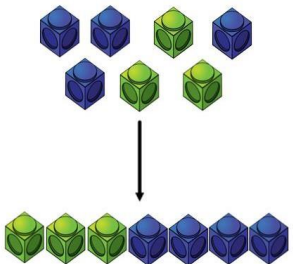
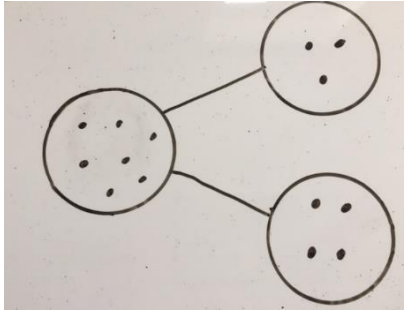
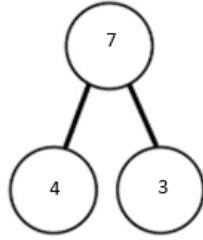
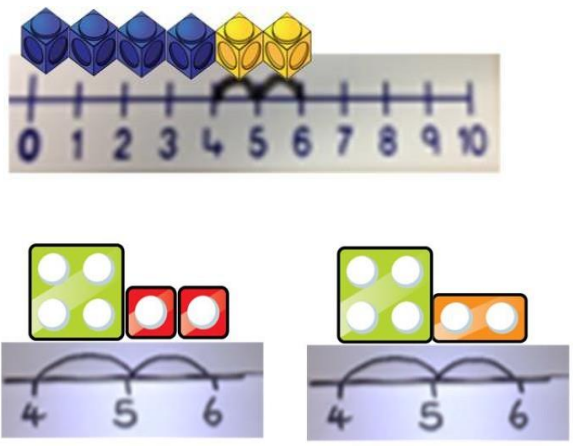
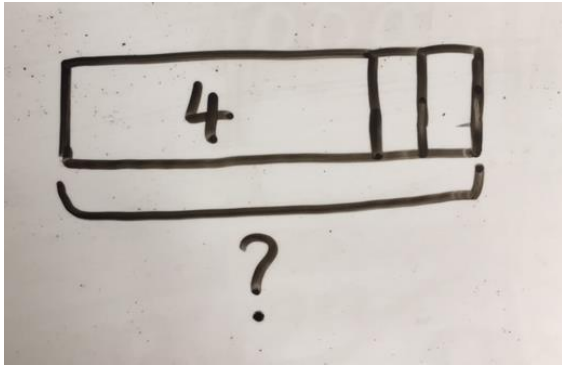



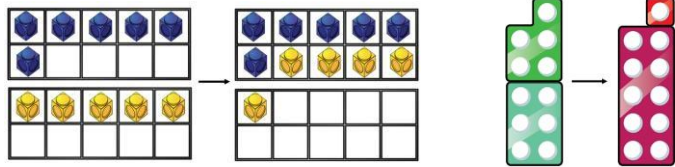
Calculation policy: Addition

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

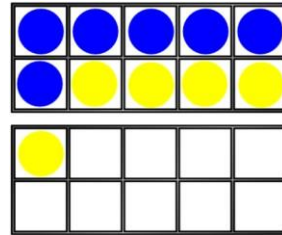
Concrete	Pictorial	Abstract
<p>Combining two parts to make a whole (use other resources too e.g. eggs, shells, teddy bears, cars).</p>  <p>The illustration shows two groups of cubes: one group of four blue cubes and one group of three green cubes. An arrow points down to a single row of seven cubes, with the first four being green and the last three being blue, representing the sum of the two groups.</p>	<p>Children to represent the cubes using dots or crosses. They could put each part on a part whole model too.</p>  <p>A hand-drawn part-whole model consisting of three circles. One large circle on the left contains seven dots, representing the whole. Two smaller circles on the right are connected to the large circle by lines. The top-right circle contains four dots, and the bottom-right circle contains three dots, representing the two parts.</p>	<p>$4 + 3 = 7$ Four is a part, 3 is a part and the whole is seven.</p>  <p>An abstract part-whole model diagram with three circles. A top circle contains the number 7. Two bottom circles are connected to the top circle by lines. The left bottom circle contains the number 4, and the right bottom circle contains the number 3.</p>
<p>Counting on using number lines using cubes or Numicon.</p>  <p>The illustration shows a number line from 0 to 10. Blue cubes are placed on the numbers 0, 1, 2, 3, 4, and yellow cubes on 5 and 6. A curved arrow starts at 4 and ends at 6. Below the number line are two Numicon blocks: a green block with four dots and two red blocks with one dot each, and another set with a green block with four dots and an orange block with two dots. Both sets have curved arrows starting at 4 and ending at 6 on a number line.</p>	<p>A bar model which encourages the children to count on, rather than count all.</p>  <p>A hand-drawn bar model consisting of a long horizontal rectangle divided into three sections. The first section on the left is labeled with the number 4. The other two sections are empty. Below the bar is a large question mark.</p>	<p>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? $4 + 2$</p>  <p>An abstract number line with numbers 4, 5, and 6. Two curved arrows are drawn above the line. The first arrow starts at 4 and ends at 5. The second arrow starts at 5 and ends at 6.</p>

Regrouping to make 10; using ten frames and counters/cubes or using Numicon.

6 + 5



Children to draw the ten frame and counters/cubes.



Children to develop an understanding of equality e.g.

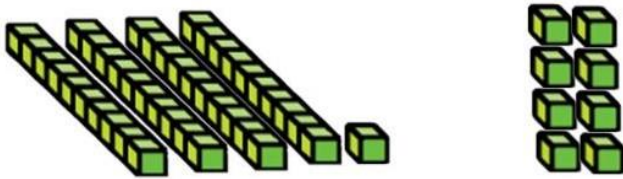
$$6 + \square = 11$$

$$6 + 5 = 5 + \square$$

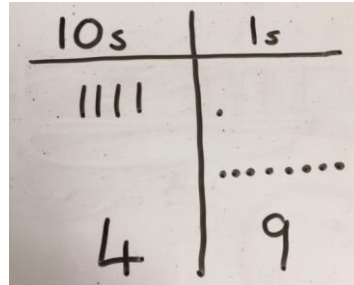
$$6 + 5 = \square + 4$$

TO + 0 using base 10. Continue to develop understanding of partitioning and place value.

41 + 8



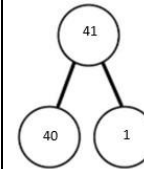
Children to represent the base 10 e.g. lines for tens and dot/crosses for ones.



41 + 8

$$1 + 8 = 9$$

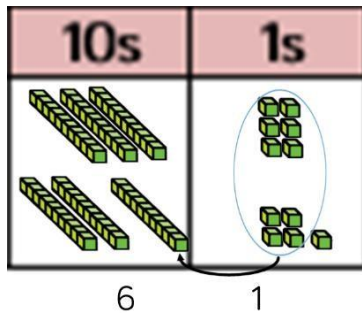
$$40 + 9 = 49$$



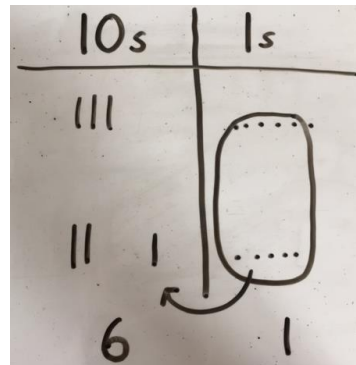
	4	1
+		8
<hr/>		
	4	9

TO + TO using base 10. Continue to develop understanding of partitioning and place value.

36 + 25



Children to represent the base 10 in a place value chart.



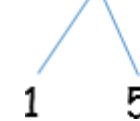
Looking for ways to make 10.

36 + 25 =

$$30 + 20 = 50$$

$$5 + 5 = 10$$

$$50 + 10 + 1 = 61$$

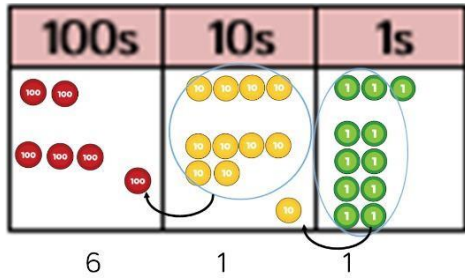


36

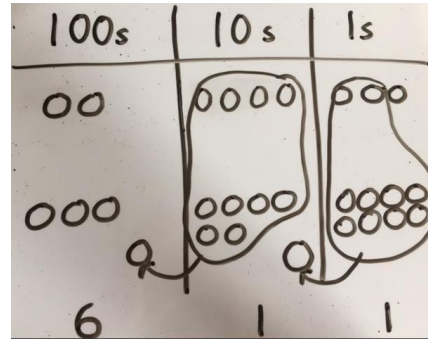
Formal method:

$$\begin{array}{r} +25 \\ 36 \\ \hline 61 \\ \hline 1 \end{array}$$

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.

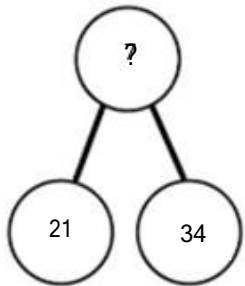


Children to represent the counters in a place value chart, circling when they make an exchange.



$$\begin{array}{r} 243 \\ +368 \\ \hline 611 \\ \hline 11 \end{array}$$

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



?	
21	34

Word problems:

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

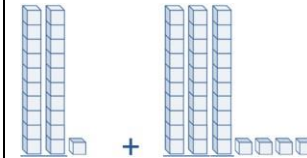
$21 + 34 = 55$. Prove it

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

$21 + 34 =$

$$\boxed{} = 21 + 34$$

Calculate the sum of twenty-one and thirty-four.

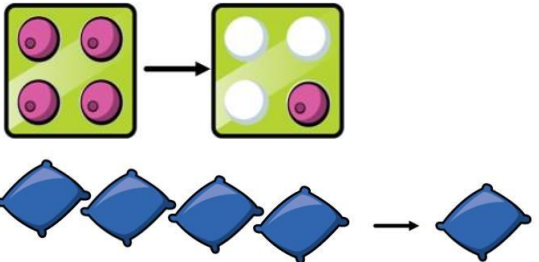
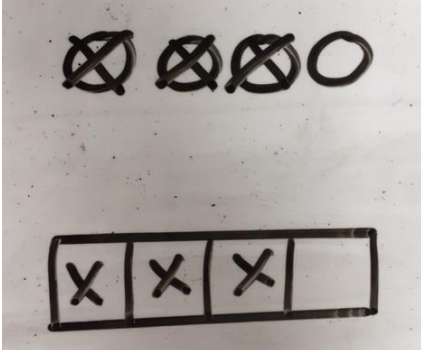

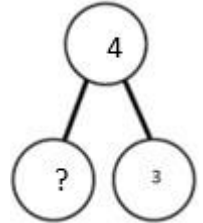
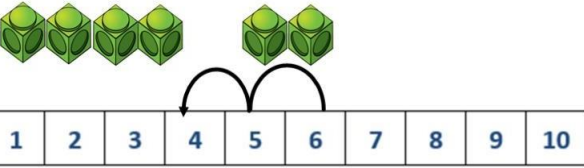
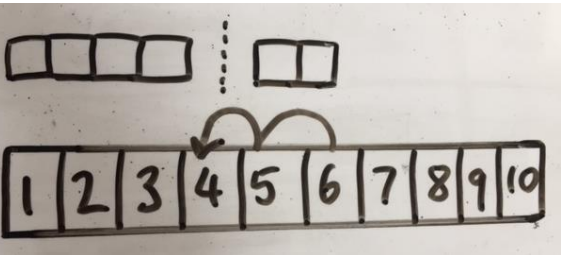
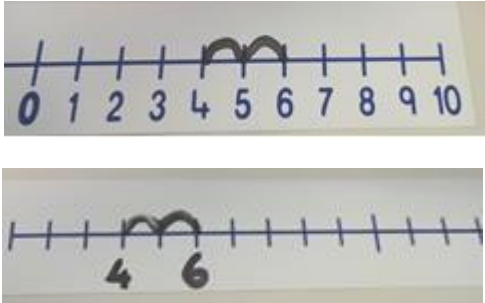


Missing digit problems:

10s	1s
10 10	1
10 10 10	?
?	5

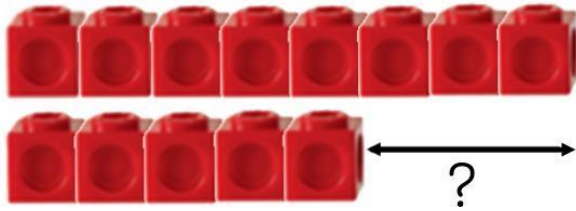
Calculation Policy: Subtraction

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

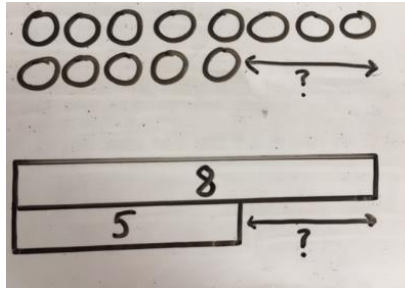
Concrete	Pictorial	Abstract				
<p>Physically taking away and removing objects from a whole (ten frames, Numicon, cubes and other items such as beanbags could be used).</p> <p>$4 - 3 = 1$</p> 	<p>Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also be used.</p> 	<p>$4 - 3 =$</p> <p> $= 4 - 3$</p> <table border="1" data-bbox="1646 550 1960 630"> <tr> <td colspan="2">4</td> </tr> <tr> <td>3</td> <td>?</td> </tr> </table> 	4		3	?
4						
3	?					
<p>Counting back (using number lines or number tracks) children start with 6 and count back 2.</p> <p>$6 - 2 = 4$</p> 	<p>Children to represent what they see pictorially e.g.</p> 	<p>Children to represent the calculation on a number line or number track and show their jumps. Encourage children to use an empty number line</p> 				

Finding the difference (using cubes, Numicon or Cuisenaire rods, 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.



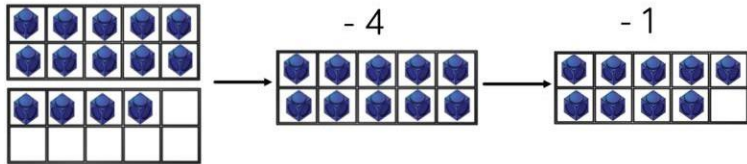
Find the difference between 8 and 5.

8 - 5, the difference is

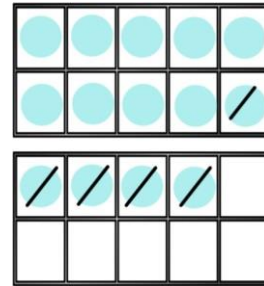
Children to explore why $9 - 6 = 8 - 5 = 7 - 4$ have the same difference.

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 the subtrahend.

$$14 - 5 = 9$$

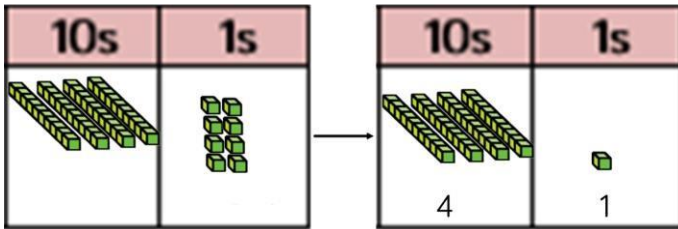
$$\begin{array}{c} 4 \quad 1 \end{array}$$

$$14 - 4 = 10$$

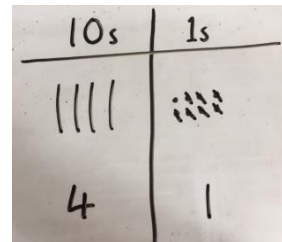
$$10 - 1 = 9$$

Column method using base 10.

48 - 7



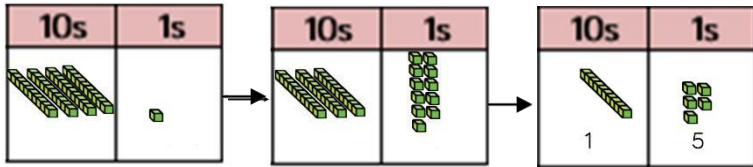
Children to represent the base 10 pictorially.



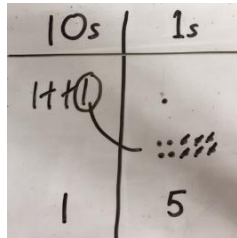
Column method or children could count back 7.

	4	8
-		7
	4	1

Column method using base 10 and having to exchange.
41 - 26



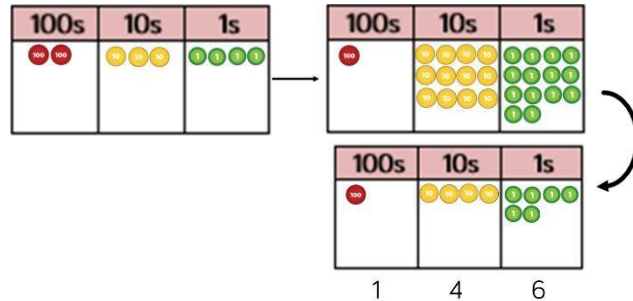
Represent the base 10 pictorially, remembering to show the exchange.



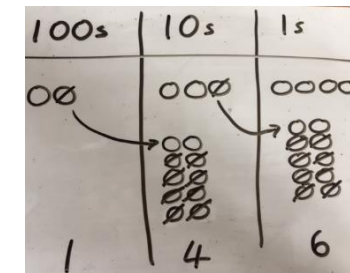
Formal column method. Children must understand that when they have exchanged the 10 they still have 41 because $41 = 30 + 11$.

$$\begin{array}{r} \cancel{3} \cancel{4} 1 \\ - 26 \\ \hline 15 \end{array}$$

Column method using place value counters.
234 - 88



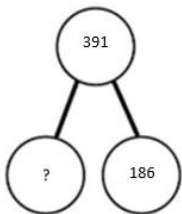
Represent the place value counters pictorially; remembering to show what has been exchanged.



Formal column method. Children must understand what has happened when they have crossed out digits.

$$\begin{array}{r} \overset{2}{\cancel{2}} \overset{1}{\cancel{3}} 4 \\ - 88 \\ \hline 6 \end{array}$$

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.

$$\square = 391 - 186$$

391

-186

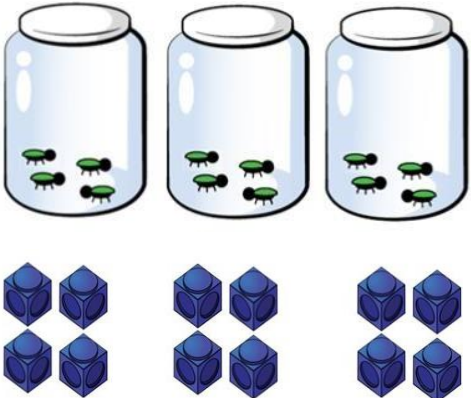
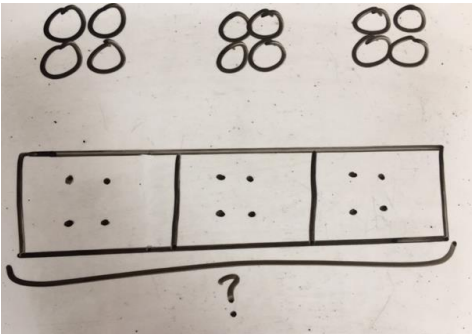
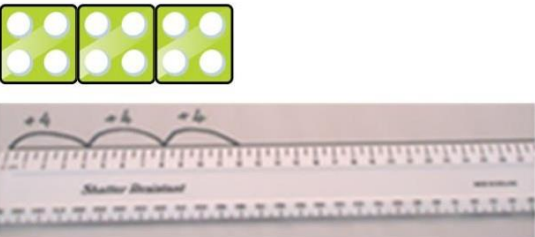
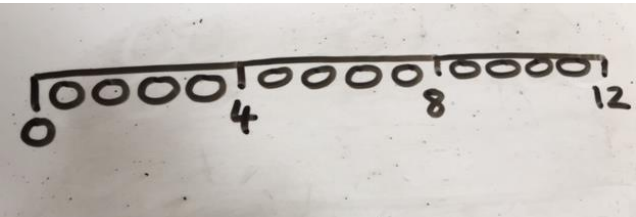
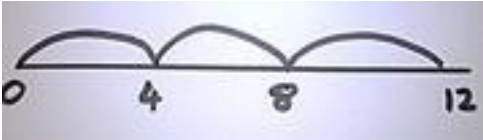
What is 186 less than 391?

Missing digit calculations

$$\begin{array}{r} 39\square \\ - \square\square 6 \\ \hline \square 05 \end{array}$$

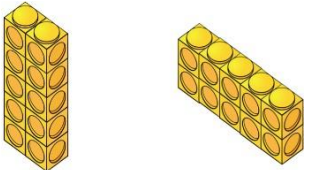
Calculation policy: Multiplication

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

Concrete	Pictorial	Abstract
<p>Repeated grouping/repeated addition 3×4 $4 + 4 + 4$ There are 3 equal groups, with 4 in each group.</p>  <p>The image shows three identical jars, each containing four small green beetles. Below the jars are three groups of four blue cubes, arranged in two rows of two.</p>	<p>Children to represent the practical resources in a picture and use a bar model.</p>  <p>The image shows a hand-drawn pictorial representation. At the top, there are three groups of four small circles arranged in a 2x2 grid. Below this is a bar model consisting of a rectangle divided into three equal columns. Each column contains four dots. A bracket underneath the entire bar model has a question mark below it.</p>	<p>$3 \times 4 = 12$ $4 + 4 + 4 = 12$</p>
<p>Number lines to show repeated groups- 3×4</p>  <p>The image shows three green rods, each with four white dots. Below the rods is a ruler with three curved arrows indicating jumps of 4 units, starting from 0 and ending at 4, 8, and 12.</p> <p>Cuisenaire rods can be used too.</p>	<p>Represent this pictorially alongside a number line e.g.:</p>  <p>The image shows a hand-drawn number line starting at 0 and ending at 12. There are three jumps of 4 units each, marked with the numbers 4, 8, and 12.</p>	<p>Abstract number line showing three jumps of four.</p> <p>$3 \times 4 = 12$</p>  <p>The image shows an abstract number line starting at 0 and ending at 12. There are three jumps of 4 units each, marked with the numbers 4, 8, and 12.</p>

Use arrays to illustrate commutativity counters and other objects can also be used.

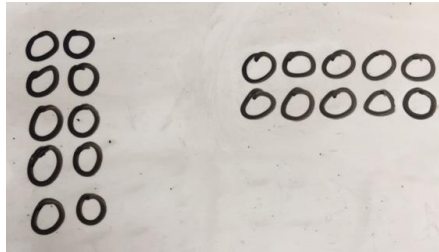
$$2 \times 5 = 5 \times 2$$



2 lots of 5

5 lots of 2

Children to represent the arrays pictorially.



Children to be able to use an array to write a range of calculations e.g.

$$10 = 2 \times 5$$

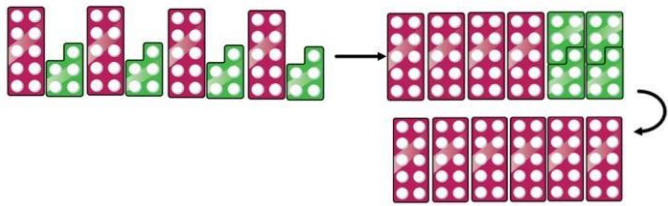
$$5 \times 2 = 10$$

$$2 + 2 + 2 + 2 + 2 = 10$$

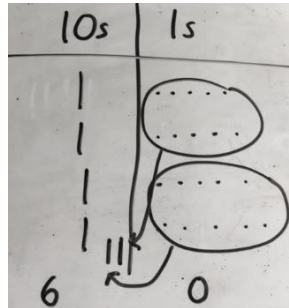
$$10 = 5 + 5$$

Partition to multiply using Numicon, base 10 or Cuisenaire rods.

$$4 \times 15$$



Children to represent the concrete manipulatives pictorially.



Children to be encouraged to show the steps they have taken.

$$4 \times 15$$

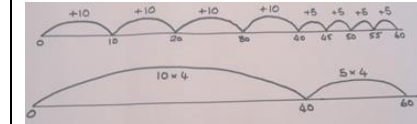
$$\begin{array}{r} 10 \\ 5 \end{array}$$

$$10 \times 4 = 40$$

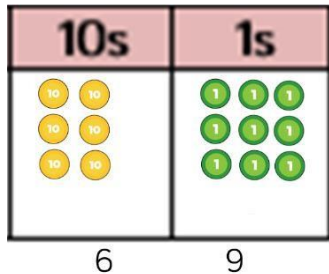
$$5 \times 4 = 20$$

$$40 + 20 = 60$$

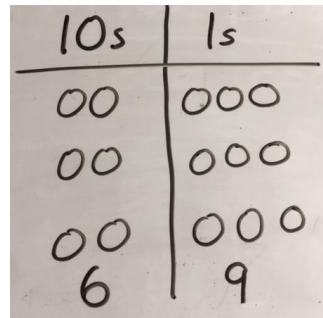
A number line can also be used



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.

$$3 \times 23 \quad 3 \times 20 = 60$$

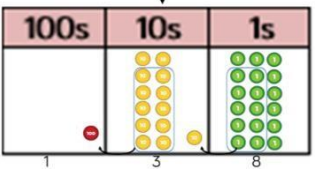
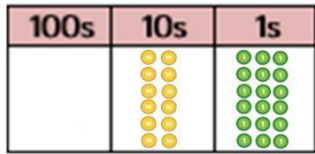
$$20 \quad 3 \quad 3 \times 3 = 9$$

$$60 + 9 = 69$$

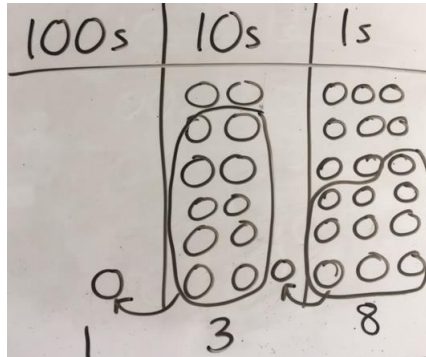
$$\begin{array}{r} 23 \\ \times 3 \\ \hline 69 \end{array}$$

Formal column method with place value counters.

$$6 \times 23$$



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



Formal written method

$$\begin{array}{r}
 6 \times 23 = \\
 23 \\
 \times 6 \\
 \hline
 138 \\
 \hline
 11
 \end{array}$$

When children start to multiply $3d \times 3d$ and $4d \times 2d$ etc., they should be confident with the abstract:

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

$$\begin{array}{r}
 124 \\
 \times 26 \\
 \hline
 744 \\
 2480 \\
 \hline
 3224 \\
 11
 \end{array}$$

Answer: 3224

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

23	23	23	23	23	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 $6 \times 23 = 138$

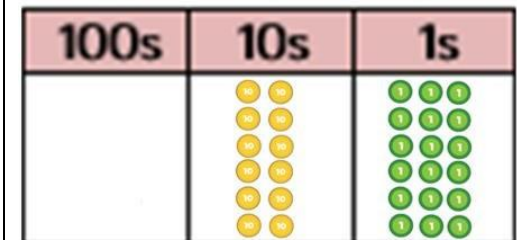
Find the product of 6 and 23

$$6 \times 23 =$$

$$\square = 6 \times 23$$

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

What is the calculation?
What is the product?



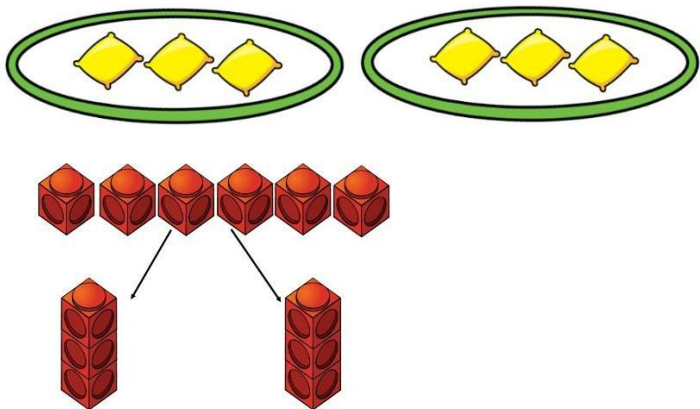
Calculation policy: Division

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

Concrete

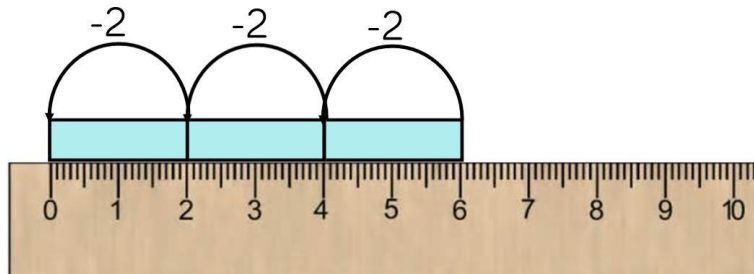
Sharing using a range of objects.

$$6 \div 2$$



Repeated subtraction using Cuisenaire rods above a ruler.

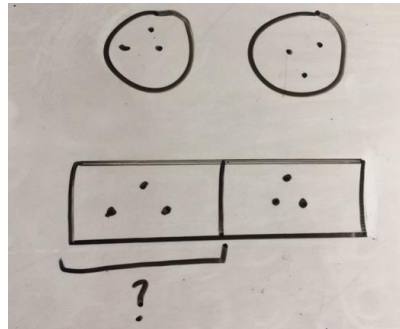
$$6 \div 2$$



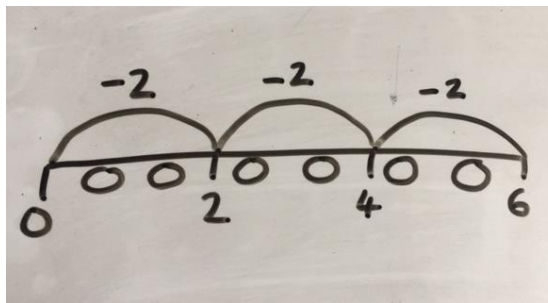
3 groups of 2

Pictorial

Represent the sharing pictorially.



Children to represent repeated subtraction pictorially.



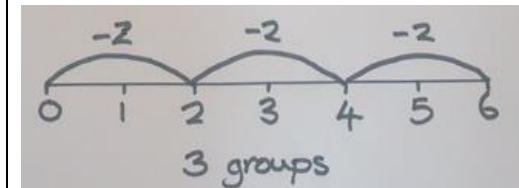
Abstract

$$6 \div 2 = 3$$

3	3
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Children should also be encouraged to use their 2 times tables facts.

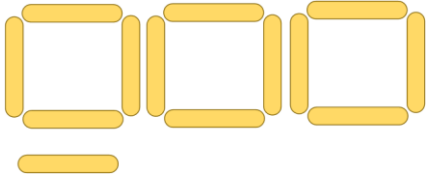
Abstract number line to represent the equal groups that have been subtracted.



2d ÷ 1d with remainders using lollipop sticks. Cuisenaire rods, above a ruler can also be used.

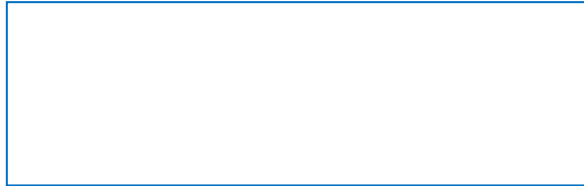
$$13 \div 4$$

Use of lollipop sticks to form wholes- squares are made because we are dividing by 4.



There are 3 whole squares, with 1 left over.

Children to represent the lollipop sticks pictorially.

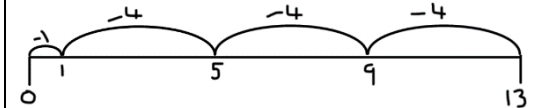


There are 3 whole squares, with 1 left over.

$$13 \div 4 = 3 \text{ remainder } 1$$

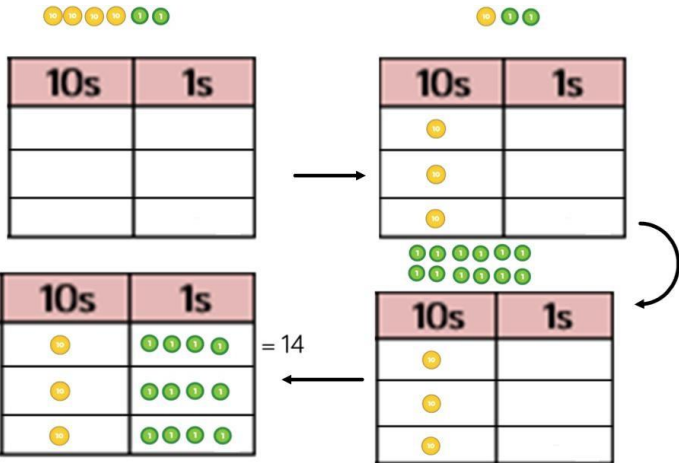
Children should be encouraged to use their times table facts; they could also represent repeated addition on a number line.

'3 groups of 4, with 1 left over'

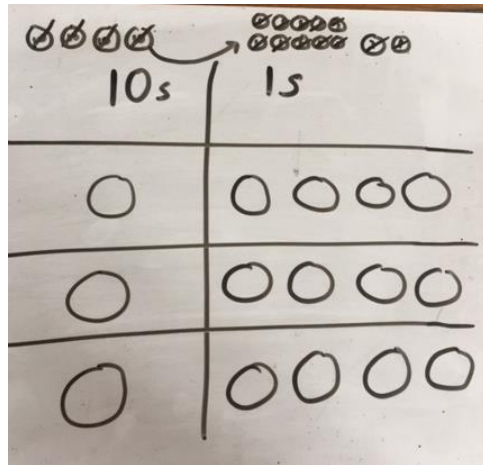


Sharing using place value counters.

$$42 \div 3 = 14$$



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.

$$42 \div 3$$

$$42 = 30 + 12$$

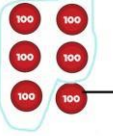
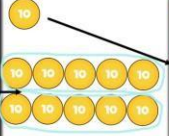

$$30 \div 3 = 10$$

$$12 \div 3 = 4$$

$$10 + 4 = 14$$

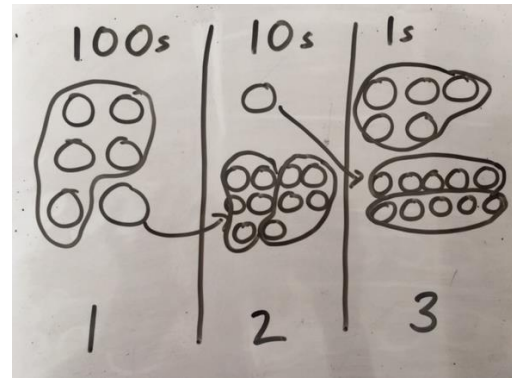
Short division using place value counters to group.

$$615 \div 5$$

100s	10s	1s
		
1	2	3

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.

$$\begin{array}{r} 123 \\ 5 \overline{) 615} \end{array}$$

Long division

1. Write out the problem

$$2654 \div 13 =$$

$$13 \overline{) 2654}$$

2. Write out jottings for the divisor (the number you are dividing by).

$$13 \times 10 = 130$$

$$13 \times 5 = 65$$

$$13 \times 1 = 13$$

$$13 \times 2 = 26$$

$$13 \times 4 = 52$$

$$13 \times 8 = 104$$

3. Start with the largest value. How many times does the divisor go into this digit? (use your jottings) Write the answer above the bus stop.

$$13 \overline{) 02654}$$

If the divisor doesn't fit exactly, carry any left over to the next column.

4. Repeat for these steps for your new number.

$$13 \overline{) 02654}$$

$$13 \overline{) 02654}$$

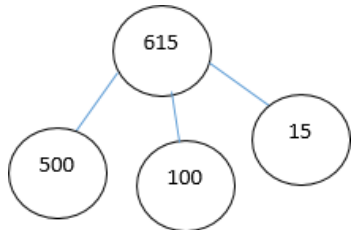
$$13 \overline{) 02654} \text{ r } 2$$

5. Write your number left over as a remainder and express it as a fraction.

$$2654 \div 13 = 204 \frac{2}{13}$$

Conceptual variation; different ways to ask children to solve $615 \div 5$

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?

$$5 \overline{) 615}$$

$$615 \div 5 =$$

$$= 615 \div 5$$

What is the calculation?
What is the answer?

