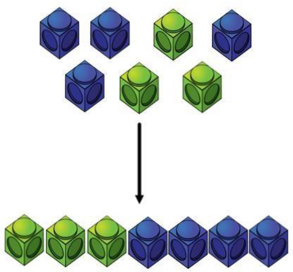
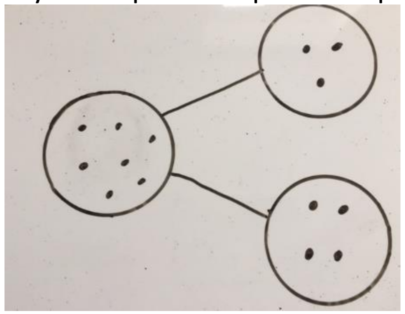
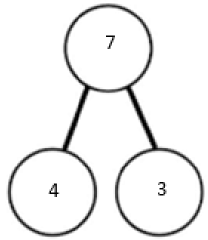
Lemington Riverside Primary School

Calculation Policy

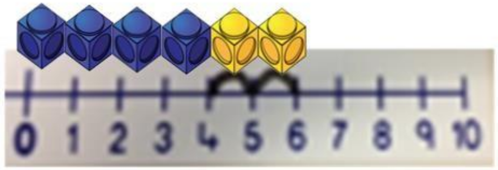
(Updated December 2019)

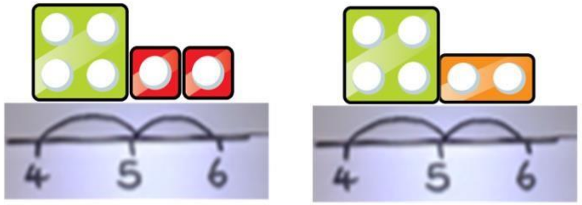
Calculation Policy : Addition

Key Language : sum, total, parts wholes, plus, add, altogether, more, is equal to is the same as

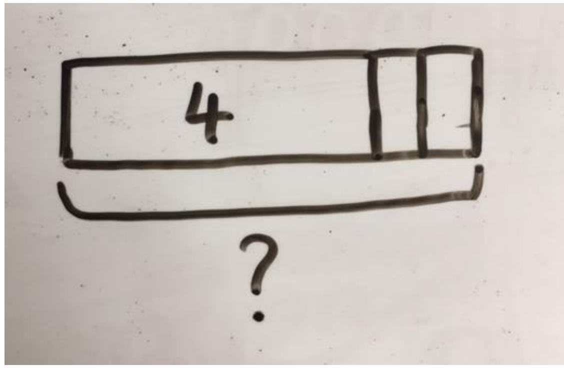
Concrete	Pictorial	Abstract
Combining two parts to make a whole (use other resources too e.g. eggs, shells, teddy bears, cars). 	Children to represent the cubes using dots or crosses. They could put each part on a part whole model too. 	4 + 3 = 7 Four is a part, 3 is a part and the whole is seven. 

Counting on using number lines using cubes or Numicon.



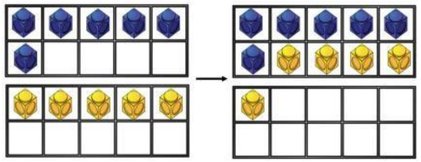


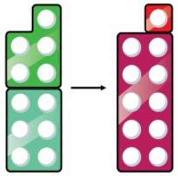
A bar model which encourages the children to count on, rather than count all.



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

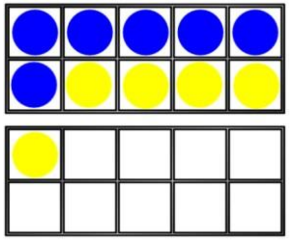
Regrouping to make 10; using ten frames and counters/cubes or using Numicon.





6 + 5

Children to draw the ten frame and counters/cubes.



Children to develop an understanding of equality e.g.

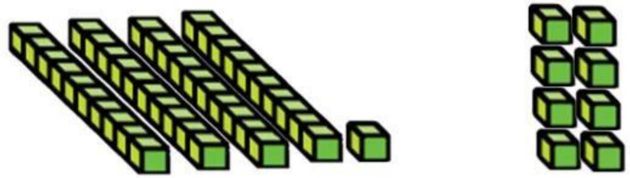
$6 + \square = 11$

$6 + 5 = 5 + \square$

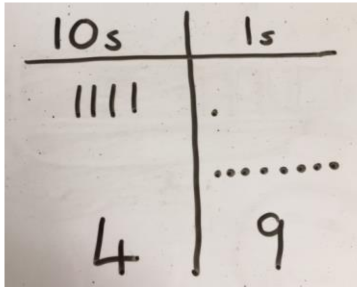
$6 + 5 = \square + 4$

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

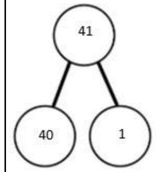
41 + 8



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



41 + 8



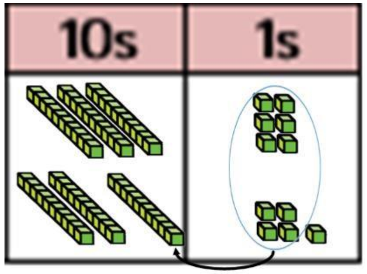
1 + 8 = 9

40 + 9 = 49

```
   4 1
+    8
   ---
   4 9
```

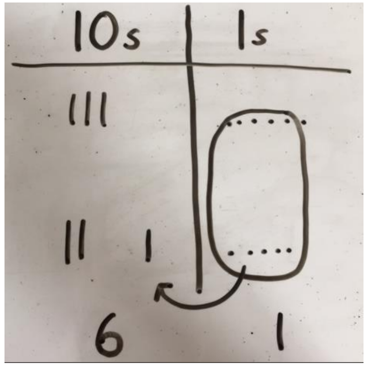
TO + TO using base 10. Continue to develop understanding of partitioning and place value.

36 + 25



6 1

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



Looking for ways to make 10.

36 + 25=

1 5

30 + 20 = 50

5 + 5 = 10

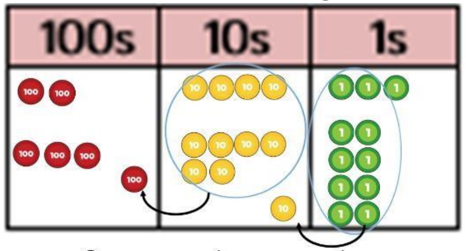
50 + 10 + 1 = 61

Formal methoc

```
  30    6
+ 20    5
  50  + 11  = 61
```

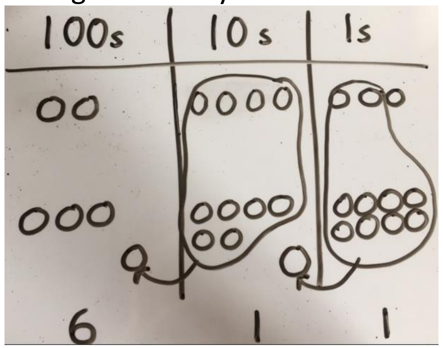
```
  36
 +25
  61
  1
```

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.



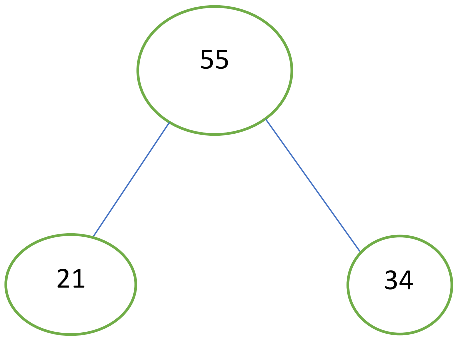
6 1 1

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




```
  243
 +368
  611
  1 1
```

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



?	
21	34

3

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

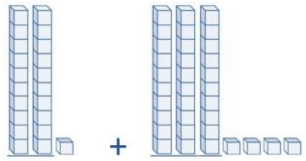
21 + 34 = 55. Prove it

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

21 + 34 =

$\boxed{}$ = 21 + 34

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

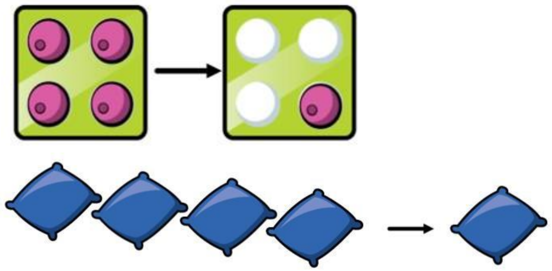
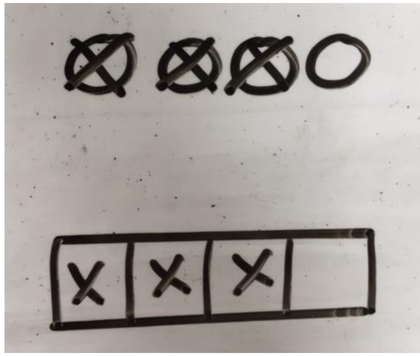


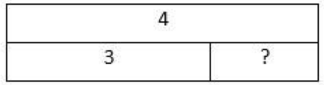
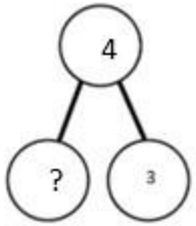
Missing digit problems:

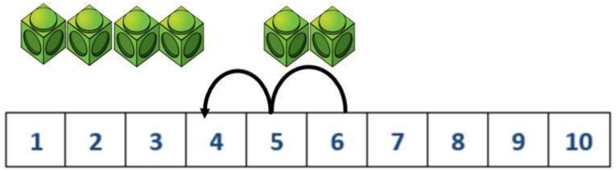
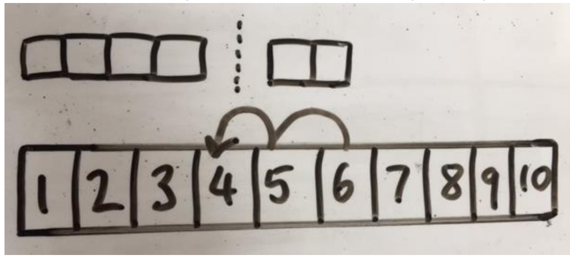
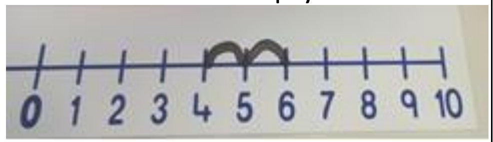
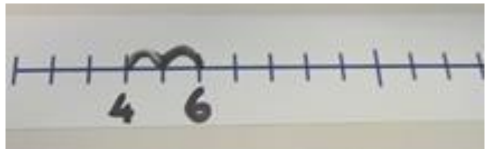
Calculation policy: Subtraction

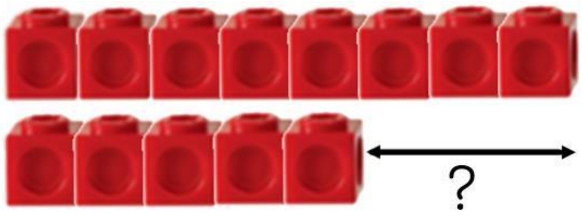
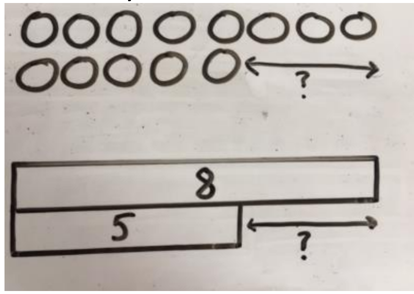
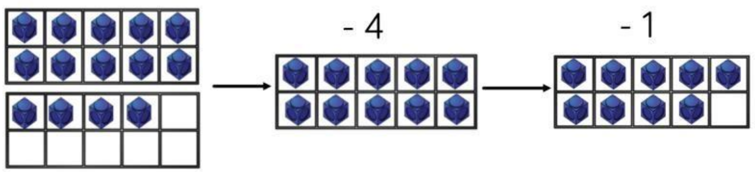
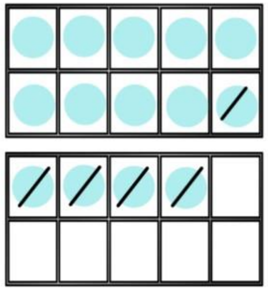
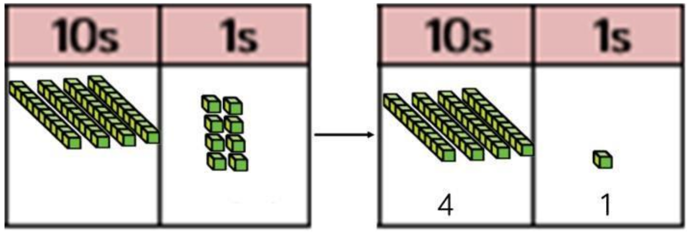
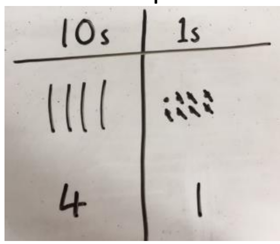
Key language: take away, less than, the difference, subtract, minus, fewer, decrease

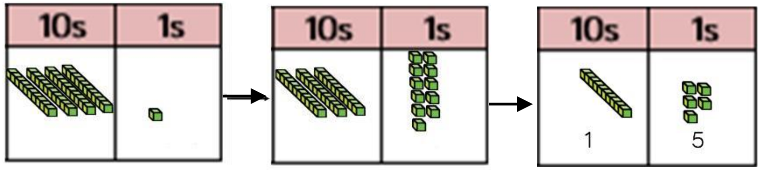
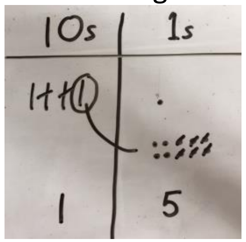
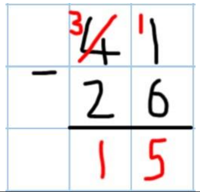
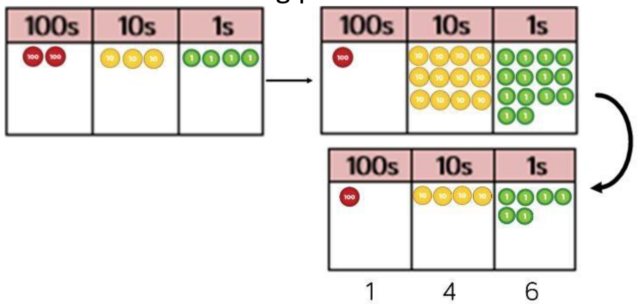
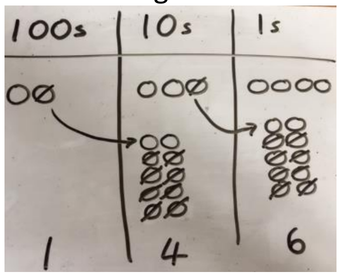
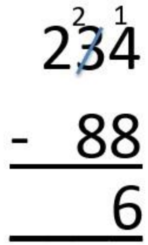
<table>
<tr><th>Concrete</th><th>Pictorial</th><th>Abstract</th></tr>
<tr>
<td>Physically taking away and removing objects from a whole (ten frames, Numicon, cubes and other items such as beanbags could be used).

4 – 3 = 1
</td>
<td>Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also be used.
</td>
<td>4- 3 =

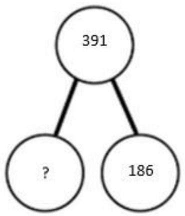
$\square$ = 4 – 3
</td>
</tr>
<tr>
<td>Counting back (using number lines or number tracks) children start with 6 and count back 2.

6 – 2 = 4
</td>
<td>Children to represent what they see pictorially e.g.
</td>
<td>Children to represent the calculation on a number line or number track and show their jumps. Encourage children to use an empty number line
</td>
</tr>
</table>

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 $\square$ 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 4 1 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. $\begin{array}{rr} & 48 \\ - & 7 \\ \hline & 41 \end{array}$ 40 8 7 40 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. 
Column method using place value counters.  234 – 88	Represent the place value counters pictorially; remembering to show what has been exchanged. 	Formal colum method. Children must understand what has happened when they have crossed out digits. 

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.

$\boxed{}$ = 391 – 186

$$\begin{array}{r} 391 \\ \underline{-186} \\ \underline{} \end{array}$$

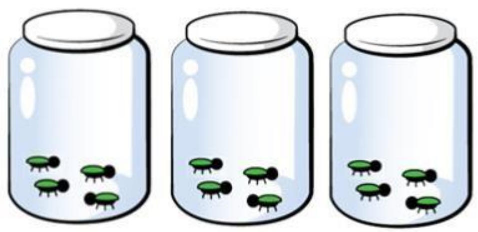
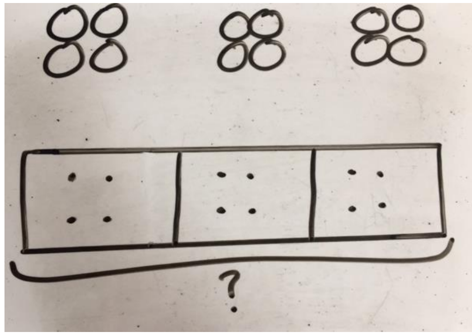
t is 186 less than 391?

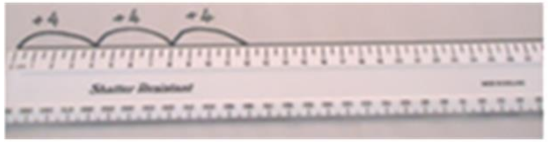
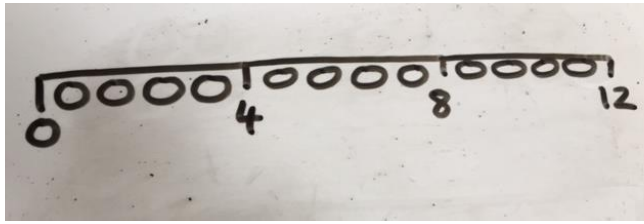
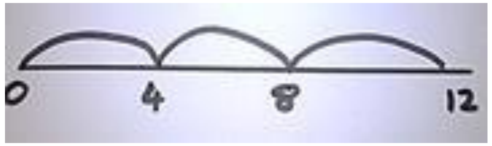
Missing digit calculations

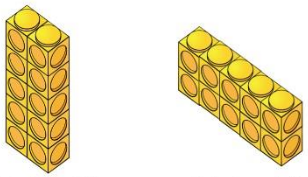
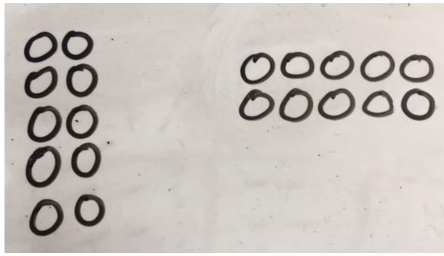
$$\begin{array}{rrr} 3 & 9 & \square \\ - \; \square & \square & 6 \\ \hline \square & 0 & 5 \end{array}$$

Calculation Policy Multiplication

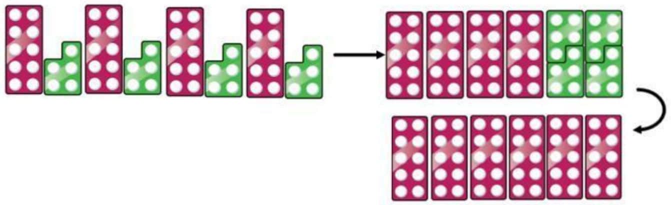
Key Language : double, times, multiplied by, the product of groups of, lots of equal groups

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

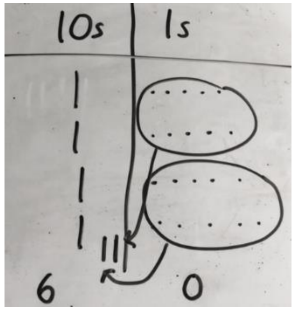
Number lines to show repeated groups-   3 × 4 Cuisenaire rods can be used too.	Represent this pictorially alongside a number line e.g.:  	Abstract number line showing three jumps of four. 3 × 4 = 12 

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	Children to represent the arrays pictorially. 	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

Partition to multiply using Numicon, base 10 or Cuisenaire rods. 4 × 15



Children to represent the concrete manipulatives pictorially.



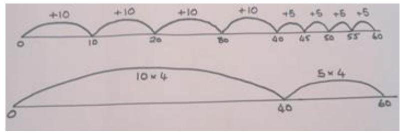
Grid method

x	10	5
4	40	20

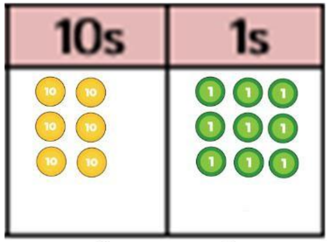
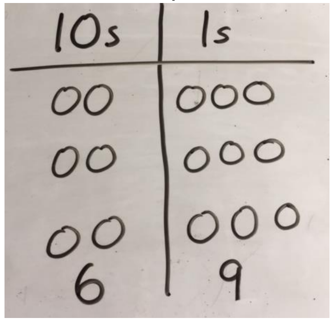
Children to be encouraged to show the steps they have taken.

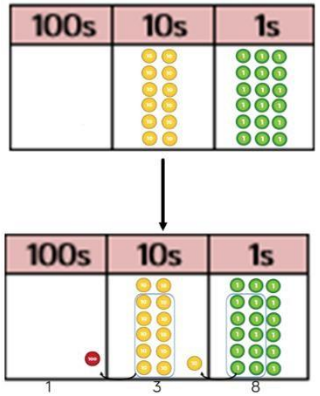
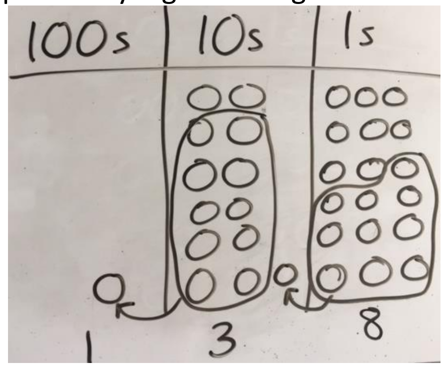
4 x 15
10 5

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



A number line can also be used

<table>
<tr>
<td>Formal column method with place value counters (base 10 can also be used.) 3 × 23

6 9</td>
<td>Children to represent the counters pictorially.
</td>
<td>Children to record what it is they are doing to show understanding. 3 × 23
3 × 20 = 60
20 3
3 × 3 = 9
60 + 9 = 69

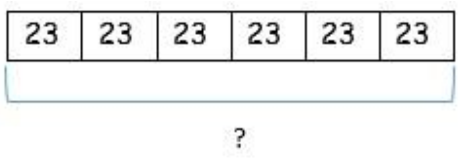
$\begin{array}{r} 23 \\ \times\ \ 3 \\ \hline 69 \\ \hline \end{array}$</td>
</tr>
<tr>
<td>Formal column method with place value counters. 6 x 23
</td>
<td>Children to represent the counters/base 10, pictorially e.g. the image below.
</td>
<td>Formal written method

6 x 23 =

$\begin{array}{r} 23 \\ \times\ \ 6 \\ \hline 138 \\ \hline {}_{1\ 1} \end{array}$</td>
</tr>
<tr>
<td colspan="2">When children start to multiply 3d × 3d and 4d × 2d etc., they should be confident with the abstract:

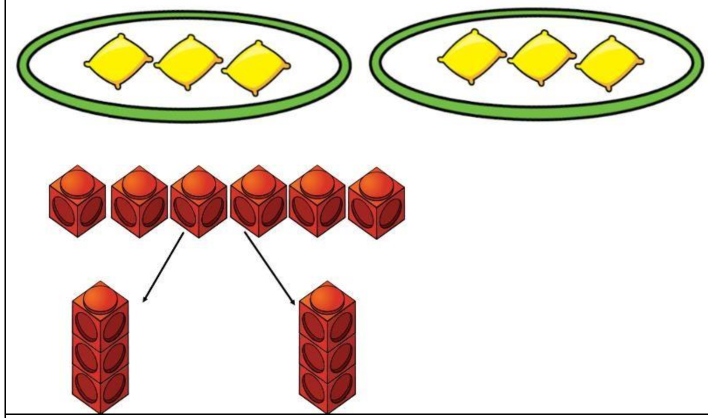
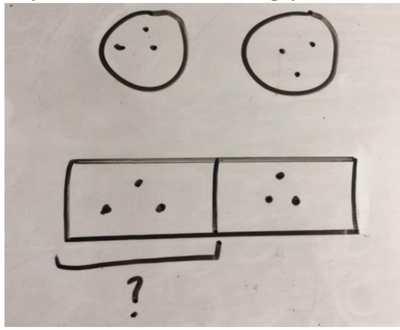
To get 744 children have solved 6 × 124.
To get 2480 they have solved 20 × 124.</td>
<td>$\begin{array}{r} 1\ 2\ 4 \\ \times\ \ \ 2\ 6 \\ \hline 7\ 4\ 4 \\ 2\ 4\ 8\ 0 \\ \hline 3\ 2\ 2\ 4 \\ \hline {}_{1\ 1} \end{array}$
Answer: 3224</td>
</tr>
</table>

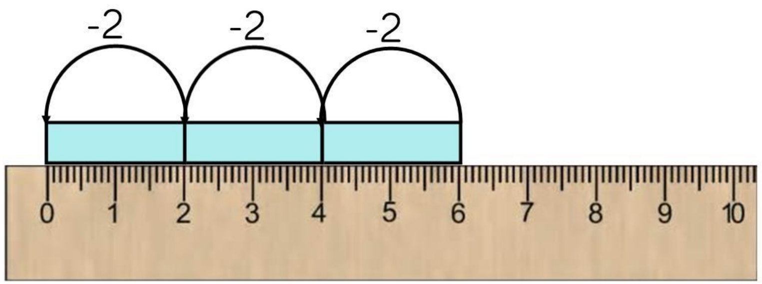
Conceptual variation; different ways to ask children to solve 6 × 23

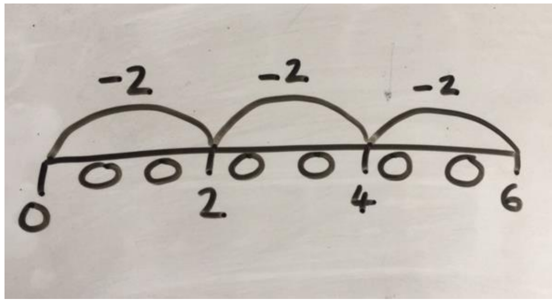
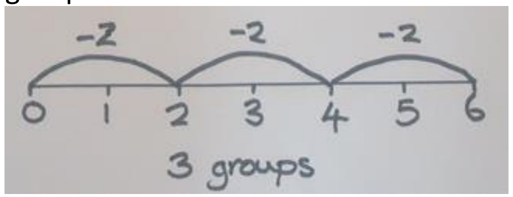
	Mai had to swim 23 lengths, 6 times a week. How many lengths did she swim in one week? With the counters, prove that 6 x 23 = 138	Find the product of 6 and 23 6 × 23 = $\square$ = 6 × 23 $\begin{array}{r} 6 \\ \times\ \underline{23} \\ \hline \end{array}$ $\begin{array}{r} 23 \\ \times\ \underline{\ \ 6} \\ \hline \end{array}$	What is the calculation?  What is the product?

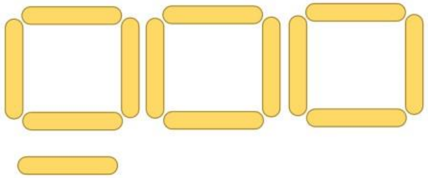
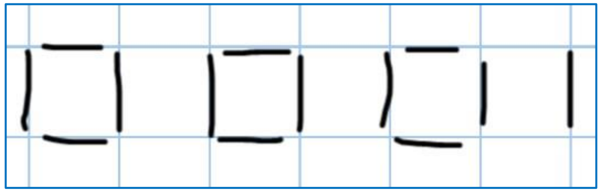
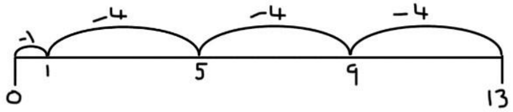
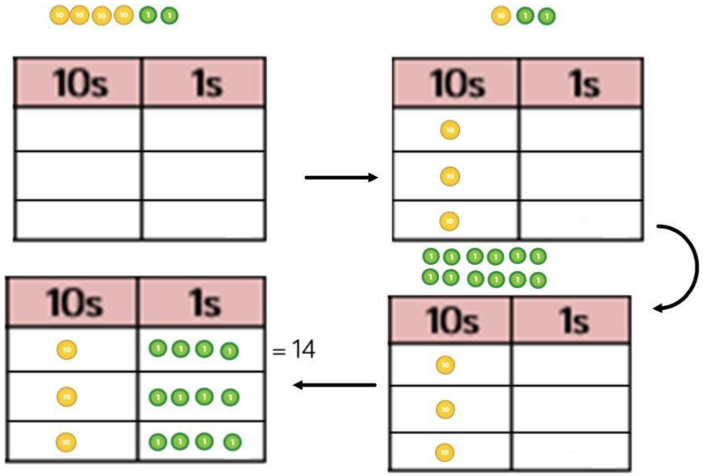
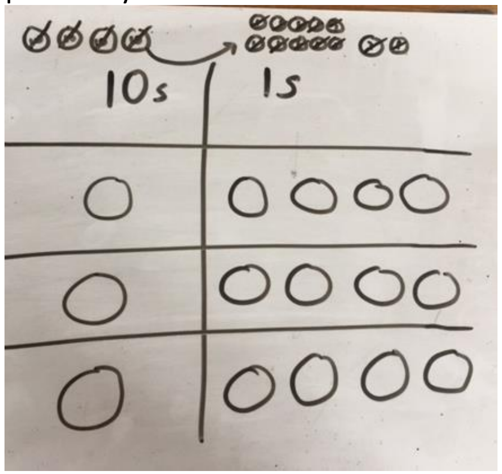
Calculation Policy Division

Key Language : Share, group, divide,divided by half

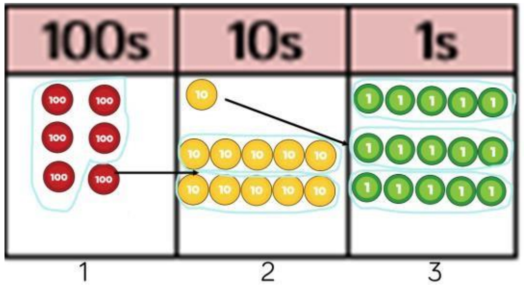
<table>
<tr><th>Concrete</th><th>Pictorial</th><th>Abstract</th></tr>
<tr>
<td>Sharing using a range of objects.
6 ÷ 2
</td>
<td>Represent the sharing pictorially.

</td>
<td>6 ÷ 2 = 3
3 3

Children should also be encouraged to use their 2 times tables facts.</td>
</tr>
<tr>
<td>Repeated subtraction using Cuisenaire rods above a ruler. 6 ÷ 2


3 groups of 2</td>
<td>Children to represent repeated subtraction pictorially.

</td>
<td>Abstract number line to represent the equal groups that have been subtracted.

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

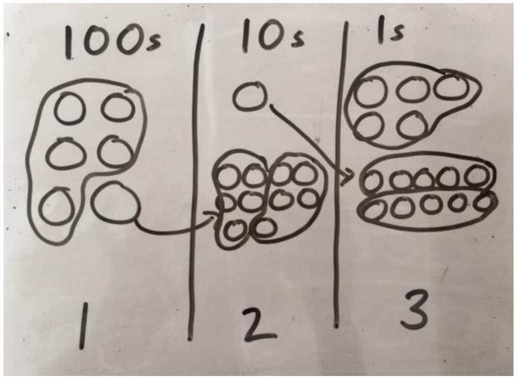
2d ÷ 1d with remainders using lollipop sticks. Cuisenaire rods, above a ruler can also be used. 13 ÷ 4 Use of lollipop sticks to form wholes- squares are made because we are dividing by 4.  There are 3 whole squares, with 1 left over.	Children to represent the lollipop sticks pictorially.  There are 3 whole squares, with 1 left over.	13 ÷ 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 ÷ 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

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.

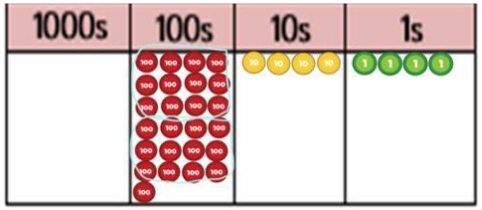


Children to the calculation using the short division scaffold.

$$\begin{array}{r} 123 \\ 5\overline{)6^{1}1^{1}5} \end{array}$$

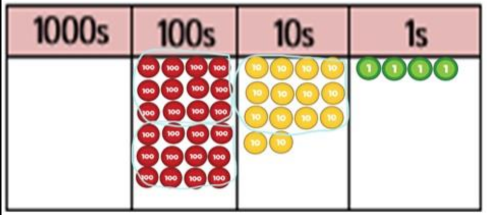
Long division using place value counters
2544 ÷ 12

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



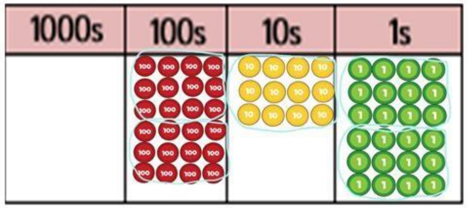
We can group 24 hundreds into groups of 12 which leaves with 1 hundred.

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



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

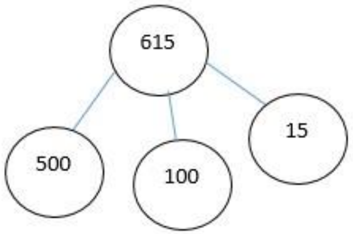
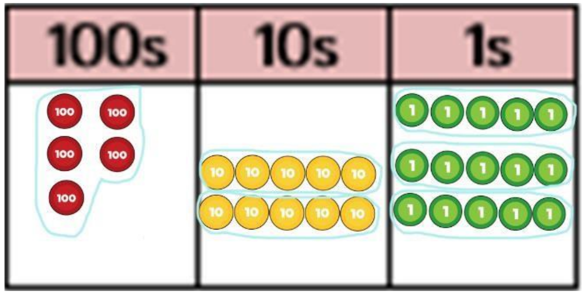
$$\begin{array}{r}
021\\
12\overline{)2544}\\
\underline{24}\\
14\\
\underline{12}\\
2
\end{array}$$



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

$$\begin{array}{r}
0212\\
12\overline{)2544}\\
\underline{24}\\
14\\
\underline{12}\\
24\\
\underline{24}\\
0
\end{array}$$

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 = $\boxed{}$ = 615 ÷ 5	What is the calculation? What is the answer? 

Maths Vocabulary by year group:

Mathematics

EYFS	KS1		LKS2		UKS2	
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
big	above	anticlockwise	2-dimensional (2d)	2-dimensional (2d)	accuracy	2-dimensional (2d)
birthday	add	bar chart	addition	3-dimensional (3d)	acute angle	3-dimensional (3d)
compare	altogether	bigger	adjacent	accuracy	addition	accuracy
corner	array	clock	ascending	acute angle	area	addition
count	below	clockwise	axe	addition	Carroll diagram	adjacent
day	column	combine	axis	area	composite numbers	algebra
doubling	compare	common	bar chart	categoric data	cubes	axis
down	corner	count	Carroll diagram	continuous data	denominator	billion
empty	difference	degrees	chart	common	division	common factors
equal	digit	describe	common	conversion	factor	common multiples
fast	double	describe	compare	convert	factor pair	construct
fast	edge	draw	degrees	coordinate	factors	conversion
fewest	equal	equal	denominator	decimal place	fifth	co-ordinates
full	face	equivalent	descending	decimals	formal written method	degrees
group	far / near	fold	diagonal	denominator	four fifths	denominator
heavy	greater than	graph	division	derive	half	diagonal
holiday	group	group	frequency table	equivalent	HCF	difference
left	half / halves	hour	horizontal	estimate	hundreds	division
less	halfway	hundred	hundred	fractions	imperial	equivalent
light	left / right	investigate	leap year	frequency	improper fraction	expand
long	less / more	label	least common	hundredth	irregular shape	expression
middle	less than	larger	least popular	integer	kilometre	factor
more	minus	least popular	most common	inverse		factor pair
morning	month	less				
most	more	line of symmetry				
night	multiply	match				
nothing	near / close	minute				
one						
order						

○ pair ○ right ○ same ○ shape ○ sharing ○ short ○ side ○ size ○ slow ○ small ○ ten ○ today ○ up ○ week ○ yesterday tomorrow ○ zero	○ number bonds ○ numeral ○ one ○ order ○ plus ○ quarter / quarters ○ repeated addition ○ row ○ seasons ○ shallow / deep ○ shapes ○ share equally ○ size ○ sum ○ take-away ○ ten ○ thick / thin ○ total ○ unit ○ whole ○ wide / narrow ○ year	○ mirror line ○ more ○ most popular ○ ninety-degree turn ○ one third ○ partition ○ pattern ○ pictogram ○ predict ○ recombine ○ reflection ○ right angle ○ rotation ○ second ○ size ○ smaller ○ sort ○ straight line ○ symmetrical ○ table ○ tally ○ temperature ○ ten ○ three quarters ○ time ○ title ○ unit / one ○ vote	○ most popular ○ multiples ○ multiplication ○ non-unit fraction ○ numerator ○ order ○ orientation ○ parallel ○ partition ○ perpendicular ○ product ○ recombine ○ right angle ○ roman numerals ○ rotate ○ rotation ○ scale down ○ scale up ○ subtraction ○ table ○ tenths ○ thousand ○ twelve-hour clock ○ twenty-four-hour clock ○ unit fraction ○ Venn diagram ○ Vertical	○ investigate ○ least common ○ line graph ○ mirror line ○ most common ○ multiples ○ negative integer ○ number system ○ numerator ○ obtuse angle ○ partition ○ perimeter ○ polygon ○ product ○ quadrant ○ quadrilateral ○ recombine ○ reflection ○ right angle ○ roman numerals ○ round ○ square number ○ subtraction ○ table ○ tenth ○ thousand ○ translation ○ triangle	○ LCM ○ least common ○ metric ○ million ○ mixed number ○ most common (mode) ○ multiples ○ multiplication ○ numerator ○ ones/units ○ percentage ○ perimeter ○ polygon ○ polygon ○ powers ○ prime factor ○ primes ○ product ○ proper fraction ○ proportion ○ quadrant ○ quadrilateral ○ quarter ○ ratio ○ reflex angle ○ regular shape ○ squares ○ subtraction	○ formal written method ○ function ○ HCF ○ horizontal ○ hundreds ○ imperial ○ investigate ○ LCM ○ least common ○ linear number sequences ○ mean ○ metric ○ miles ○ millions ○ most common (most) ○ multiple ○ multiplication ○ numerator ○ ones/units ○ operation ○ opposite ○ parallel ○ perpendicular ○ pie chart ○ powers ○ prime factor ○ prime number

				○ volume ○ x-axis ○ y-axis	○ tens ○ thousands ○ translation ○ two fifths ○ units ○ Venn diagram ○ vinculum ○ volume	○ product ○ quadrants ○ reflection ○ remainder ○ segment ○ sequences ○ simplify ○ square ○ subtraction ○ surface area ○ symmetrical ○ tens ○ thousands ○ translation ○ unknown ○ variable ○ vertical ○ vinculum ○ volume ○ x-axis ○ y-axis

Based on research by the Educational Endowment Fund in 2018, there is a clear vocabulary gap between students from disadvantaged backgrounds and students from non-disadvantaged backgrounds. The research says that, before they even start school, disadvantaged children have a 30,000,000-word gap on their peers. Currently, as they progress through the education system, this gap does not decrease quickly enough: 49% of Year 1 pupils have a limited vocabulary to which it affects their learning; and 43% of Year 7 pupils have a limited vocabulary to which it affects their learning. Following this trend, nearly half of students who come from a disadvantaged background are not sufficiently prepared for further education and/or employment.

Understanding the importance of subject-specific vocabulary can therefore greatly increase children’s chances both within education, and beyond. To address this, The Outer West Learning Trust and Walbottle Campus decided to collaborate to create a vocabulary document which would ensure children from all backgrounds were provided with clear and consistent definitions of key subject-specific/Tier-3 vocabulary. As well as supporting children in their reading and writing progress whilst at primary school, this also supports children with their transition to secondary school; this document was created by subject leaders from across the Outer West

Learning Trust with input from subject faculty leads at Walbottle Campus. Using both secondary schemes of work and through discussions with secondary subject leaders, primary staff were able to create a ‘vocabulary scheme of work’ which ensured cross-curricular links and a ‘spiralled coverage’ of key vocabulary to ensure retainment.