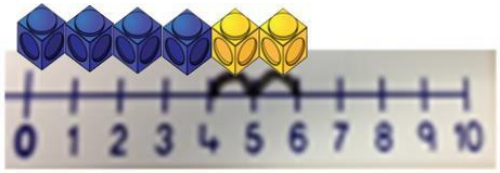
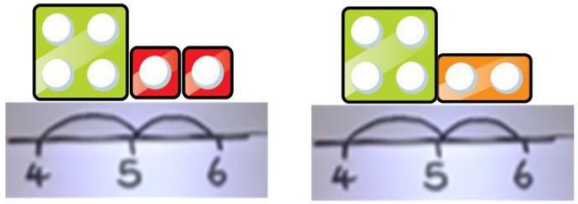
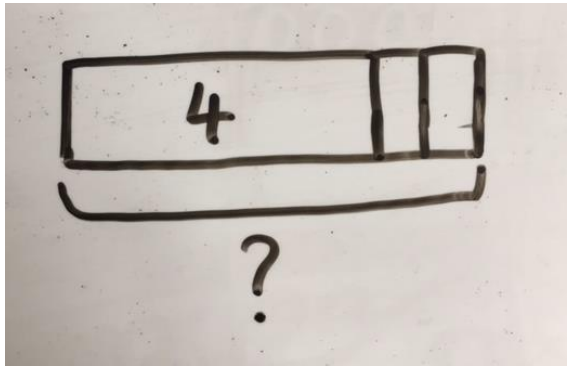
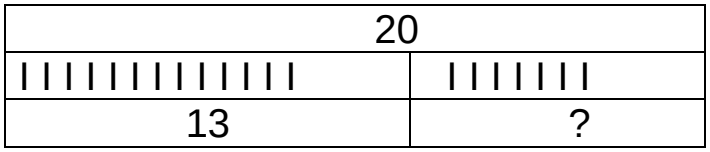
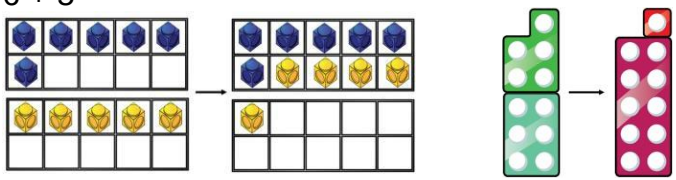
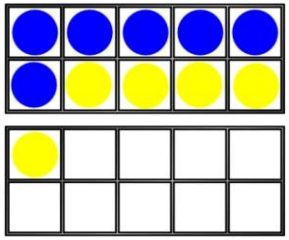
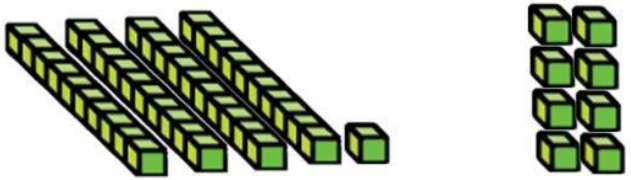
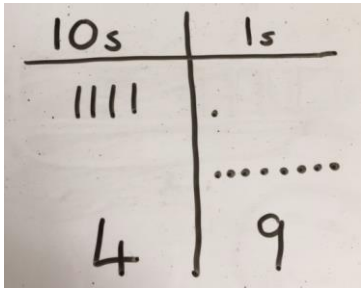
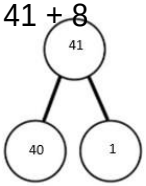
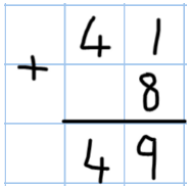
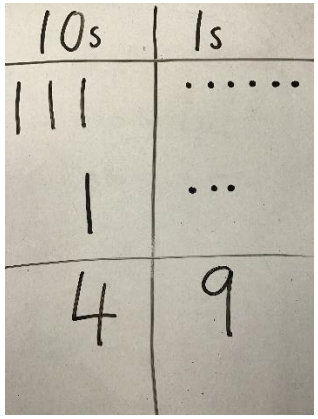
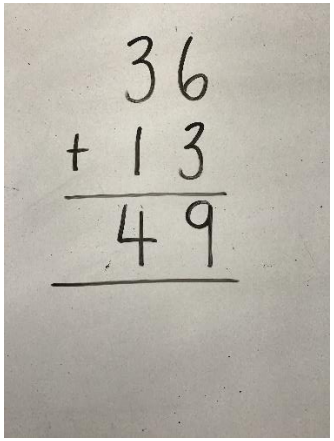
Calculation policy: Addition

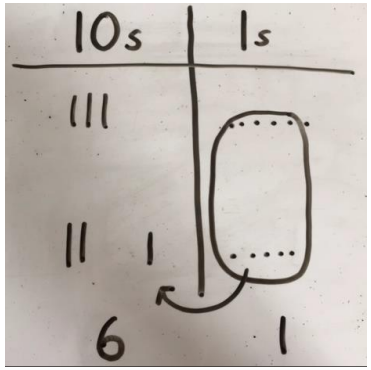
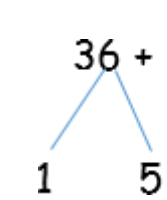
Key language: sum, total, parts and wholes, plus, add, altogether, more, ‘is equal to’ ‘is the same as’.

Concrete	Pictorial	Abstract
Combining two parts to make a whole (use other resources too e.g. eggs, shells, teddy bears, cars, cups). 	Children to represent the cubes using dots or crosses. They could put each part on a part whole model too.  Next step is to include numbers	4 + 3 = 7 Four is a part, 3 is a part and the whole is seven. 
Counting on using number lines using cubes, cups or Numicon.  	A bar model which encourages the children to count on, rather than count all. 	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 

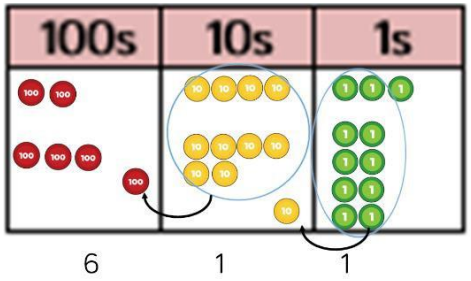
	13 + ? = 20  With missing number calculations, put 13 in the bar and count on in second part of the bar until you make 20	

<table>
<tr>
<td>Regrouping to make 10; using ten frames and counters/cubes, cups or using Numicon.
6 + 5
  </td>
<td>Children to draw the ten frame and counters/cubes, cups, egg cartons etc.
  </td>
<td>Children to develop an understanding of equality e.g.
$6 + \square = 11$
$6 + 5 = 5 + \square$
$6 + 5 = \square + 4$</td>
</tr>
<tr>
<td>TO + O using base 10. Continue to develop understanding of partitioning and place value.
41 + 8
  </td>
<td>Children to represent the base 10 e.g. lines for tens and dot/crosses for ones.
 
Use of number lines to count on</td>
<td>41 + 8
 
1 + 8 = 9
40 + 9 = 49
  </td>
</tr>
<tr>
<td>TO + TO- no tricky columns. Use of place value counters and dienes

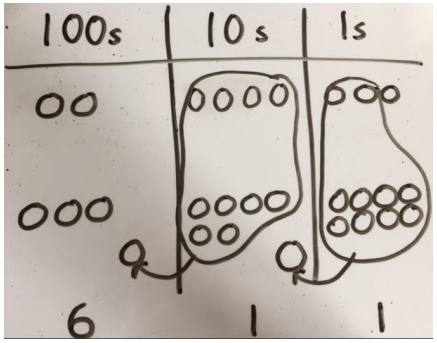
36 + 13</td>
<td>  </td>
<td>  </td>
</tr>
</table>

TO + TO using base 10. Continue to develop understanding of partitioning and place value. 36 + 25- involves 'tricky' columns	Children to represent the base 10 in a place value chart.  	Looking for ways to make 10.  30 + 20 = 50 5 + 5 = 10 50 + 10 + 1 = 61 Formal method: 36 +25 61 1

Use of place value counters to add HTO + TO, HTO + HTO etc. When there are 10 ones in the 1s column- we exchange for 1 ten, when there are 10 tens in the 10s column- we exchange for 1 hundred.



Children to represent the counters in a place value chart, circling when they make an exchange.



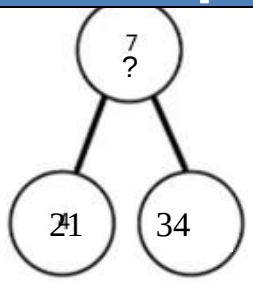
$$\begin{array}{r} 243 \\ +368 \\ \hline 611 \\ \hline 1\ 1 \end{array}$$

4 digit + + decimals

$$\begin{array}{r} 7.9 \\ +\ 3.26 \\ \hline 11.16 \\ \hline 1 \end{array}$$

Ensure place value of digits to line columns up

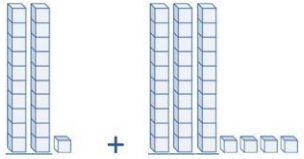
Conceptual variation; different ways to ask children to solve 21 + 34



Word problems:
In year 3, there are 21 children and in year 4, there are 34 children.
How many children in total?

$$\begin{array}{r} 21 \\ +34 \\ \hline \\ \hline \end{array}$$

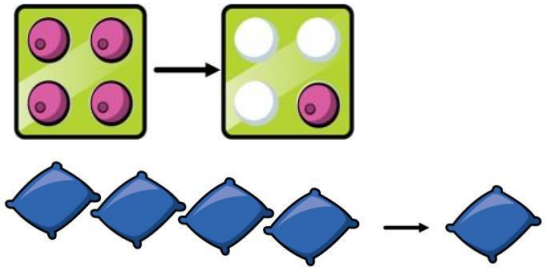
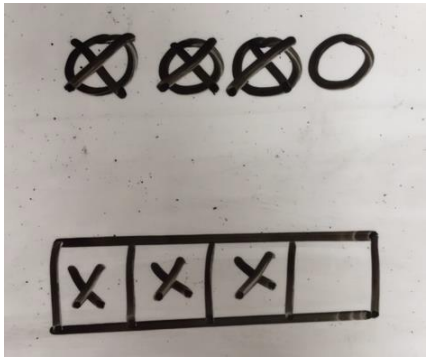
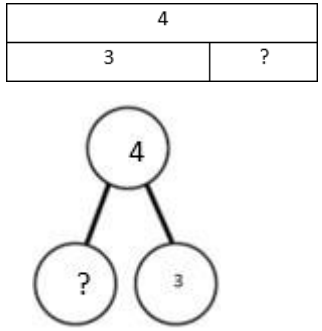
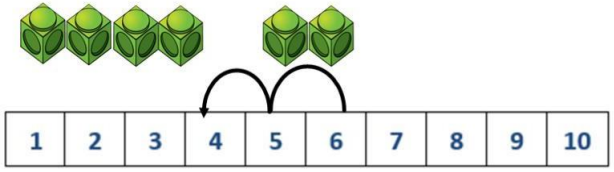
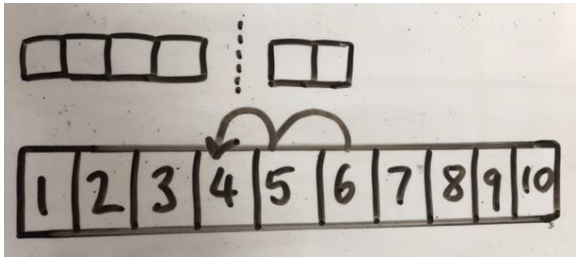
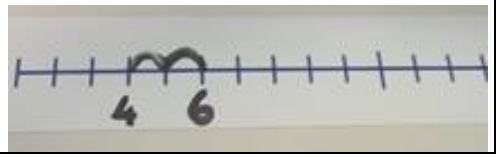
21 + 34 =

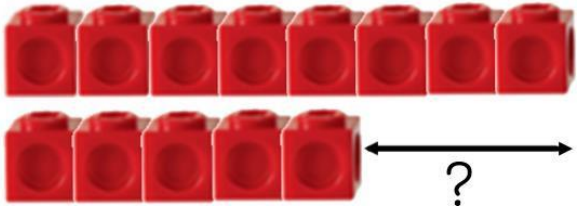
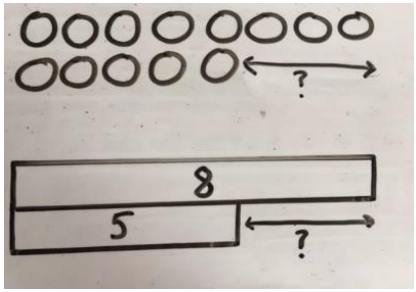
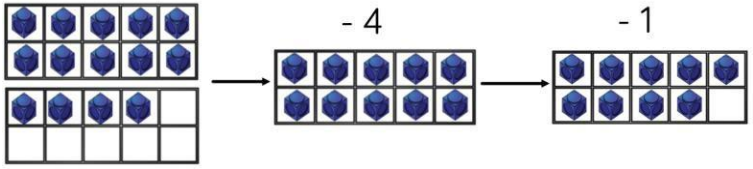
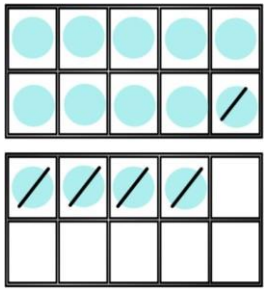
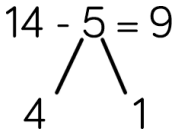
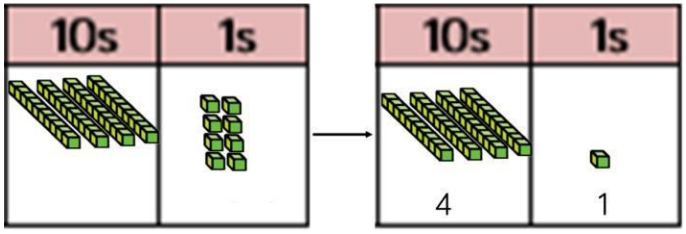
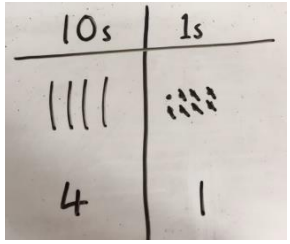
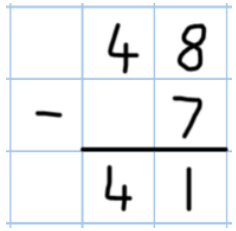


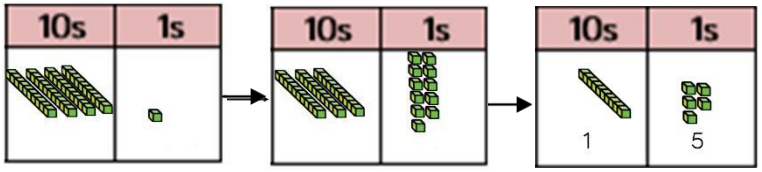
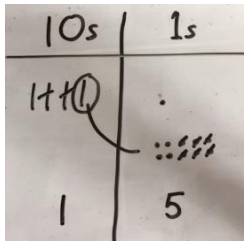
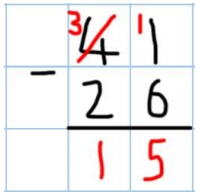
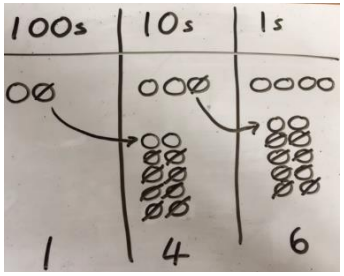
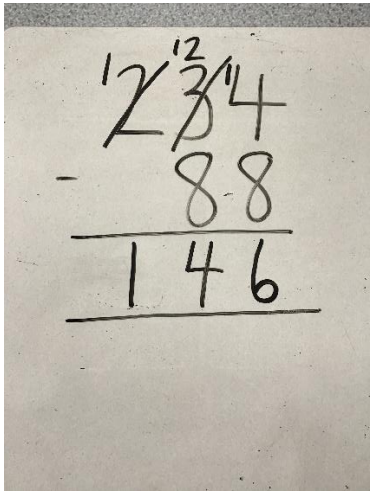
<table><tr><td colspan="2">?</td></tr><tr><td>21</td><td>34</td></tr></table>		☐ = 21 + 34 Calculate the sum of twenty-one and thirty-four.	Missing digit problems: 2 1 + 3 ? ? 5  Use this to extend and apply to solve other + calculations with increasing complexity

Calculation policy: Subtraction

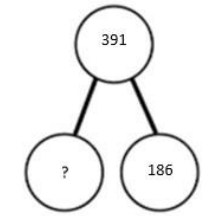
Key language: take away, less than, the difference, subtract, minus, fewer, decrease

Concrete	Pictorial	Abstract
Physically taking away and removing objects from a whole (ten frames, Numicon, cubes, cups and other items such as beanbags could be used). 4 – 3 = 1 	Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also be used. 	**4- 3 =** **= 4 – 3** 
Counting back (using number lines or number tracks) children start with 6 and count back 2. 6 – 2 = 4 	Children to represent what they see pictorially e.g. 	Children to represent the calculation on a number line or number track and show their jumps. Encourage children to use an empty number line  

Finding the difference (using cubes, cups, Numicon or other objects can also be used). Calculate the difference between 8 and 5. 	Children to draw the cubes/other concrete objects which they have used or use the bar model to illustrate what they need to calculate. 	Find the difference between 8 and 5. 8 – 5, the difference is ☐ Children to explore why 9 - 6 = 8 – 5 = 7 – 4 have the same difference.
Making 10 using ten frames. 14 – 5 	Children to present the ten frame pictorially and discuss what they did to make 10. 	Children to show how they can make 10 by partitioning.  14 – 4 =10 10 – 1 = 9
Column method using base 10. 48-7 	Children to represent the base 10 pictorially. 	Column method or children could count back 7. 

Column method using base 10 and having to exchange. 41 – 26  Physically remove manipulatives	Represent the base 10 pictorially, remembering to show the exchange.  	Formal column method. Children must understand that when they have exchanged the 10 they still have 41 because 41 = 30 + 11. 
Column method using place value counters. 234 – 88	Represent the place value counters pictorially; remembering to show what has been exchanged.  	Formal column method. Children must understand what has happened when they have crossed out digits.  Formal method as above with 4 digits + and decimals

Conceptual variation; different ways to ask children to solve 391 - 186



391	
186	?

Raj spent £391, Timmy spent £186.
How much more did Raj spend?

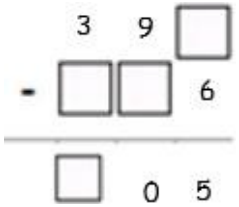
Calculate the difference between 391 and 186.

☐ = 391 – 186

391
-186
———

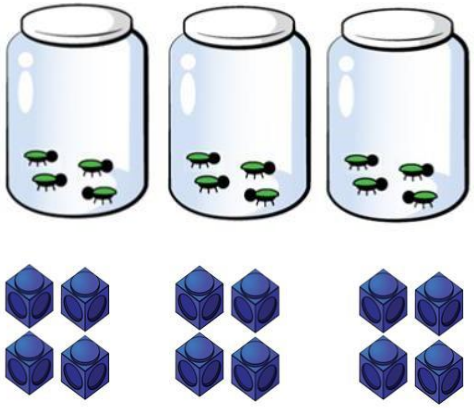
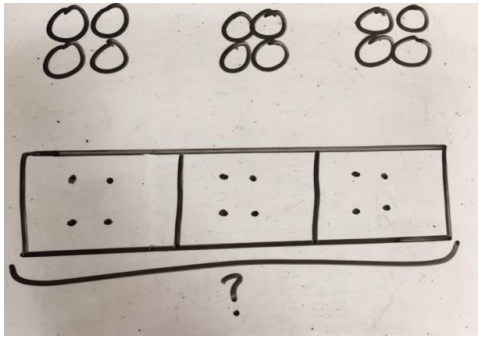
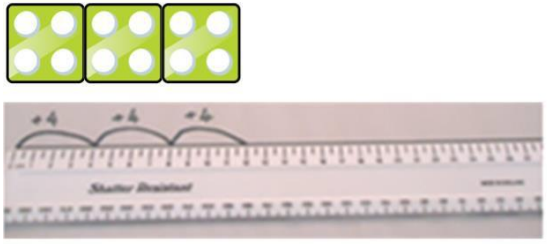
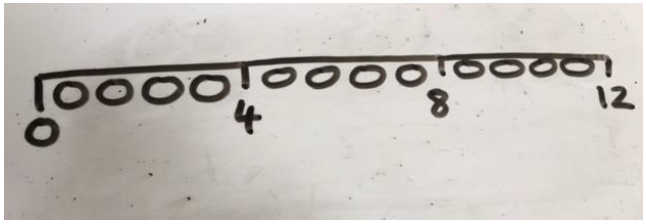
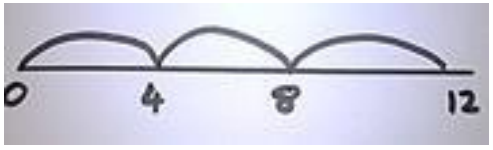
What is 186 less than 391?

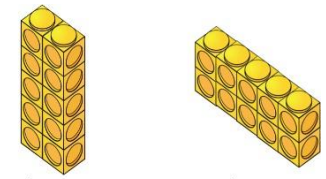
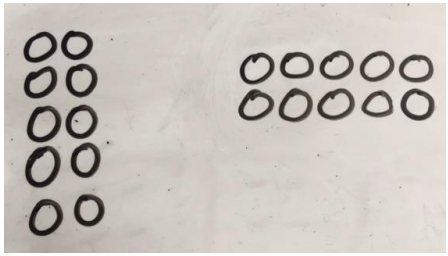
Missing digit calculations



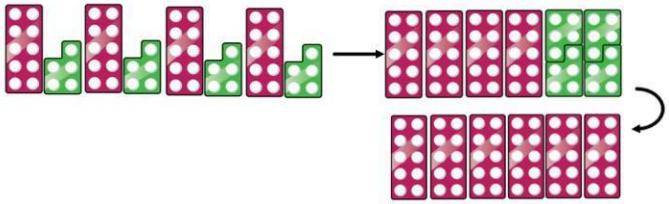
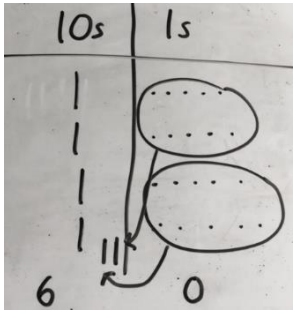
Calculation policy: Multiplication

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

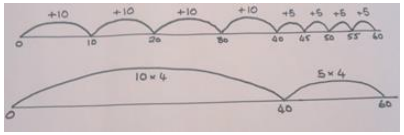
Concrete	Pictorial	Abstract
Repeated grouping/repeated addition 3 × 4 4 + 4 + 4 There are 3 equal groups, with 4 in each group. 	Children to represent the practical resources in a picture and use a bar model. 	3 × 4 = 12 4 + 4 + 4 = 12
Number lines to show repeated groups- 3 × 4 	Represent this pictorially alongside a number line e.g.: 	Abstract number line showing three jumps of four. 3 × 4 = 12 

<table>
<tr>
<td>Use arrays to illustrate commutativity counters and other objects can also be used.
2 × 5 = 5 × 2
 
2 lots of 5 5 lots of 2</td>
<td>Children to represent the arrays pictorially.
  </td>
<td>Children to be able to use an array to write a range of calculations e.g.

10 = 2 × 5
5 × 2 = 10
2 + 2 + 2 + 2 + 2 = 10
10 = 5 + 5</td>
</tr>
<tr>
<td>Partition to multiply using Numicon, base 10 (Dienes)

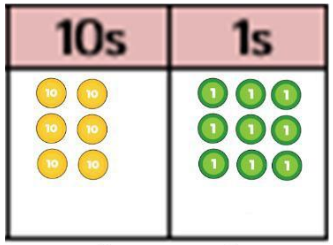
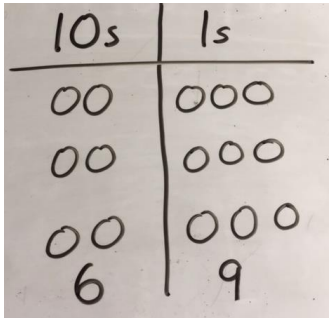
4 × 15
  </td>
<td>Children to represent the concrete manipulatives pictorially.
 
</td>
<td>Children to be encouraged to show the steps they have taken.
4 x 15
10 5

10 x 4 = 40
5 x 4 = 20
40 + 20 = 60

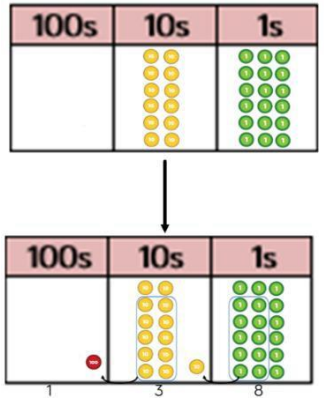
A number line can also be used
 

Multiplication grid uses partitioning. Add columns and rows to the grid according to digits in numbers used

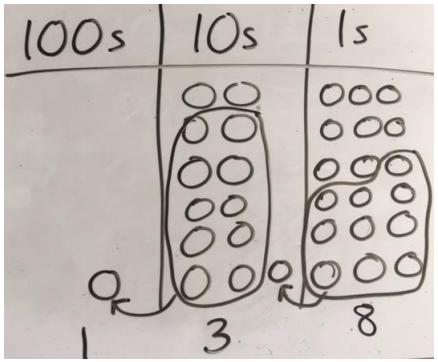
<table>
<tr><td>x</td><td>4</td></tr>
<tr><td>10</td><td>40</td></tr>
<tr><td>5</td><td>20</td></tr>
<tr><td></td><td>60</td></tr>
</table>
</td>
</tr>
</table>

Formal column method with place value counters (base 10 can also be used.) 3 × 23  	Children to represent the counters pictorially.  	Children to record what it is they are doing to show understanding. 3 × 23 3 × 20 = 60 3 × 3 = 9 20 3 60 + 9 = 69 23 × 3 69

Formal column method with place value counters.
6 x 23



Children to represent the counters/base 10, pictorially e.g. the image below.



Formal written method

$$6 \times 23 =$$

$$\begin{array}{r} 23 \\ \times\ 6 \\ \hline 138 \\ \hline 1\ 1 \end{array}$$

When children start to multiply TO x TO and HTO × TO and ThHTU × TO etc., they should be confident with the abstract:

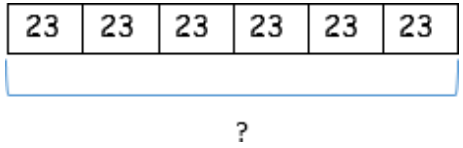
To get 744 children have solved 6 × 124.
To get 2480 they have solved 20 × 124.

Know commutativity rule

$$\begin{array}{r} 1\ 2\ 4 \\ \times\ \ 2\ 6 \\ \hline 7\ 4\ 4 \\ 2\ 4\ 8\ 0 \\ \hline 3\ 2\ 2\ 4 \\ \hline 1\ 1 \end{array}$$

Answer: 3224

Conceptual variation; different ways to ask children to solve 6 × 23



Mai had to swim 23 lengths, 6 times a week.
How many lengths did she swim in one week?

With the counters, prove that 6 x 23 = 138

Find the product of 6 and 23

6 × 23 =

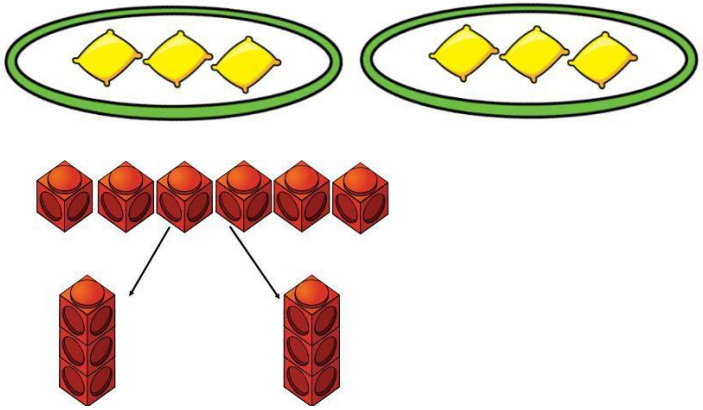
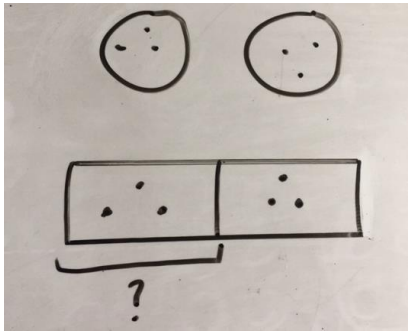
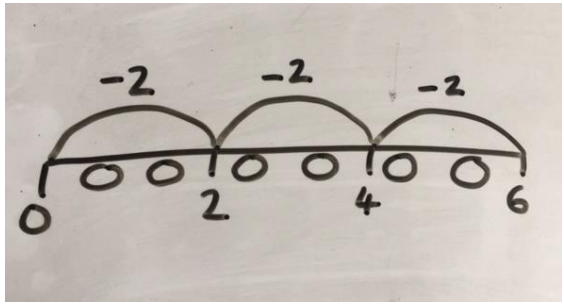
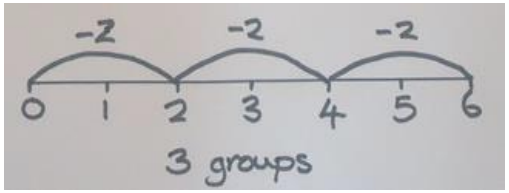
☐ = 6 × 23

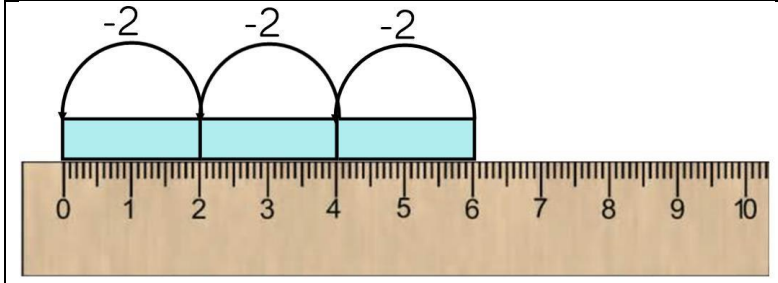
$$\begin{array}{r} 6 \\ \times\ 23 \\ \hline \\ \hline \end{array} \qquad \begin{array}{r} 23 \\ \times\ 6 \\ \hline \\ \hline \end{array}$$

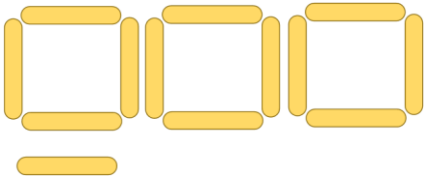
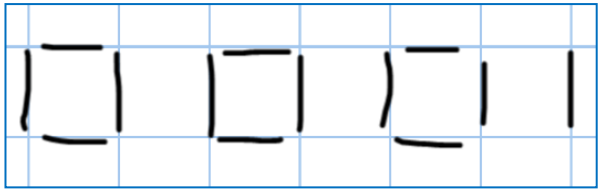
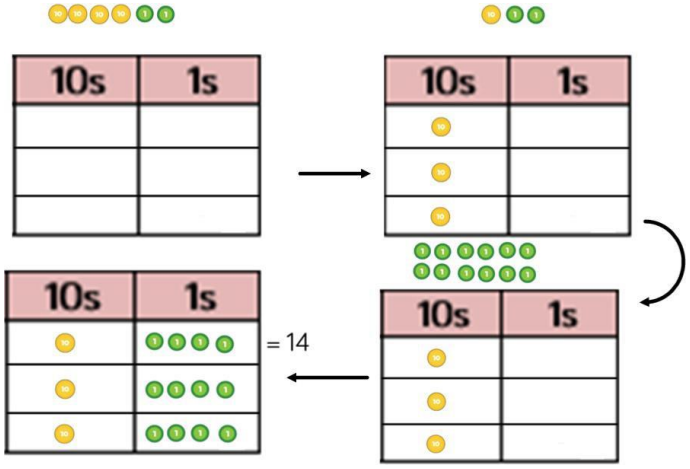
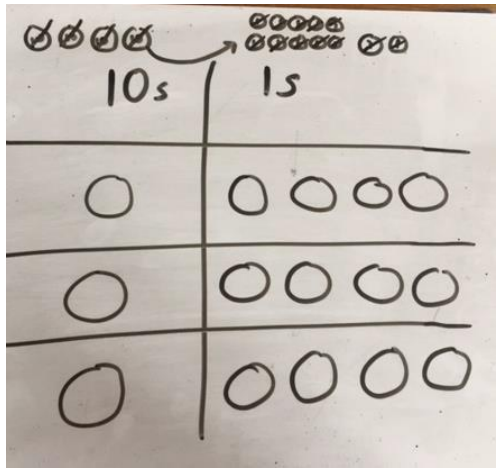
What is the calculation?
What is the product?

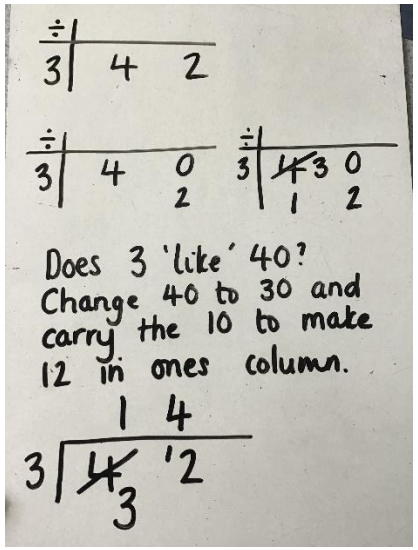
Calculation policy: Division

Key language: share, group, divide, divided by, half.

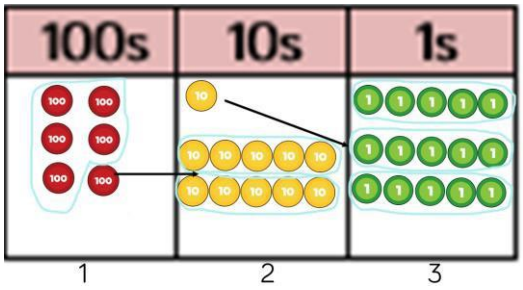
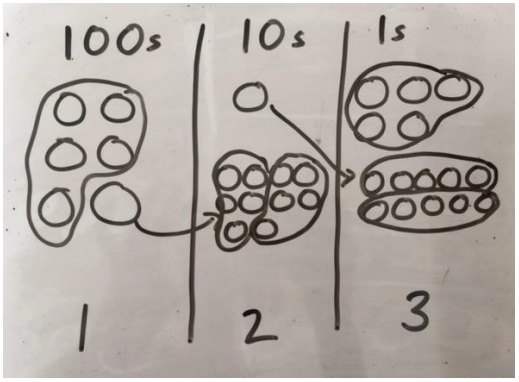
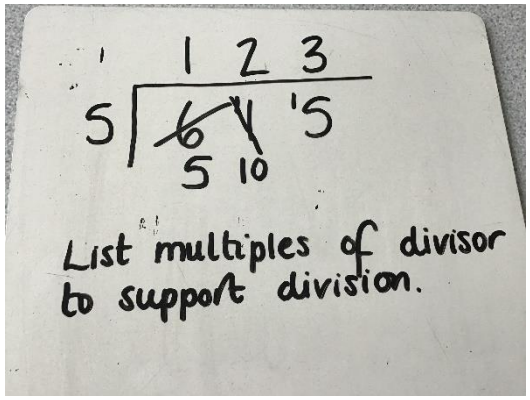
Concrete	Pictorial	Abstract
Sharing using a range of objects. 6 ÷ 2 	Represent the sharing pictorially.  6 1 1 1 | 1 1 1	6 ÷ 2 = 3 3 | 3 Children should also be encouraged to use their 2 times tables facts. Use knowledge of x facts to support division (no remainders)
Repeated subtraction 6 ÷ 2	Children to represent repeated subtraction pictorially.  	Abstract number line to represent the equal groups that have been subtracted. 

 3 groups of 2		

TO ÷ O with remainders using lollipop sticks, 'piles' of cups (MMS ref) 13 ÷ 4 Use of lollipop sticks to form wholes- squares are made because we are dividing by 4. Similarly, create piles of 4 cups.  There are 3 whole squares, with 1 left over.	Children to represent the lollipop sticks pictorially.  There are 3 whole squares, with 1 left over. **Represent as a bar**. Count 13 between the 4 parts: I I I I I I I I I I I I I I I I | I I I | I I I | I I I I left over	13 ÷ 4 = 3 remainder 1 Children should be encouraged to use their times table facts
Sharing using place value counters and dienes. (exchange 10s for 1s) 42 ÷ 3 = 14 	Children to represent the place value counters pictorially. 	Children to be able to make sense of the place value counters and write calculations to show the process. 42 ÷ 3 42 = 30 + 12 30 ÷ 3 = 10 12 ÷ 3 = 4 10 + 4 = 14

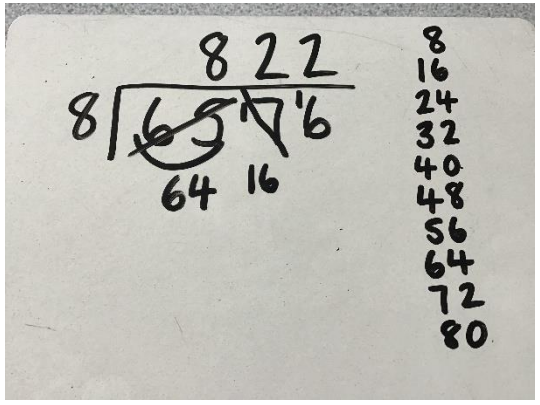
÷
3 | 4 2
÷
3 | 4 0
2
÷
3 | 4 3 0
1 2
Does 3 'like' 40?
Change 40 to 30 and
carry the 10 to make
12 in ones column.
1 4
3 | 4 2
3

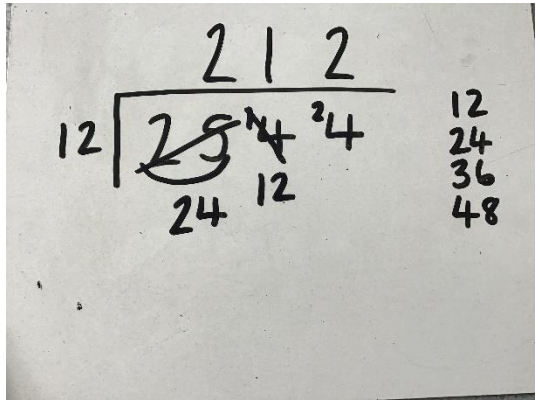
Short division using place value counters to group. 615 ÷ 5  1. Make 615 with place value counters. 2. How many groups of 5 hundreds can you make with 6 hundred counters? 3. Exchange 1 hundred for 10 tens. 4. How many groups of 5 tens can you make with 11 ten counters? 5. Exchange 1 ten for 10 ones. 6. How many groups of 5 ones can you make with 15 ones?	Represent the place value counters pictorially.  	Children to the calculation using the short division scaffold.  123 5 6¹1¹5

Long division

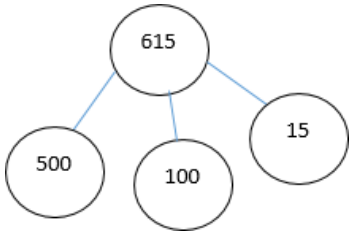
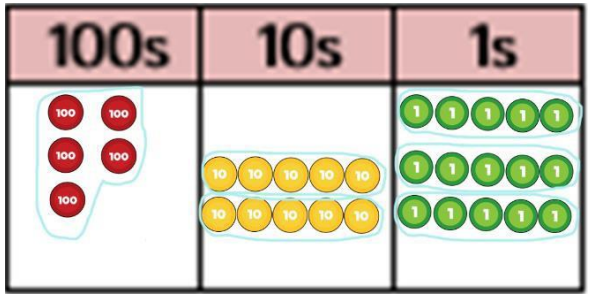
2544 ÷ 12

If a pupil is confident with using the abstract formal method to divide by a single digit, they are likely to be able to go straight to the abstract when dividing by a 2 digit number





Conceptual variation; different ways to ask children to solve 615 ÷ 5

Using the part whole model below, how can you divide 615 by 5 without using short division?  	I have £615 and share it equally between 5 bank accounts. How much will be in each account? 615 pupils need to be put into 5 groups. How many will be in each group?	$5 \overline{)615}$ 615 ÷ 5 = ? = 615 ÷ 5	What is the calculation? What is the answer? 

Remember in all of the stages (C, P and A) and for all operations continue to use 'Logic of the Language'

These steps and stages can be used in any year group depending on the stage the pupils are working at. Some steps/stages may suit some pupils better than others.

Use the term 'ones' instead of units