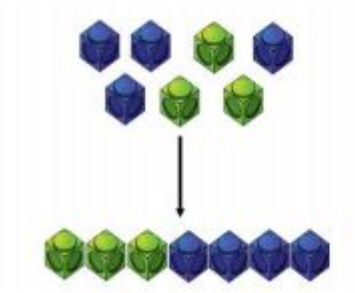
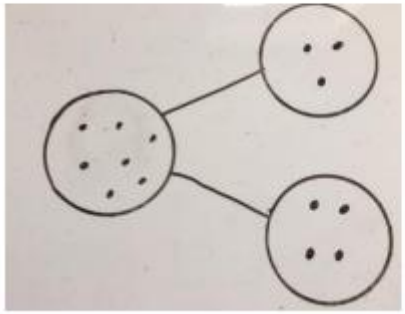
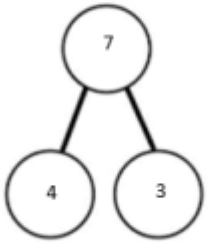
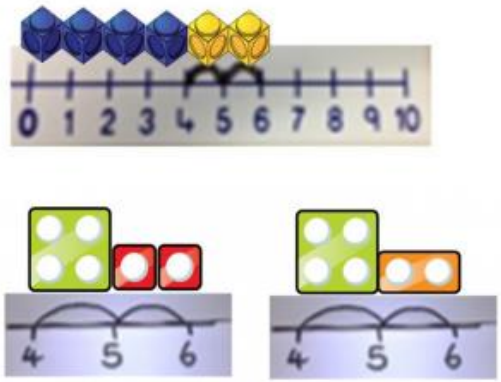
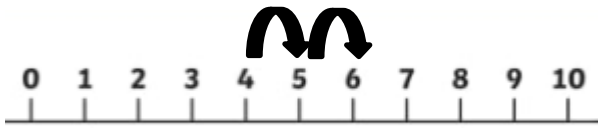
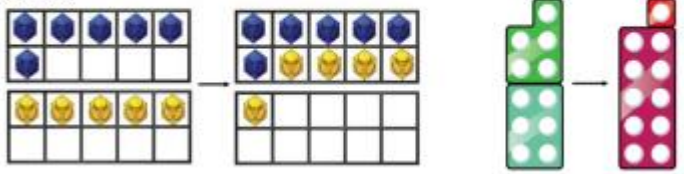
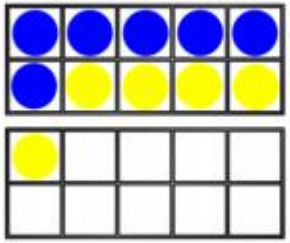
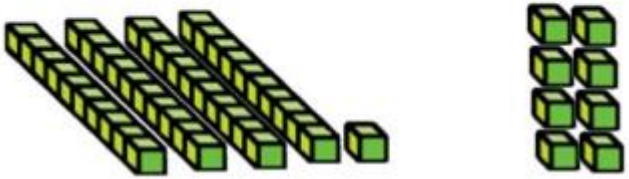
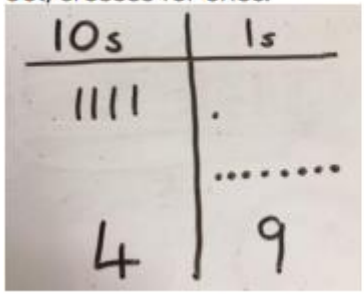
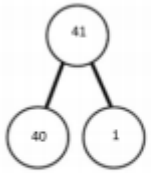
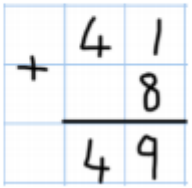
Ormesby Village Infant and Junior Schools Federation

Calculation Policy

Addition

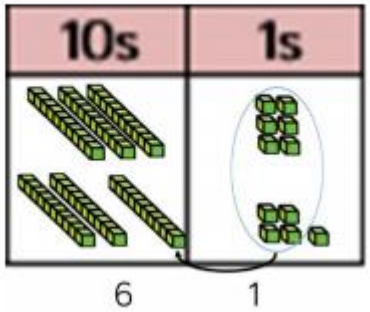
Key language: sum, total, parts and wholes, plus, add, altogether, more, 'is equal to', 'is the same as'.

Concrete	Pictorial	Abstract
Combining two parts to make a whole (use other resources too e.g. eggs, shells, teddy bears, cars). 	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. 

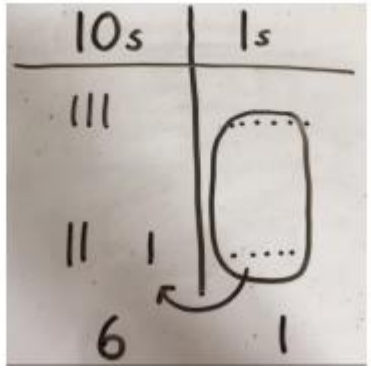
Counting on using number lines using cubes or Numicon.  	A number line which encourages children to count on rather than count all.  	The abstract number line: What is 2 more than 4? What is the sum of 2 and 4? What is the total of 4 and 2? 4 + 2 
Regrouping to make 10; using ten frames and counters/cubes 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 

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

36 + 25

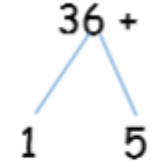


Chidlren to represent the base 10 in a place value chart.



Looking for ways to make 10.

36 + 25=

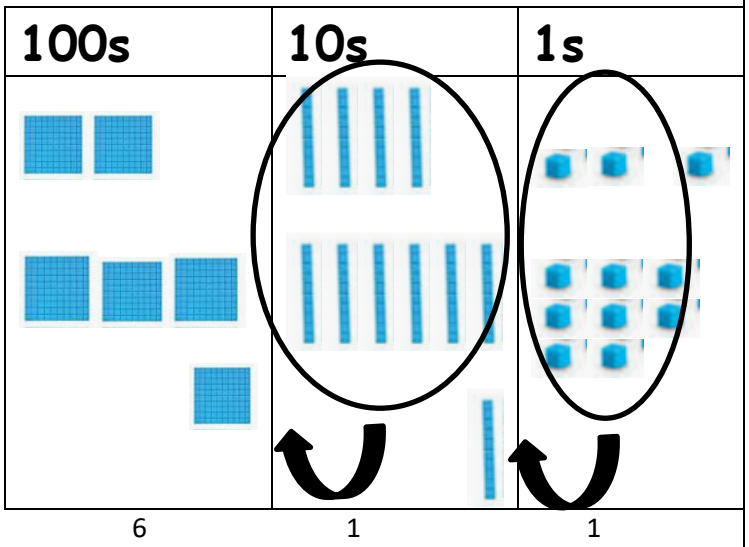


30 + 20 = 50
5 + 5 = 10
50 + 10 + 1 = 61

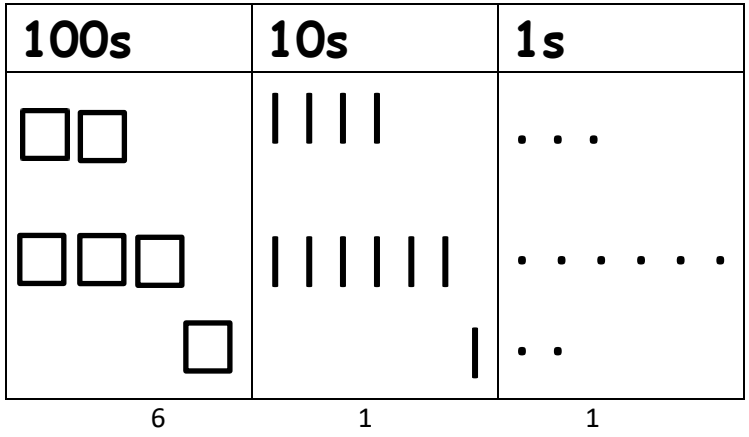
Formal method:

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

Use of Base 10 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 Base 10 in a place value chart, circling when they make an exchange.



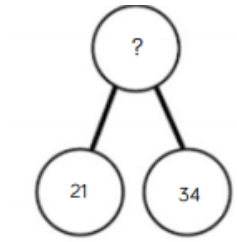
Expanded column method:

$$\begin{array}{rrr} 200 & 40 & 3 \\ +\ 300 & 60 & 8 \\ \hline 600 & 10 & 1 \\ \cancel{100} & \cancel{10} & \end{array}$$

Progressing to the formal method:

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

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?

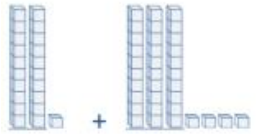
21 + 34 = 55. Prove it

21
+34
___

21 + 34 =

☐ = 21 + 34

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



Missing digit problems:

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

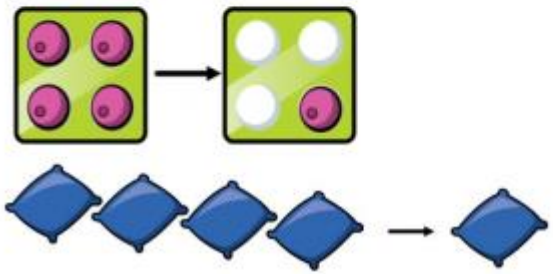
Subtraction

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

Concrete

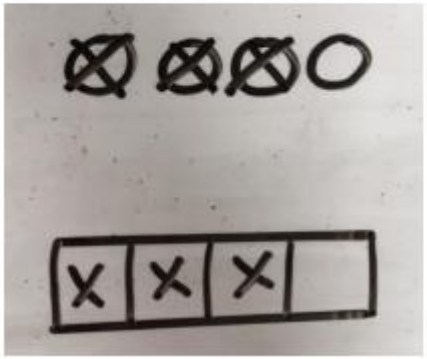
Physically taking away and removing objects from a whole (ten frames, Numicon, cubes and other items such as beanbags could be used).

4 – 3 = 1



Pictorial

Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also be used.

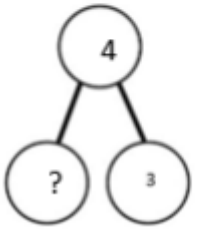


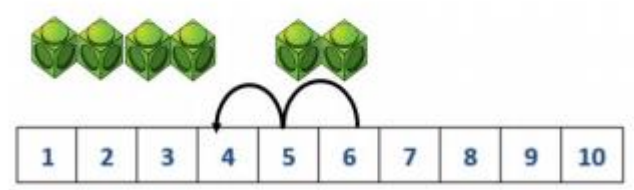
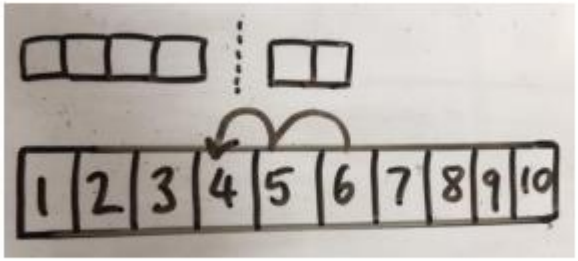
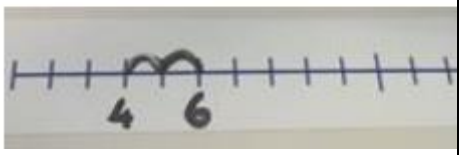
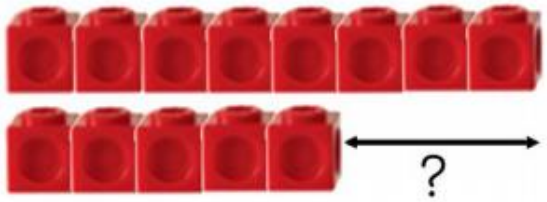
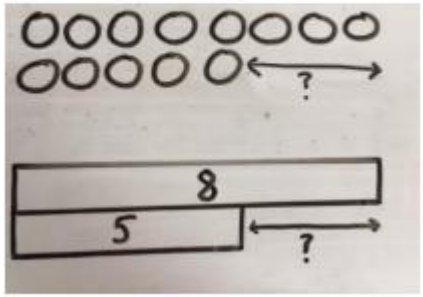
Abstract

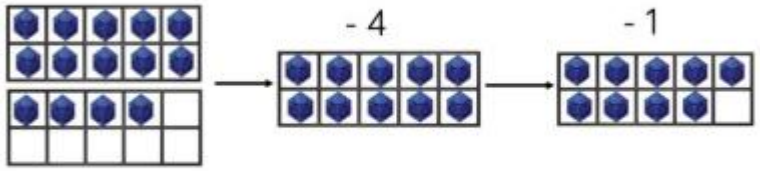
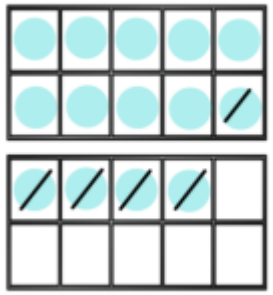
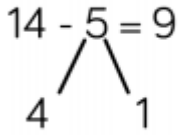
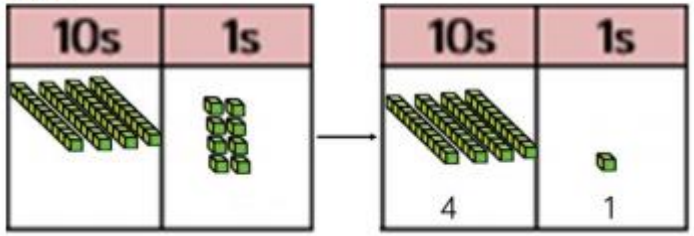
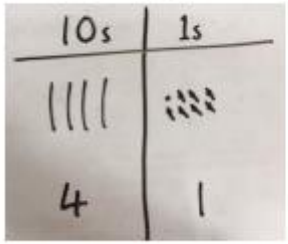
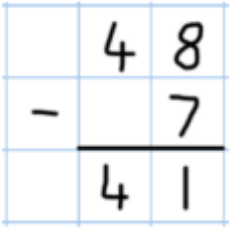
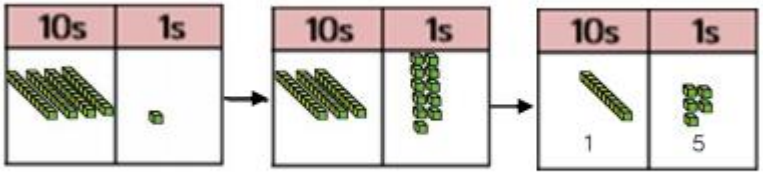
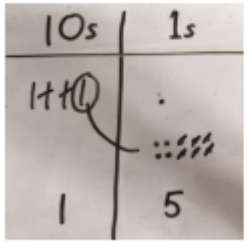
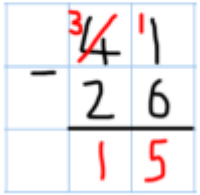
4 - 3 =

☐ = 4 – 3

4	
3	?



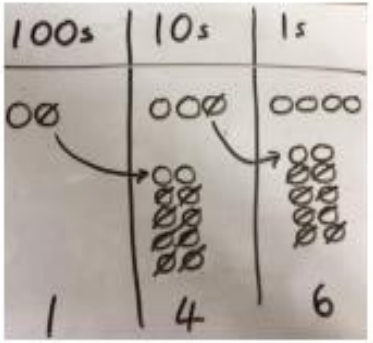
Counting back (using number lines or number tracks) children start with 6 and count back 2. 6 – 2 = 4 	Children to represent what they see pictorially e.g. 	Children to represent the calculation on a number line or number track an show their jumps. Encourage children to use an empty number line  
Finding 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 – 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 	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 Base 10 for exchanging as above.
e.g. 234-88:

1. Make the numbers using Base 10 in a place value grid.
2. Exchange a ten for 10 ones.
3. Take 8 ones from the ones column to leave 6.
4. Exchange a hundred for 10 tens.
5. Take 8 tens from the tens column to leave 4.
6. One hundred will remain in the hundreds column.

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



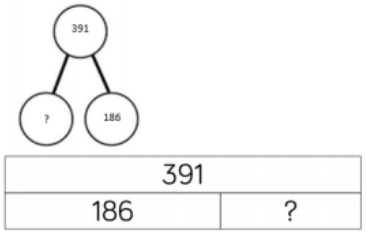
Expanded column method.
Children must understand what is happening when the cross out digits:

100	120	
~~200~~	~~30~~	14
-	80	8
100	40	6

Formal column method:

1	12	1
~~2~~	~~3~~	4
-	8	8
1	4	6

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



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

Calculate the difference between 391 a
186.

□ = 391 – 186

391
-186

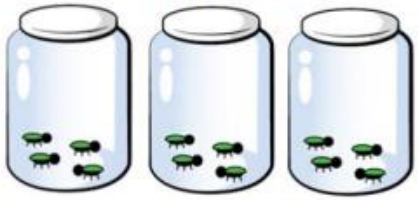
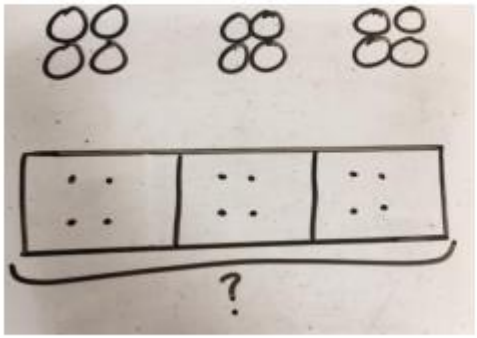
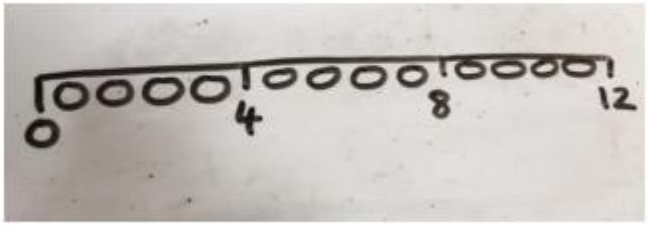
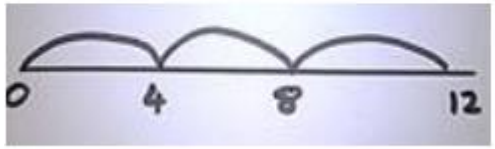
What is 186 less than 391?

Missing digit calculations

3	9	□
-	□	□ 6
□	0	5

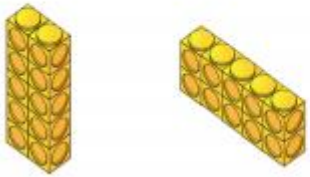
Multiplication

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 

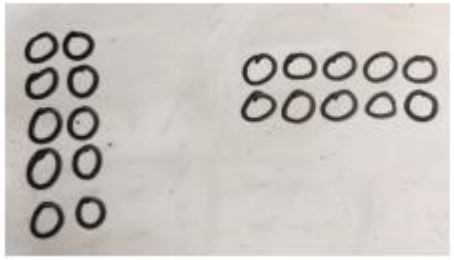
Use arrays to illustrate commutativity counters and other objects can also be used.

$2 \times 5 = 5 \times 2$



2 lots of 5 5 lots of 2

Children to represent the arrays pictorially.

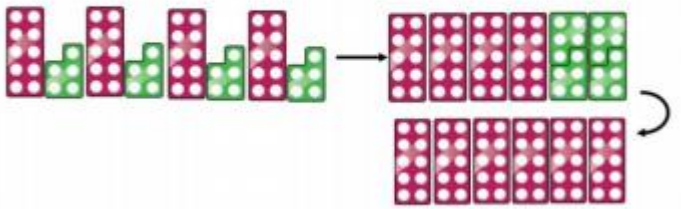


Children to be able to use an array to write a range of calculations e.g.

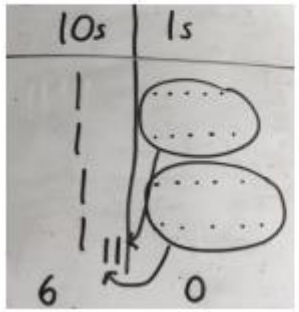
$10 = 2 \times 5$
$5 \times 2 = 10$
$2 + 2 + 2 + 2 + 2 = 10$
$10 = 5 + 5$

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

4×15



Children to represent the concrete manipulatives pictorially.



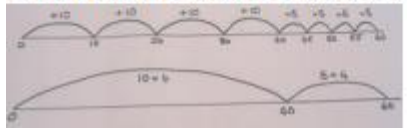
Children to be encouraged to show the steps they have taken.

4×15

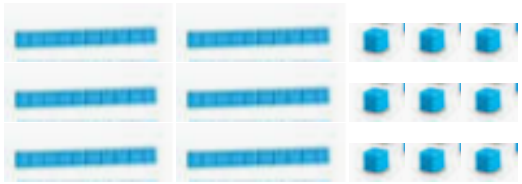
$10 \quad 5$

$10 \times 4 = 40$
$5 \times 4 = 20$
$40 + 20 = 60$

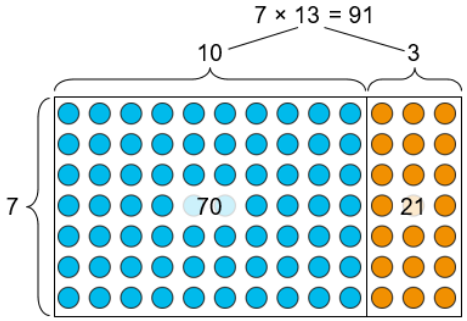
A number line can also be used



Using Base 10 to make arrays to multiply tens and ones by a single digit e.g. Three rows each with 23 chairs, how many chairs altogether?



Partitioning an array when multiplying larger numbers by a single digit.



$7 \times 13 = 7 \times 10 + 7 \times 3$
$= 70 + 21$
$= 91$

Grid method:

7x13-

X	10	3
7	70	21

70+21=91

Progressing to the formal column method:

$$\begin{array}{r} 13 \\ \times \quad 7 \\ \hline 21 \ (7\times3) \\ + \quad 70 \ (7\times10) \\ \hline 91 \end{array}$$

$$\begin{array}{r} 13 \\ \times \quad 7 \\ \hline 91 \\ \not{2} \end{array}$$

Multiplying by a teens number using grid
e.g. 23x14:

x	20	3
10	200	30
4	80	12

= 230 + 92 = 322

23
X 14
12 (4x3)
80 (4x20)
30 (10x3)
200 (10x20)
322

23
x 14
92
230
322

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.

124
× 26
744
2480
3224

Answer: 3224

Conceptual variation; different ways to ask children to solve 6x23

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 x 23 = 138

Find the product of 6 and 23

6 × 23 =

☐ = 6 × 23

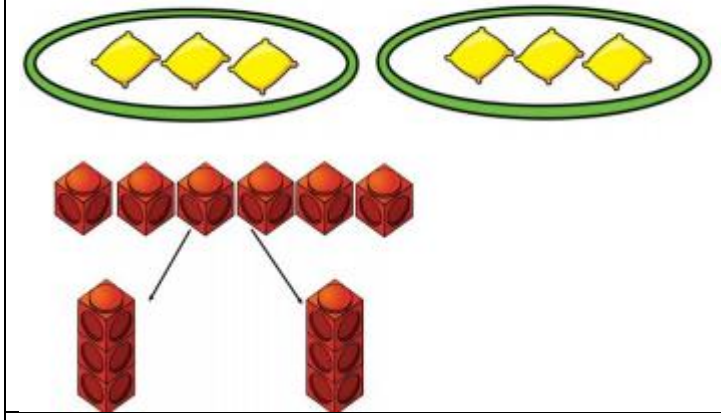
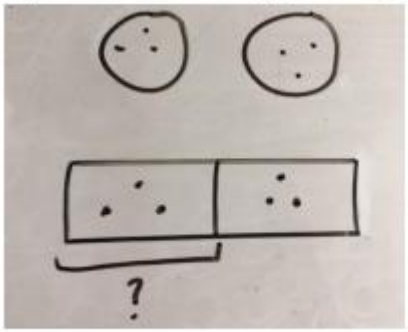
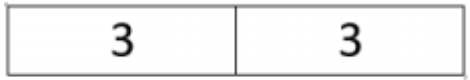
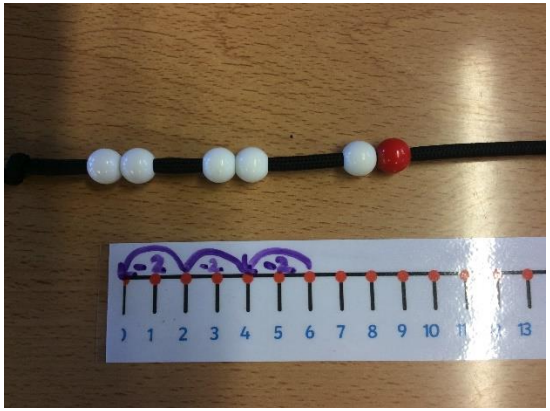
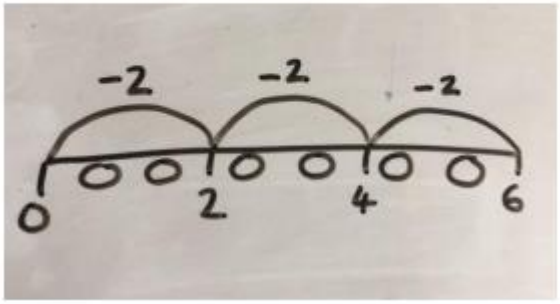
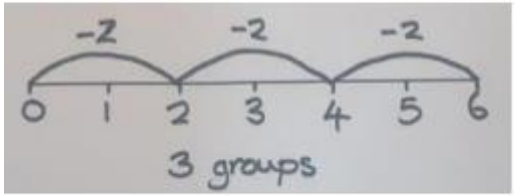
6 × 23 = 23 × 6

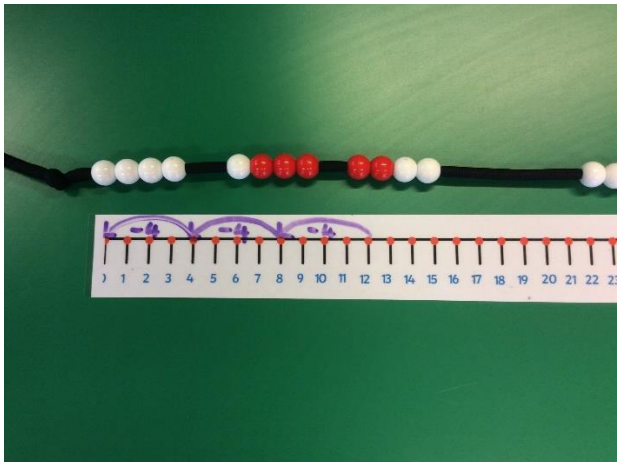
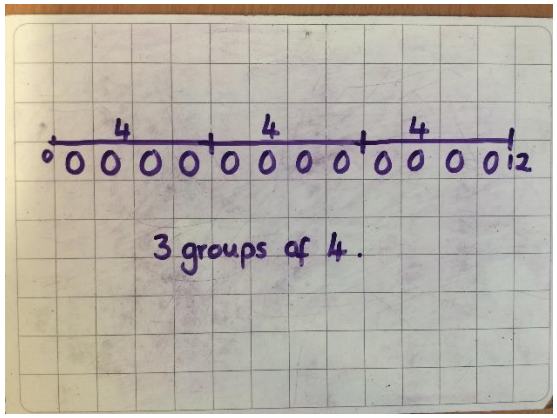
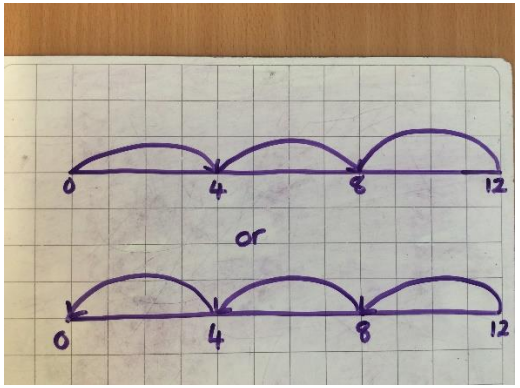
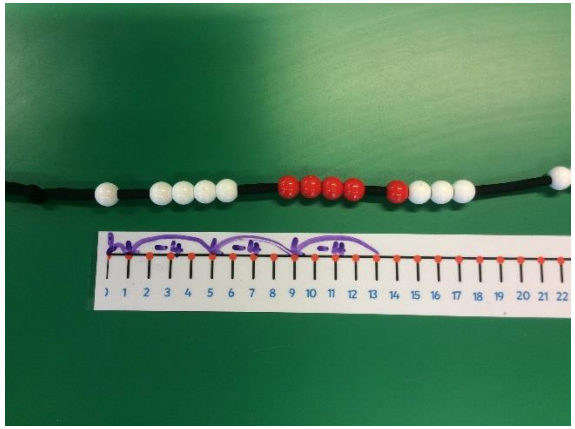
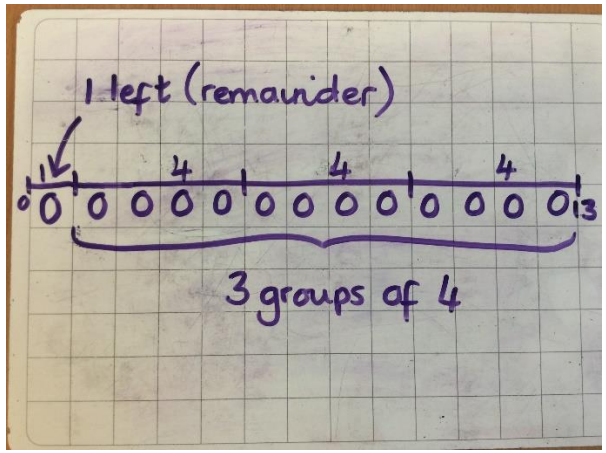
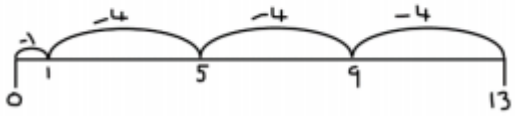
What is the calculation?
What is the product?

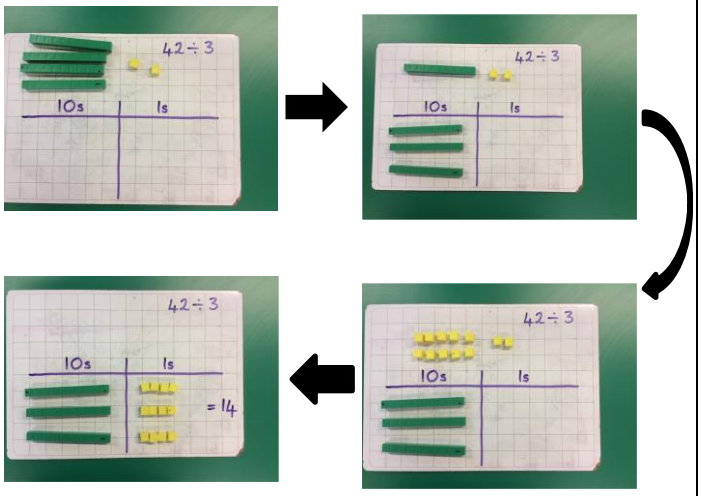
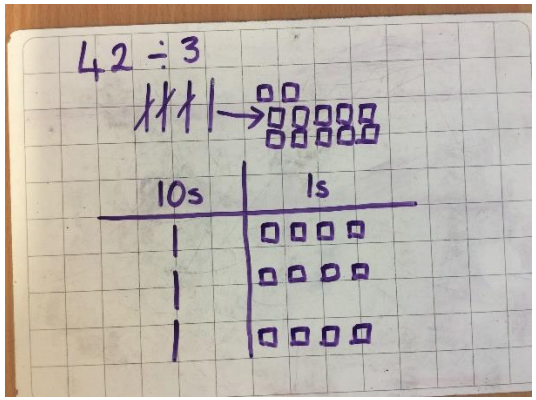
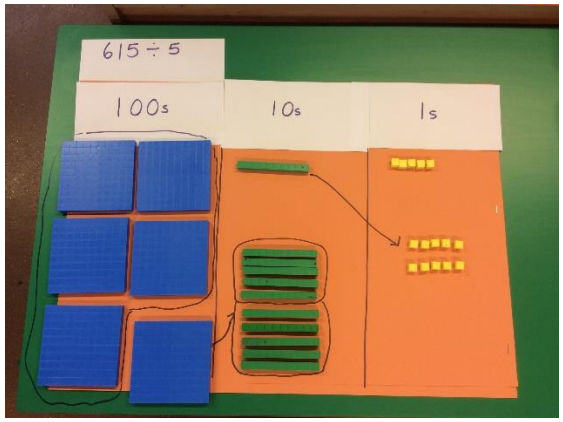
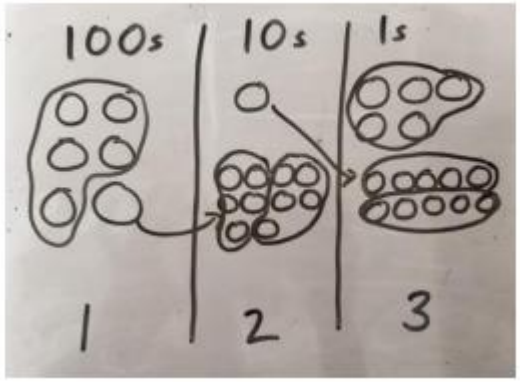
100s	10s	1s

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 ÷ 2 = 3  Children should also be encouraged to use their 2 times tables facts.
Repeated subtraction using a beadstring on a number line. 	Children to represent repeated subtraction pictorially. 	Abstract number line to represent the equal groups that have been subtracted. 

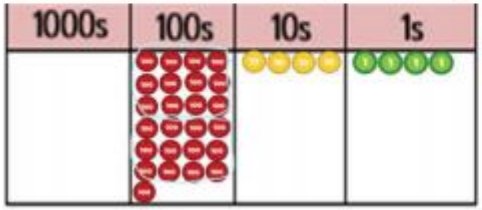
Two digit divided by one digit, no remainder, using a beadstring and a number line. 12 ÷ 4: 	Children to represent the beadstring pictorially. 	12 ÷ 4 = 3 Children should be encouraged to use their times table facts; they could also represent repeated addition or subtraction on a number line. 
Two digit divided by one digit with a remainder, using a beadstring and a number line. 13 ÷ 4: 	Children to represent the beadstring pictorially. 	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'  NB. Year 6 children will need to be able to write the remainder as a decimal and a fraction.

Sharing using Base 10. 	Children to represent the Base 10 pictorially. 	Children to be able to make sense of the Base 10 and write calculations to show the process. 42 ÷ 3 42 = 30 + 12 30 ÷ 3 = 10 12 ÷ 3 = 4 10 + 4 = 14
Short division using Base 10 to group. 615÷5 	Represent the place value counters pictorially. 	Children to the calculation using the short division scaffold. $5\overline{)615}$ = 123

Long division using place value counters (these can be found on MathsBot.com).

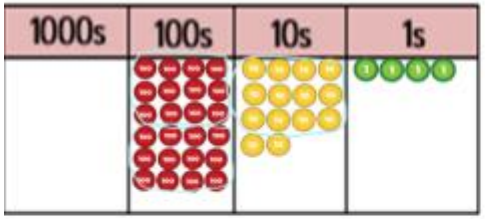
$2544 \div 12$

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



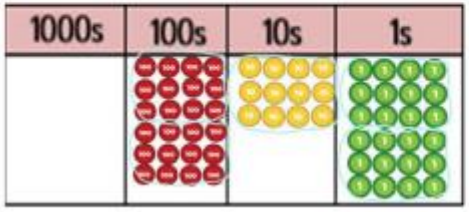
We can group 24 hundreds into groups of 12 which leaves with 1 hundred.

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



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

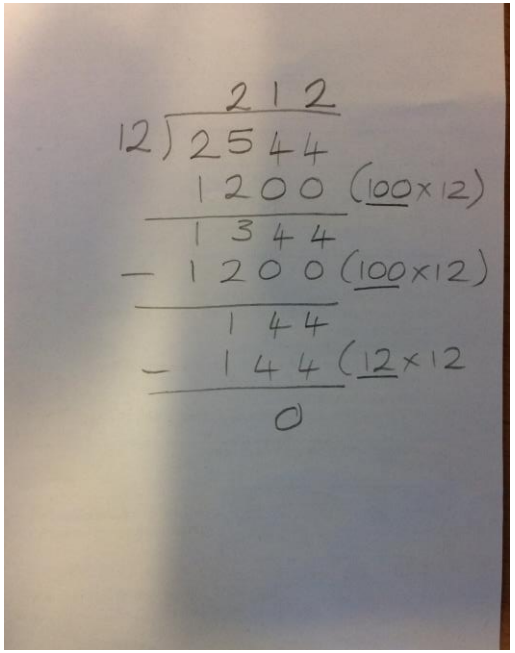
$$\begin{array}{r} 021 \\ 12\overline{)2544} \\ 24 \\ \hline 14 \\ 12 \\ \hline 2 \end{array}$$



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

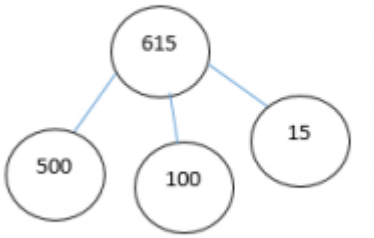
$$\begin{array}{r} 0212 \\ 12\overline{)2544} \\ 24 \\ \hline 14 \\ 12 \\ \hline 24 \\ 24 \\ \hline 0 \end{array}$$

Repeated subtraction can also be used. Children to use their knowledge of multiples to help with this.



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?