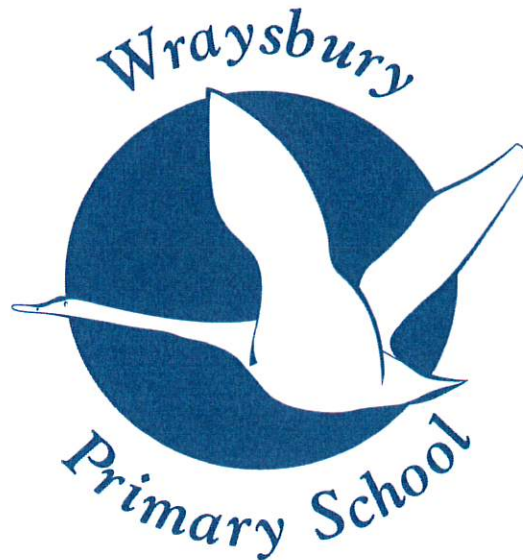


Calculation Policy



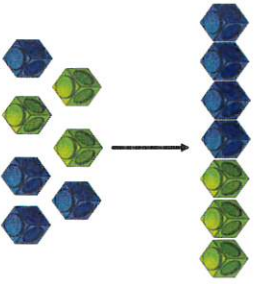
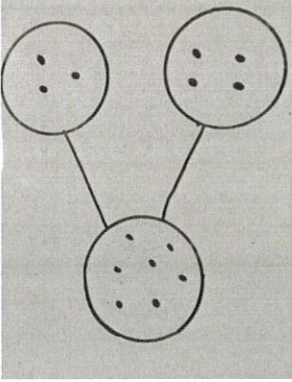
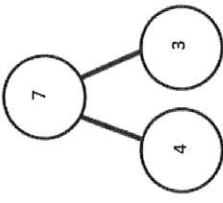
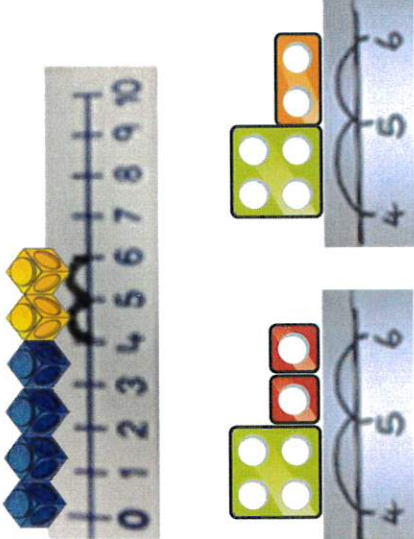
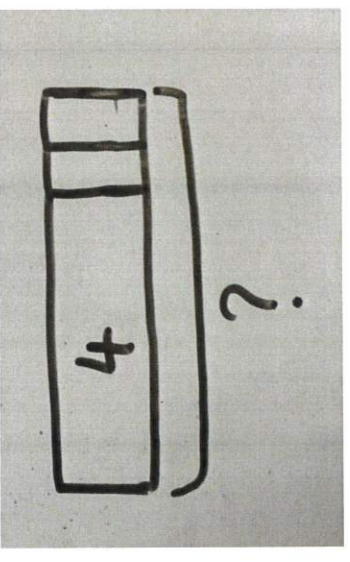
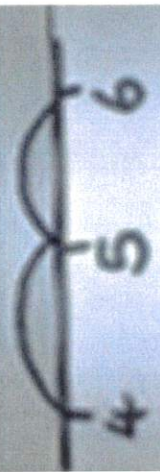
Welley Road
Wraysbury, Staines
TW19 5DJ

Headteacher: Mrs A Fox

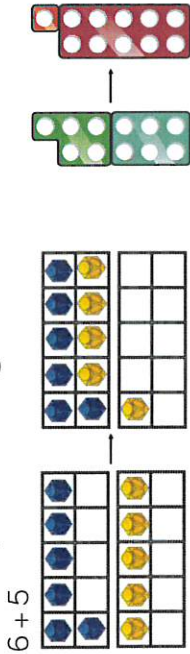
Produced by: Alison Brech (White Rose Document)
Approved by: Teaching and Learning Committee May 2019
Review date: May 2021

Calculation policy: Addition

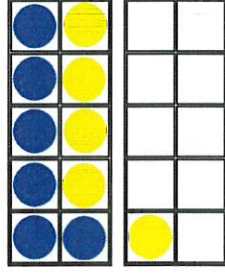
Key language: sum, total, parts and wholes, plus, add, altogether, more, 'is equal to' 'is the same as'.

Concrete	Pictorial	Abstract
<p>Combining two parts to make a whole (use other resources too e.g. eggs, shells, teddy bears, cars).</p> 	<p>Children to represent the cubes using dots or crosses. They could put each part on a part whole model too.</p> 	<p>Abstract</p> <p>$4 + 3 = 7$</p> <p>Four is a part, 3 is a part and the whole is seven.</p> 
<p>Counting on using number lines using cubes or Numicon.</p> 	<p>A bar model which encourages the children to count on, rather than count all.</p> 	<p>The abstract number line:</p> <p>What is 2 more than 4?</p> <p>What is the sum of 2 and 4?</p> <p>What is the total of 4 and 2?</p> <p>$4 + 2$</p> 

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



Children to draw the ten frame and counters/cubes.



Children to develop an understanding of equality e.g.

$$6 + \square = 11$$

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

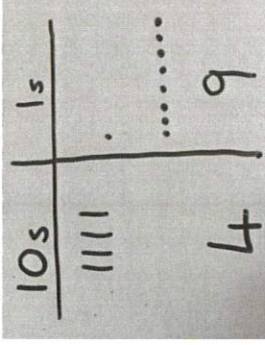
$$6 + 5 = \square + 4$$

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

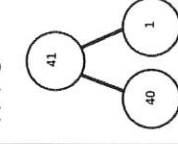
$$41 + 8$$



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

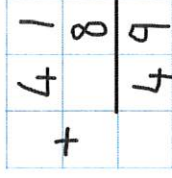


$$41 + 8$$



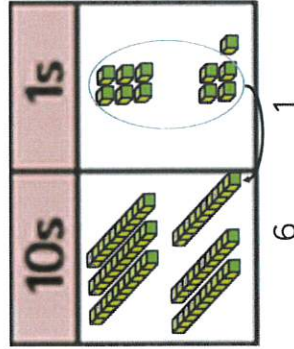
$$1 + 8 = 9$$

$$40 + 9 = 49$$

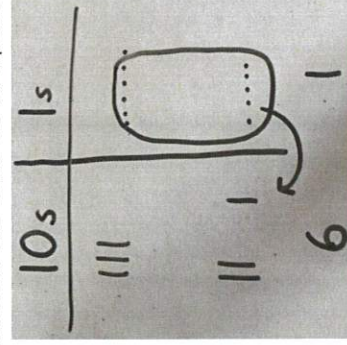


TO + TO using base 10. Continue to develop understanding of partitioning and place value.

$$36 + 25$$



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



Looking for ways to make 10.

$$36 + 25 =$$

$$30 + 20 = 50$$

$$5 + 5 = 10$$

$$50 + 10 + 1 = 61$$

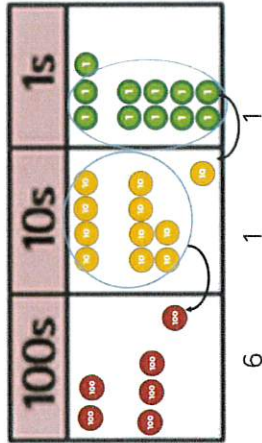
$$1 \quad 5$$

$$36$$

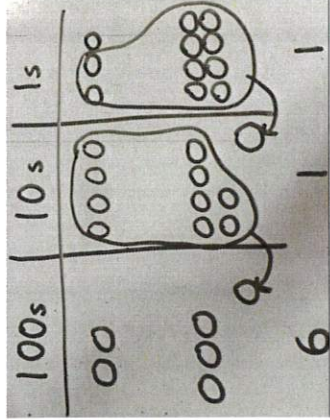
Formal method:

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

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.

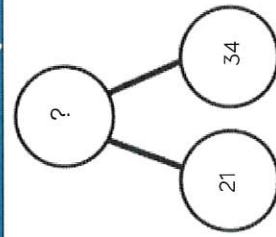


Children to represent the counters in a place value chart, circling when they make an exchange.



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

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



?	34
21	

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

21

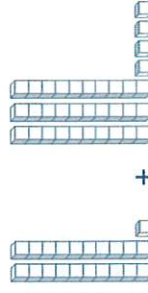
+34

—

$21 + 34 =$

$= 21 + 34$

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

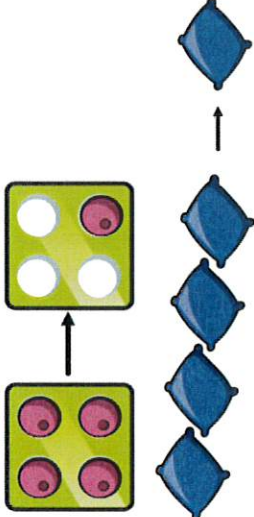
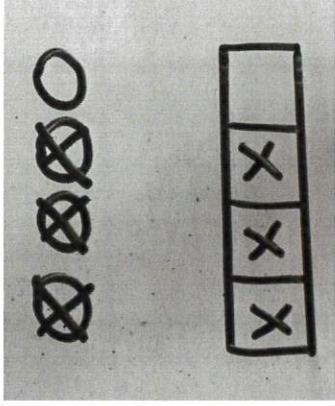
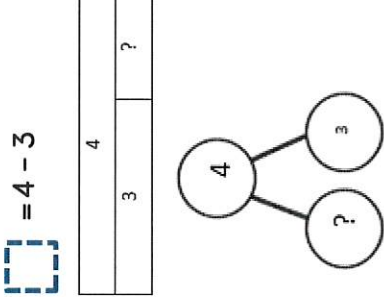
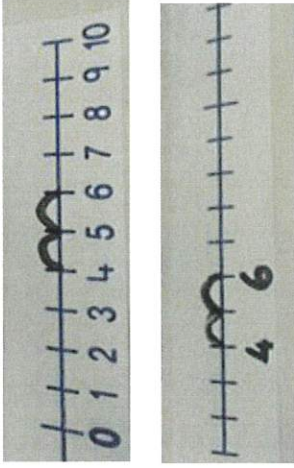
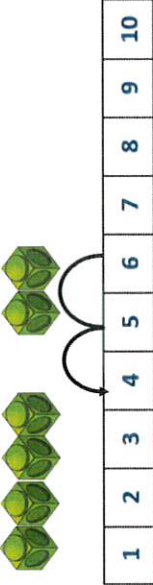
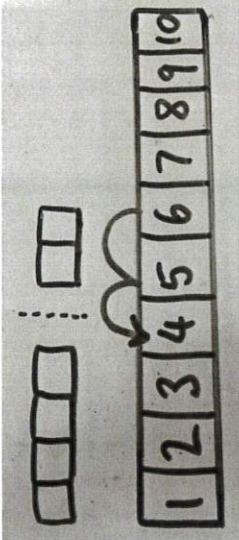
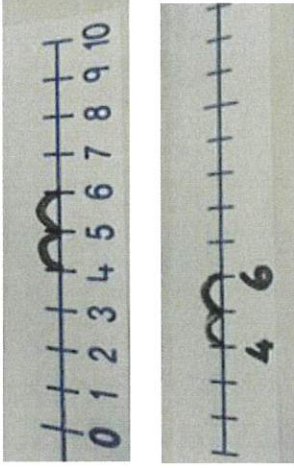


Missing digit problems:

10s	1s
?	?
?	5

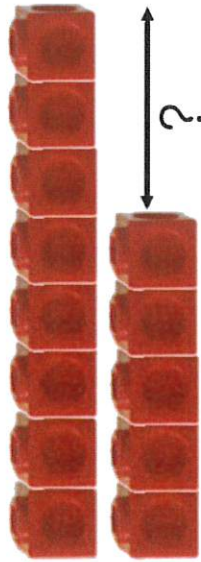
Calculation policy: Subtraction

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

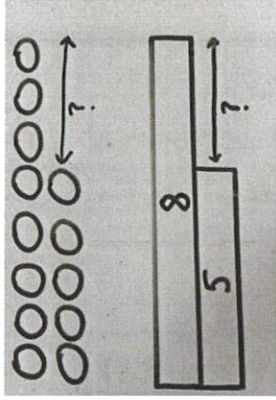
Concrete	Pictorial	Abstract
<p>Physically taking away and removing objects from a whole (ten frames, Numicon, cubes and other items such as beanbags could be used).</p> <p>$4 - 3 = 1$</p> 	<p>Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also be used.</p> 	<p>$4 - 3 =$</p> <p>$\square = 4 - 3$</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> 
<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.



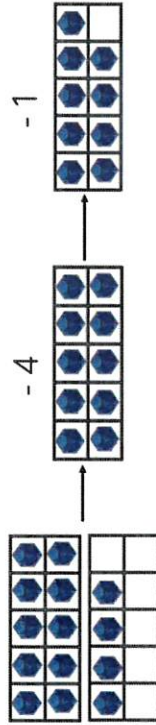
Find the difference between 8 and 5.

8 - 5, the difference is

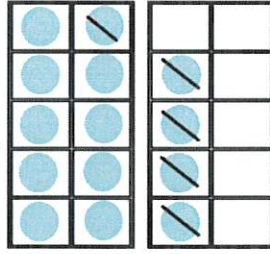
Children to explore why $9 - 6 = 8 - 5 = 7 - 4$ have the same difference.

Making 10 using ten frames.

$14 - 5$

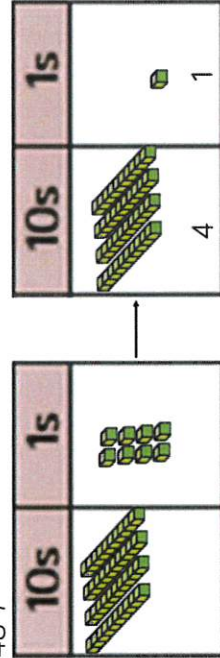


Children to present the ten frame pictorially and discuss what they did to make 10.

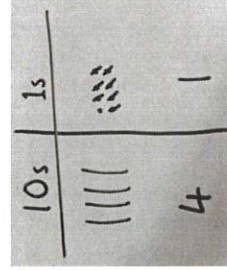


Column method using base 10.

48-7



Children to represent the base 10 pictorially.



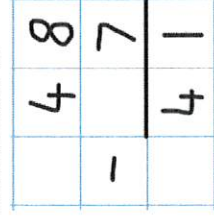
Children to show how they can make 10 by partitioning the subtrahend.

$$14 - 5 = 9$$

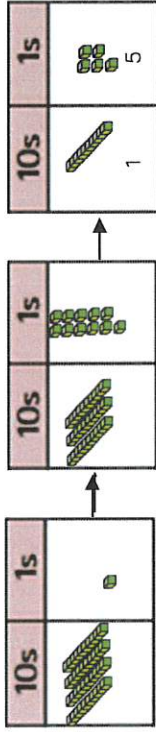
$14 - 4 = 10$

$10 - 1 = 9$

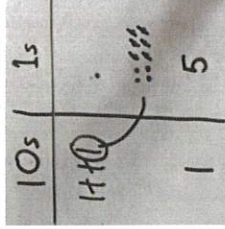
Column method or children could count back 7.



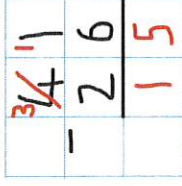
Column method using base 10 and having to exchange.
41 - 26



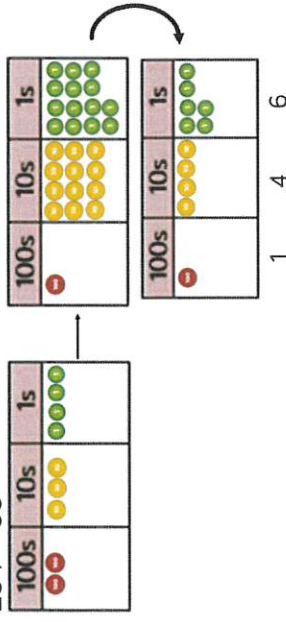
Represent the base 10 pictorially, remembering to show the exchange.



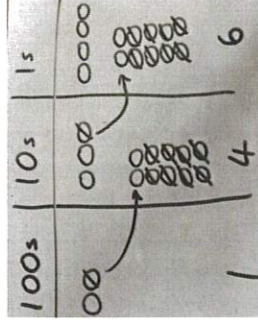
Formal column method. Children must understand that when they have exchanged the 10 they still have 41 because $41 = 30 + 11$.



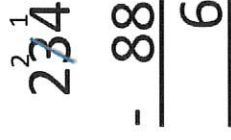
Column method using place value counters.
234 - 88



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.



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

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

$$\square = 391 - 186$$

$$391$$

$$-186$$

What is 186 less than 391?

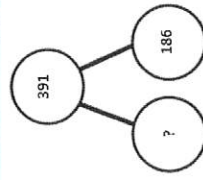
Missing digit calculations

$$39\square$$

$$- \square\square 6$$

$$\square 0 5$$

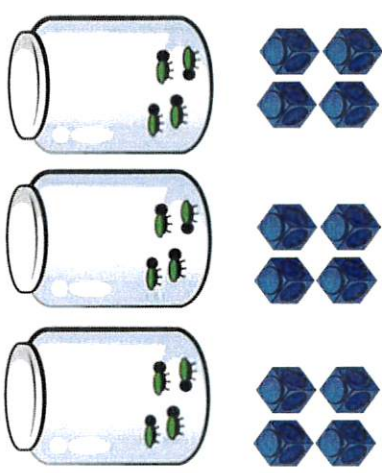
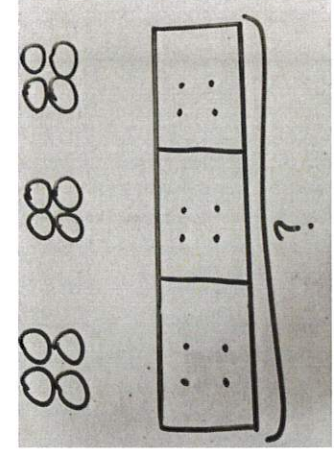
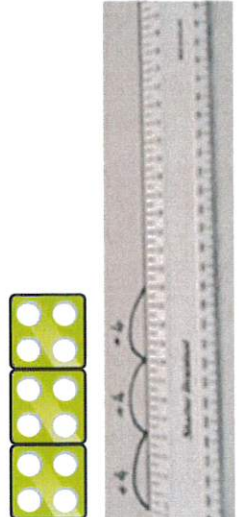
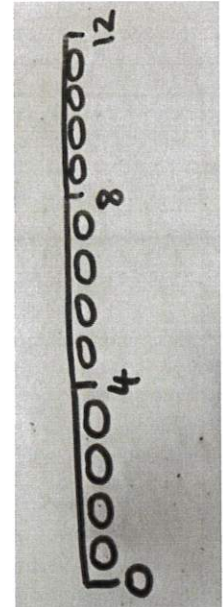

Calculate the difference between 391 and 186.



391	?
186	

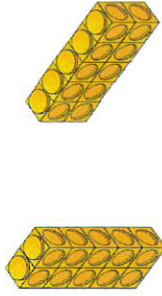
Calculation policy: Multiplication

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>Children to represent the practical resources in a picture and use a bar model.</p> 	<p>$3 \times 4 = 12$ $4 + 4 + 4 = 12$</p>
<p>Number lines to show repeated groups- 3×4</p>  <p>Cuisenaire rods can be used too.</p>	<p>Represent this pictorially alongside a number line e.g.:</p> 	<p>Abstract number line showing three jumps of four. $3 \times 4 = 12$</p> 

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

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

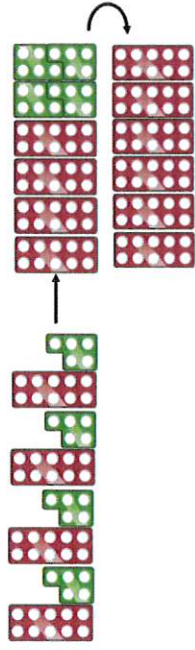


2 lots of 5

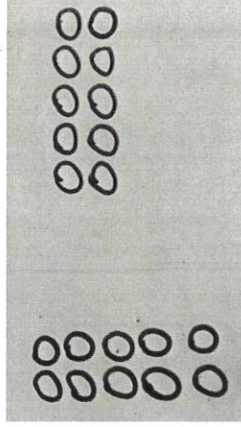
5 lots of 2

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

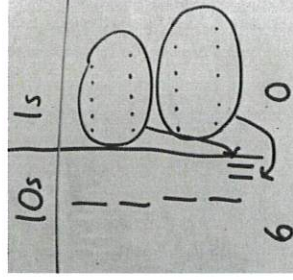
$$4 \times 15$$



Children to represent the arrays pictorially.



Children to represent the concrete manipulatives pictorially.



Formal column method with place value counters (base 10 can also be used.) 3×23

10s	1s
6	9

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

$$10 = 2 \times 5$$

$$5 \times 2 = 10$$

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

$$10 = 5 + 5$$

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

$$4 \times 15$$

$$\swarrow \searrow$$

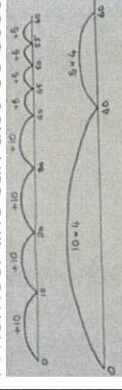
$$10 \quad 5$$

$$10 \times 4 = 40$$

$$5 \times 4 = 20$$

$$40 + 20 = 60$$

A number line can also be used



Children to record what it is they are doing to show understanding.

$$3 \times 23$$

$$\swarrow \searrow$$

$$20 \quad 3$$

$$3 \times 20 = 60$$

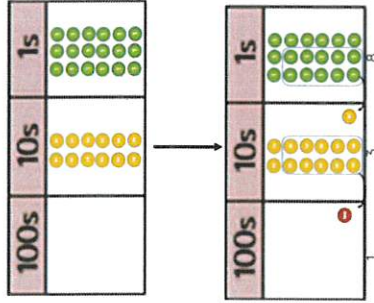
$$3 \times 3 = 9$$

$$60 + 9 = 69$$

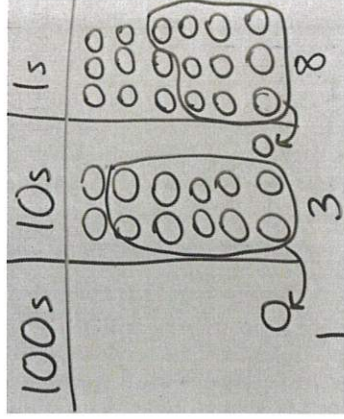
$$\begin{array}{r} 23 \\ \times 3 \\ \hline 69 \end{array}$$

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

$$6 \times 23 = 138$$

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 .

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

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?

23	23	23	23	23
?				

Find the product of 6 and 23

$$6 \times 23 =$$

$$\square = 6 \times 23$$

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

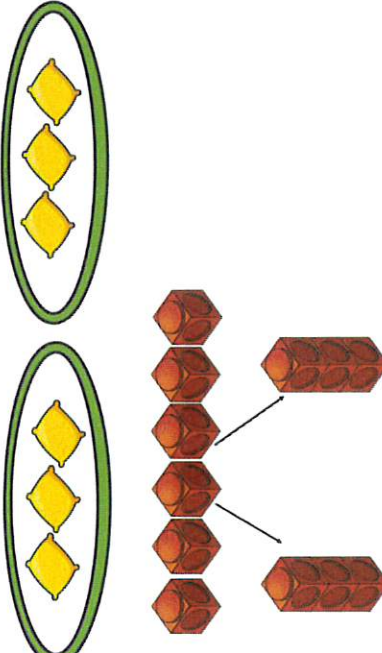
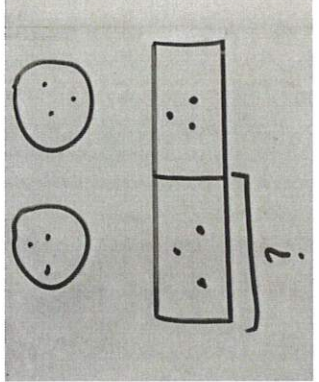

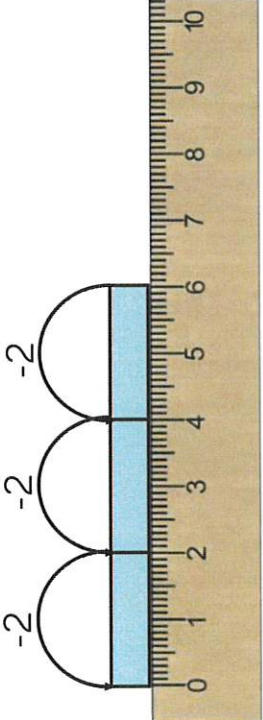
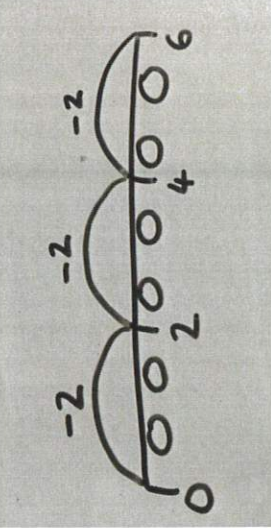
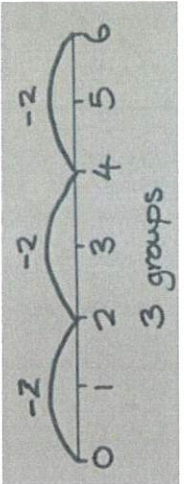
With the counters, prove that $6 \times 23 = 138$

What is the calculation?
What is the product?



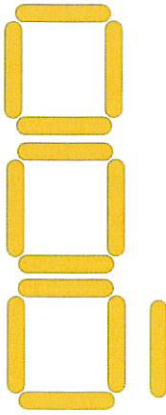
Calculation policy: Division

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

Concrete	Pictorial	Abstract
<p>Sharing using a range of objects. $6 \div 2$</p> 	<p>Represent the sharing pictorially.</p> 	<p>$6 \div 2 = 3$</p>  <p>Children should also be encouraged to use their 2 times tables facts.</p>
<p>Repeated subtraction using Cuisenaire rods above a ruler. $6 \div 2$</p>  <p>3 groups of 2</p>	<p>Children to represent repeated subtraction pictorially.</p> 	<p>Abstract number line to represent the equal groups that have been subtracted.</p> 

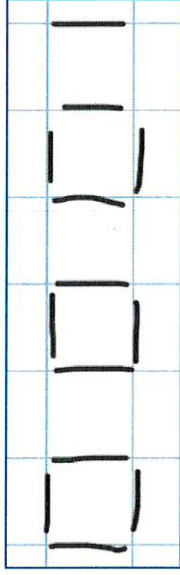
2d ÷ 1d with remainders using lollipop sticks. Cuisenaire rods, above a ruler can also be used.
 $13 \div 4$

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.

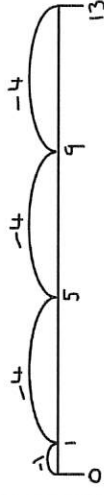


There are 3 whole squares, with 1 left over.

$13 \div 4 = 3$ remainder 1

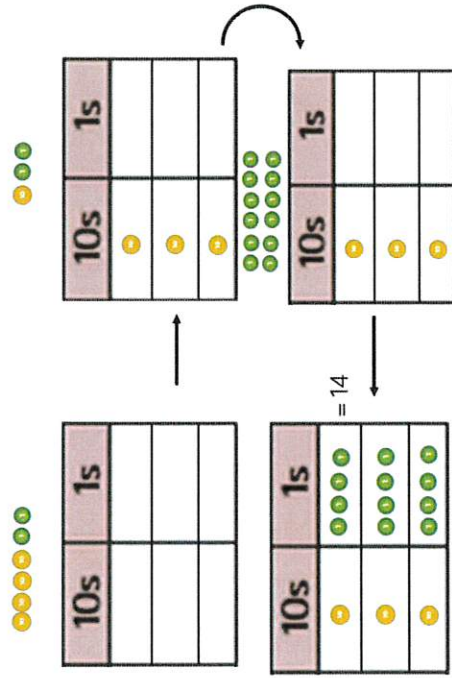
Children should be encouraged to use their times table facts; they could also represent repeated addition on a number line.

'3 groups of 4, with 1 left over'

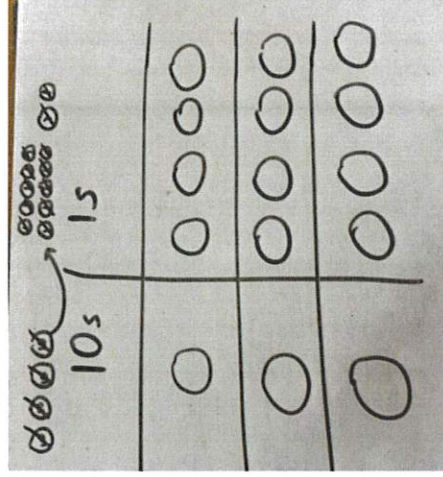


Sharing using place value counters.

$42 \div 3 = 14$



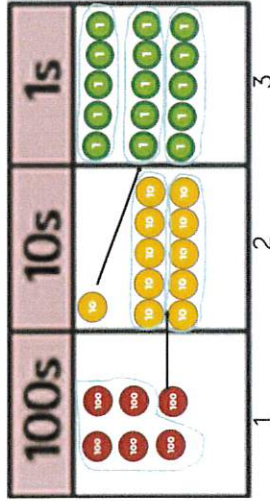
Children to represent the place value counters pictorially.



Children to be able to make sense of the place value counters and write calculations to show the process.

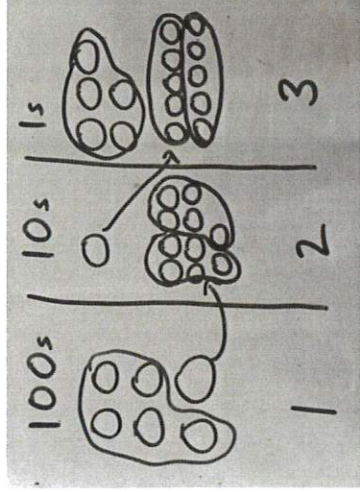
$42 \div 3$
 $42 = 30 + 12$
 $30 \div 3 = 10$
 $12 \div 3 = 4$
 $10 + 4 = 14$

Short division using place value counters to group.
 $615 \div 5$



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?

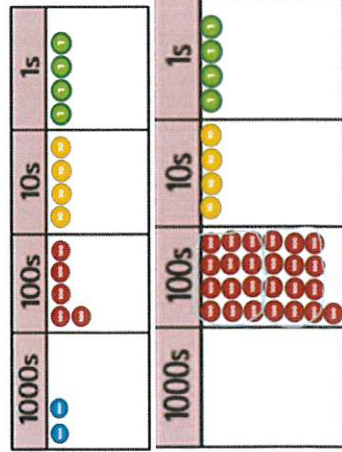
Represent the place value counters pictorially.



Children to the calculation using the short division scaffold.

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

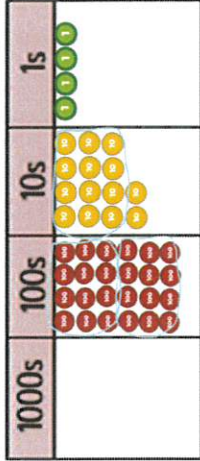
Long division using place value counters
 $2544 \div 12$



We can't group 2 thousands into groups of 12 so will exchange them.

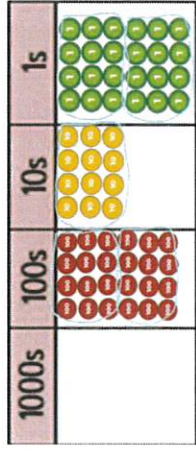
We can group 24 hundreds into groups of 12 which leaves with 1 hundred.

$$\begin{array}{r} 02 \\ 12 \overline{) 2544} \\ \underline{24} \\ 1 \end{array}$$



After exchanging the hundred, we have 14 tens. We can group 12 tens into a group of 12, which leaves 2 tens.

$$\begin{array}{r} 0.2.1 \\ 12 \overline{) 2544} \\ \underline{24} \\ 14 \\ \underline{12} \\ 2 \end{array}$$

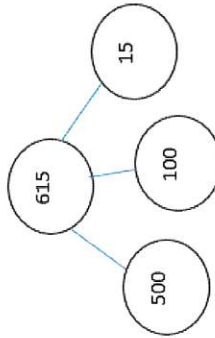


After exchanging the 2 tens, we have 24 ones. We can group 24 ones into 2 groups of 12, which leaves no remainder.

$$\begin{array}{r} 0.2.1.2 \\ 12 \overline{) 2544} \\ \underline{24} \\ 14 \\ \underline{12} \\ 24 \\ \underline{24} \\ 0 \end{array}$$

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?

$$5 \overline{) 615}$$

$$615 \div 5 = \square = 615 \div 5$$

What is the calculation?
What is the answer?

