



Calculation Policy – Pucklechurch CE VC Primary School

Reviewed January 2024

Rationale

This calculation policy is in place to ensure a consistent approach to calculation across the school. It has been designed to support our delivery of the Maths curriculum using the White Rose program of study.

Purpose

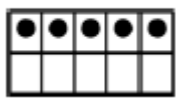
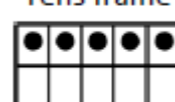
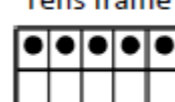
- Supporting teachers to be clear on appropriate progression of calculation skills;
- Support teachers to be clear on an appropriate progression of manipulatives in each year group
- Enabling teachers to deliver high-quality teaching;
- Ensuring that children build progressively on what they have learned whatever their age or ability;
- Supporting teachers and teaching assistants to enable children to ‘keep up’ on their maths learning, closing gaps with their peers and addressing misconceptions that have the potential to hinder progress.

Guidance

	EYFS/Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Addition	Creating 2 parts to make a whole.	Adding 3 single digits.	Column method up to 3 digits with exchanging	Column method up to 4 digits with exchanging	Column method over 4 digits with exchanging	Column method over 4 digits with exchanging
Subtraction	Taking away ones Counting back Find the difference Part whole model	Taking away ones Counting back Find the difference Part whole model Make 10	Column method up to 3 digits with exchanging	Column method up to 4 digits with exchanging	Column method over 4 digits with exchanging	Column method over 4 digits with exchanging
	EYFS/Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Multiplication	Recognise and make equal groups Doubling Counting in multiples	Arrays – showing commutative multiplication	Arrays 2 digits x 1 digit	Column multiplication - 2 and 3 digit x 1 digit	Column multiplication - up to 4 digits x 1 or 2 digits	Column multiplication - up to 4 digits x 2 digits
Division	Sharing objects into groups	Division as grouping Division within arrays linking to multiplication Division as repeated subtraction	Division with remainder using times table facts and repeated subtraction 2 digit divided by 1 digit using place value manipulatives	Division with a remainder using times table facts Short division – up to 3 digits divided by 1 digit	Division using times table facts Short division – up to 4 digits divided by 1 digit	Division using times table facts Long division – up to 4 digits divided by 2 digits exchanging into tenths and hundredths column too.

Progression in the use of manipulatives to support learning at Pucklechurch Primary



EYFS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Real-life objects	Real-life objects	Real-life objects	Real-life objects	Real-life objects	Real-life objects	Real-life objects
0-9 digit cards	0-9 digit cards	0-9 digit cards	0-9 digit cards	0-9 digit cards	0-9 digit cards	0-9 digit cards
Number track to 10	Number line to 20	Number line to 100	Number line to 100	Number line to 100 including negative numbers	Number line to 100 including negative numbers	Number line to 100 including negative numbers
Numbered counting stick	Counting stick	Counting stick	Counting stick	Counting stick	Counting stick	Counting stick
Tens frame 	Tens frame 	Tens frame 				
	Place value chart T and O	Place value chart H, T and O	Place value chart Th, H, T and O	Place value chart Th, H, T, O and tenths	Place value chart to a million and 3 decimal places	Place value chart to ten million and 3 decimal places
	Base 10 T and O	Base 10 H, T and O	Base 10 H, T and O	Base 10 Th, H, T and O	Base 10 Th, H, T and Ones plus using various representations to represent a whole	Base 10 Th, H, T and Ones plus using various representations to represent a whole
	Place value arrow cards T and O	Place value arrow cards H, T and O	Place value arrow cards Th, H, T and O	Place value arrow cards Th, H, T and O	Place value arrow cards	Place value arrow cards
Part-part-whole model	Part-part-whole model	Part-part-whole model	Part-part-whole model	Part-part-whole model	Part-part-whole model	Part-part-whole model
Bar model with real-life objects	Bar model with real-life objects/pictorial objects/representative objects e.g. counters	Bar model with counters/base 10 progressing to numerals	Bar model with numerals	Bar model with numerals	Bar model with numerals	Bar model with numerals
Numicon shapes	Numicon shapes	Numicon shapes	Numicon shapes	Numicon shapes	Numicon shapes	Numicon shapes
Multilink - use one colour to represent an amount	Multilink - use one colour to represent an amount	Multilink - use one colour to represent an amount	Multilink - use one colour to represent an amount	Multilink - use one colour to represent an amount	Multilink - use one colour to represent an amount	Multilink - use one colour to represent an amount
	Hundred Square - Summer term	Hundred Square	Hundred Square	Hundred Square	Hundred Square	Hundred Square

Progression in the teaching of counting

Pre-counting

The key focus in pre-counting is an understanding of the concepts more, less and the same and an appreciation of how these are related. Children at this stage develop these concepts by comparison and no counting is involved.

Ordering

Count by reciting the number names in order forwards and backwards from any starting point.

One to one correspondence

One number word has to be matched to each and every object.
Lack of coordination is a source of potential error – it helps if children move the objects as they count, use large rhythmic movements, or clap as they count

Cardinality (Knowing the final number counted is the total number of objects)

Count out a number of objects from a larger collection. Know the number they stop counting at will give the total number of objects.

Pre-counting ideas

Provide children with opportunities to sort groups of objects explicitly using the language of **more** and **less**



Which group of apples has the most? Which group of apples has the least?

Ordering ideas

Provide children with opportunities to count orally on a daily basis. Rote count so that children are able to understand number order and can hear the rhythm and pattern. Use a drum or clap to keep the beat.

One to one correspondence ideas

Play counting games together moving along a track, play games involving amounts such as knocking down skittles.

Use traditional counting songs throughout the day ensuring children have the visual/kinesthetic resources e.g. 5 little ducks, 10 green bottles


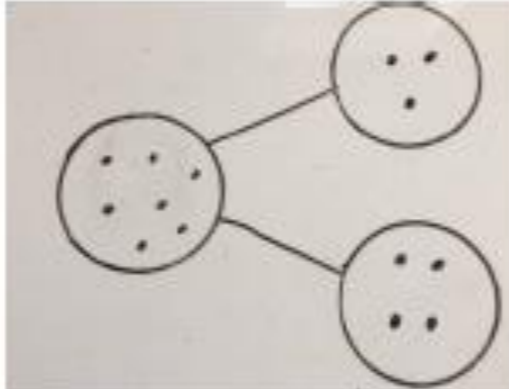
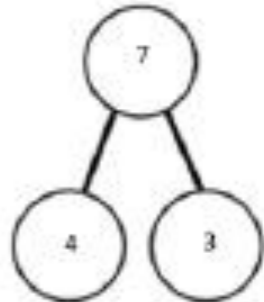

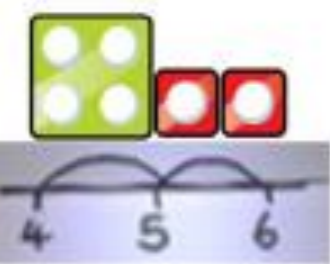
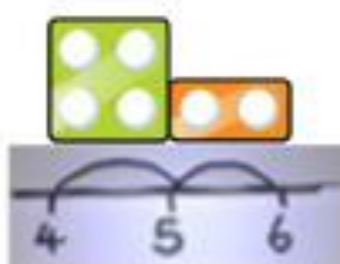
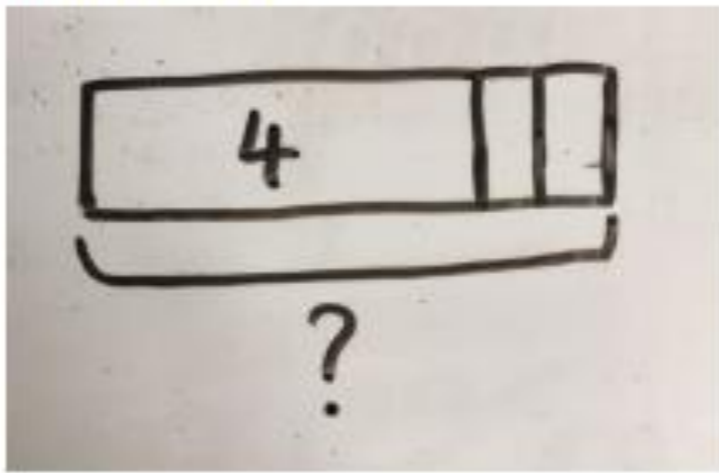
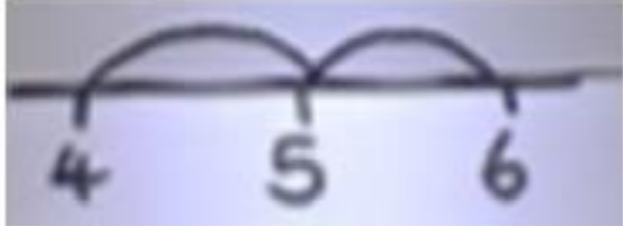
Cardinal counting ideas



How many bananas are in my fruit bowl? Allow children to physically handle the fruit. Provide children with objects to point to and move as they count and say the numbers.

Calculation policy: Addition

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

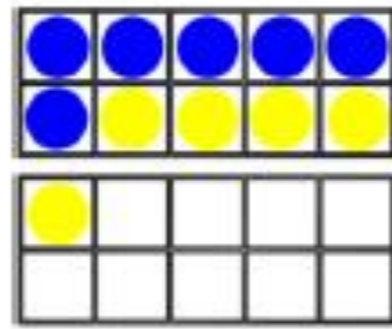
Concrete	Pictorial	Abstract
<p>Combining two parts to make a whole (use other resources too e.g. eggs, shells, teddy bears, cars).</p> 	<p>Children to represent the cubes using dots or crosses. They could put each part on a part whole model too.</p> 	<p>$4 + 3 = 7$ Four is a part, 3 is a part and the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

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.

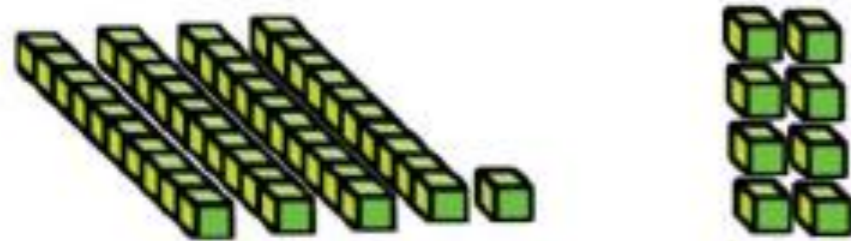
$6 + \square = 11$

$6 + 5 = 5 + \square$

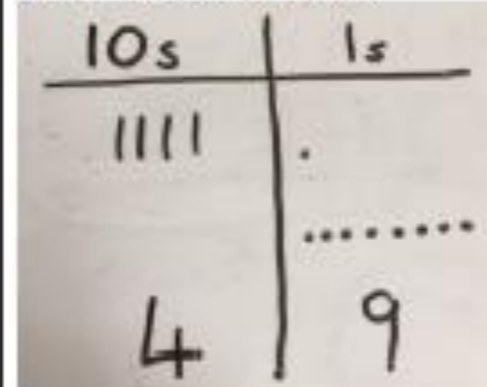
$6 + 5 = \square + 4$

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

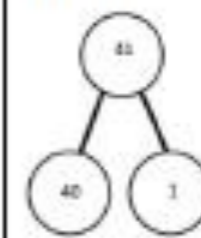
$41 + 8$



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

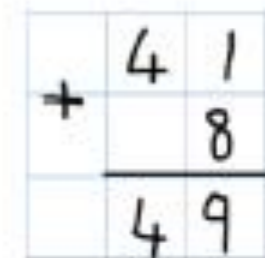


$41 + 8$



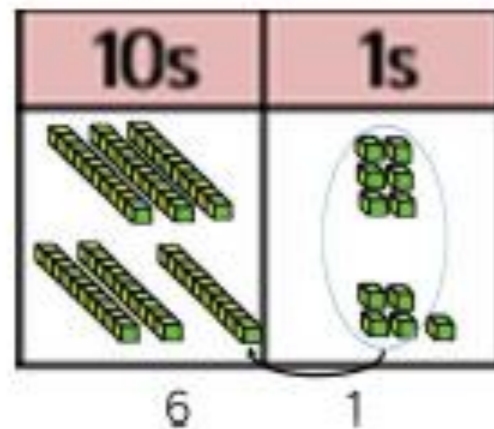
$1 + 8 = 9$

$40 + 9 = 49$

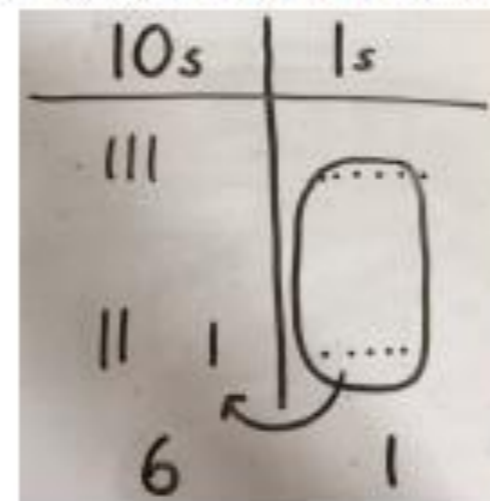


TO + TO using base 10. Continue to develop understanding of partitioning and place value.

$36 + 25$



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



Looking for ways to make 10.

$36 + 25 =$

$30 + 20 = 50$

$5 + 5 = 10$

$50 + 10 + 1 = 61$

Formal method:

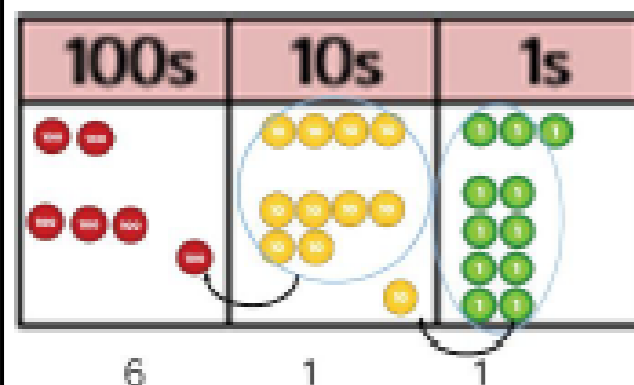
36

$+25$

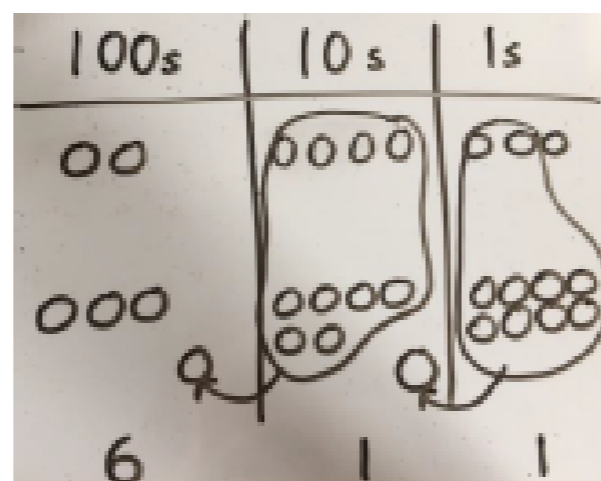
$\hline 61$

$\hline 1$

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

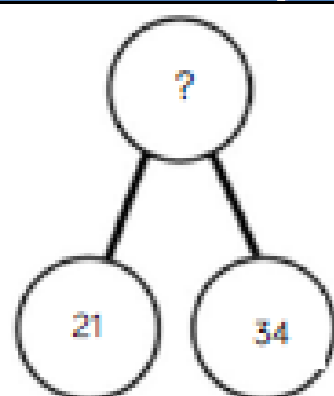


Children to represent the counters in a place value chart, circling when they make an exchange.



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

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?

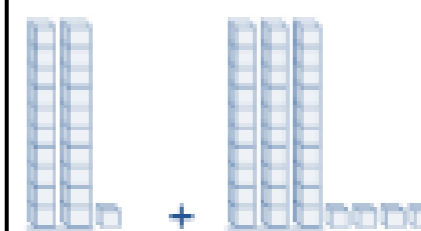
$$21 + 34 = 55. \text{ Prove it}$$

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

$$21 + 34 =$$

$$\square = 21 + 34$$

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

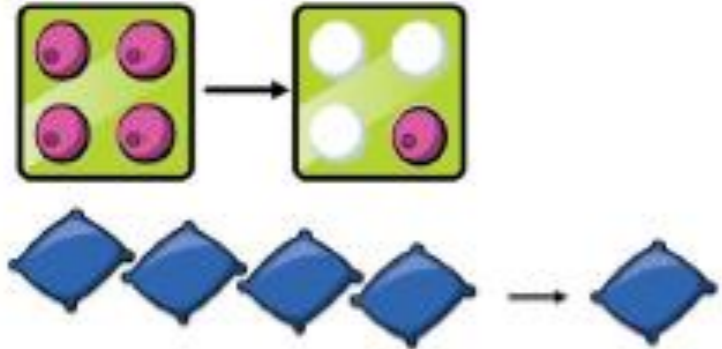
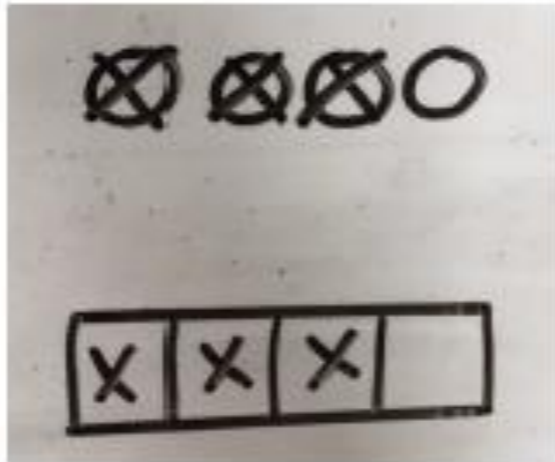


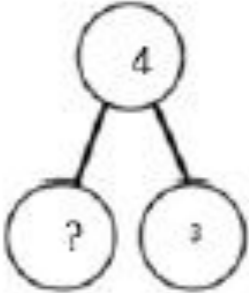

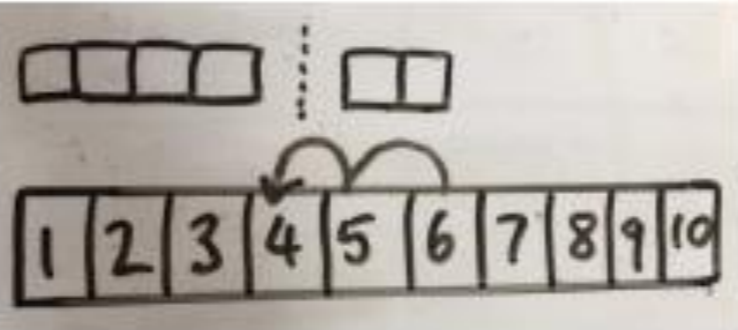
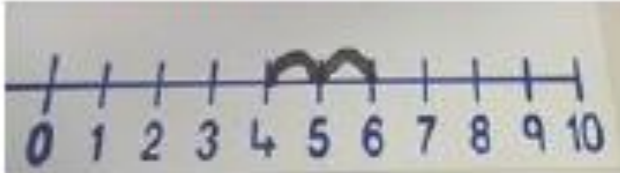
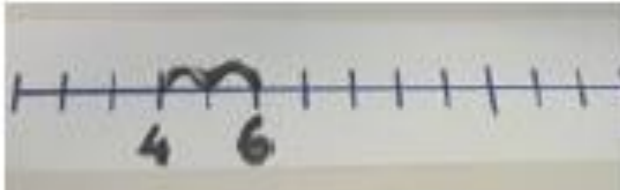


Missing digit problems:

10s	1s
20	1
30	?
?	5

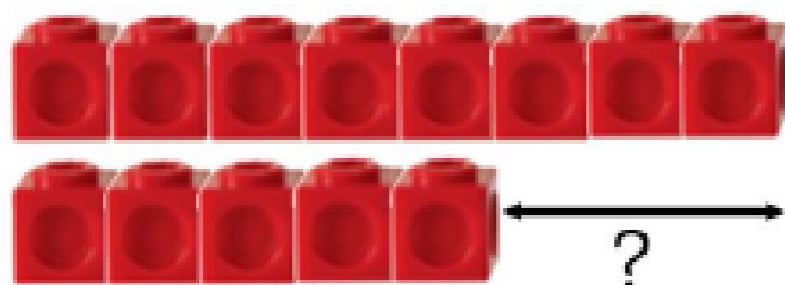
Calculation policy: Subtraction

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

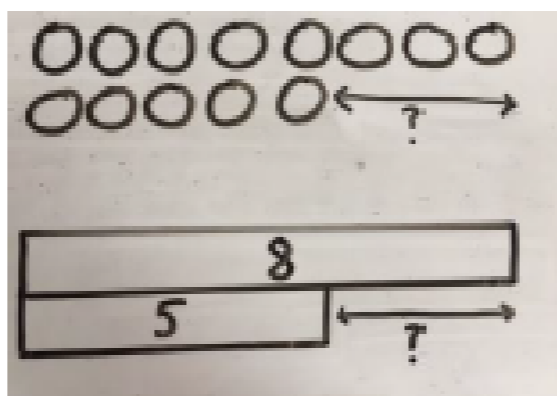
Concrete	Pictorial	Abstract
<p>Physically taking away and removing objects from a whole (ten frames, Numicon, cubes and other items such as beanbags could be used).</p> <p>$4 - 3 = 1$</p> 	<p>Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also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

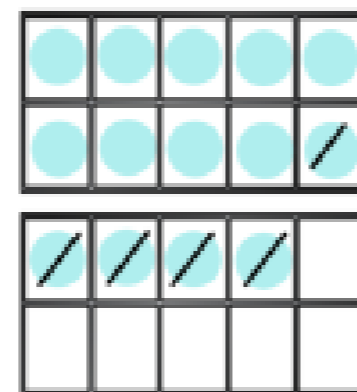
Children to explore why
 $9 - 6 = 8 - 5 = 7 - 4$ have the same difference.

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.

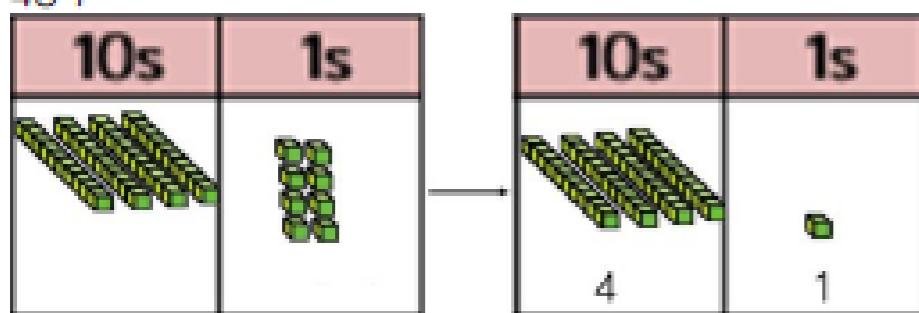
$$14 - 5 = 9$$

$$14 - 4 = 10$$

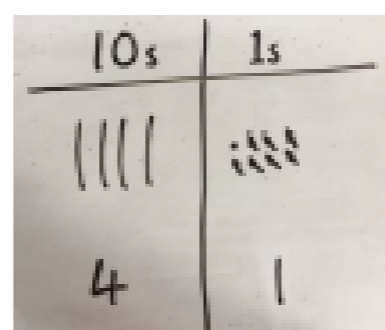
$$10 - 1 = 9$$

Column method using base 10.

48 - 7



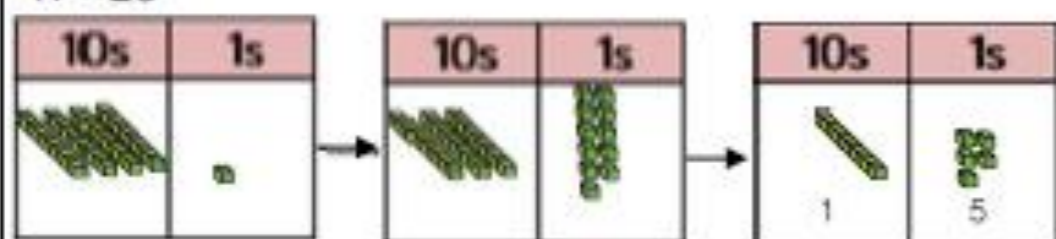
Children to represent the base 10 pictorially.



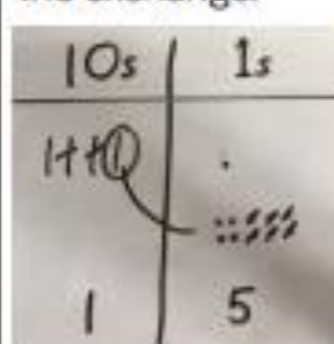
Column method or children could count back 7.

	4	8
-		7
	4	1

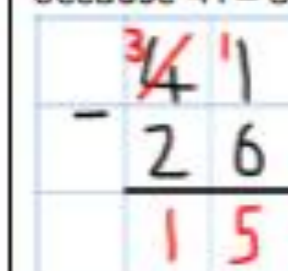
Column method using base 10 and having to exchange.
41 - 26



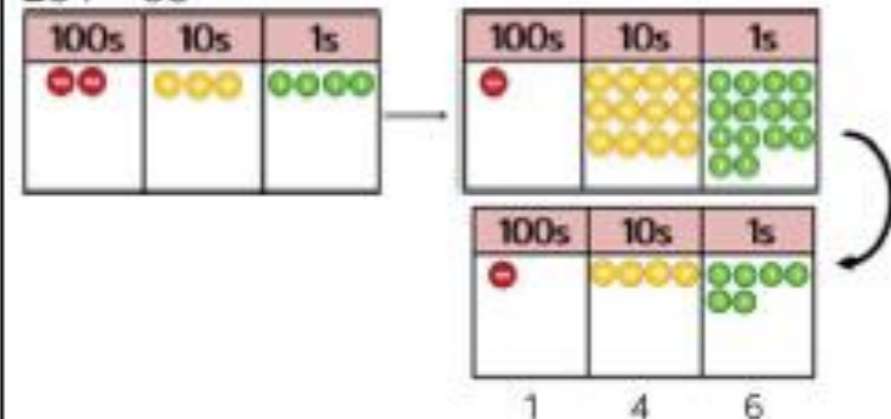
Represent the base 10 pictorially, remembering to show the exchange.



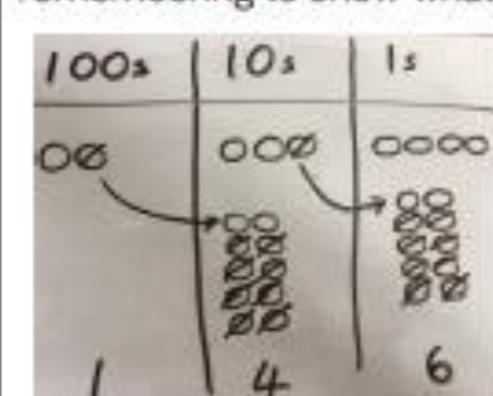
Formal column method. Children must understand that when they have exchanged the 10 they still have 41 because $41 = 30 + 11$.



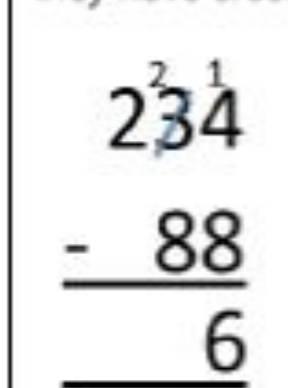
Column method using place value counters.
234 - 88



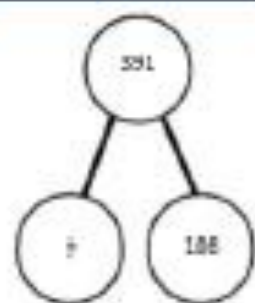
Represent the place value counters pictorially, remembering to show what has been exchanged.



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



391	
186	?

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

Calculate the difference between 391 and 186.

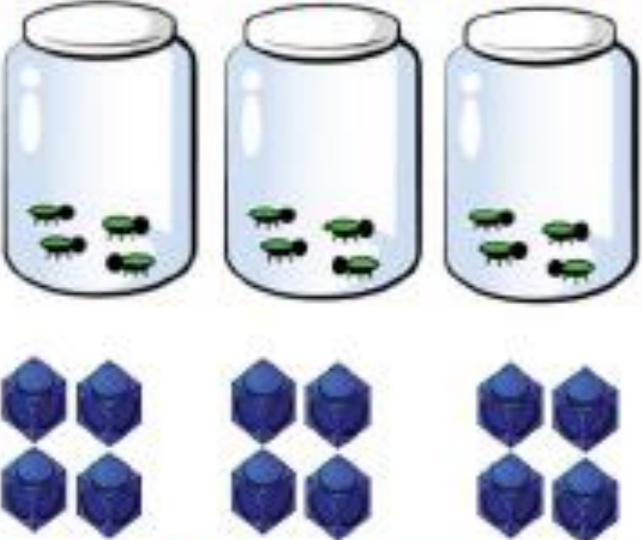
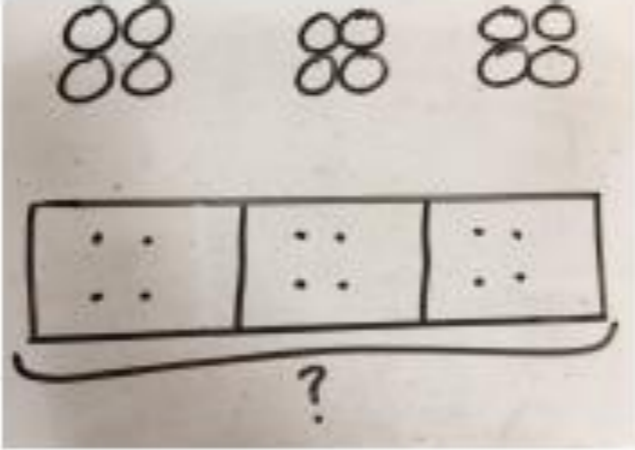
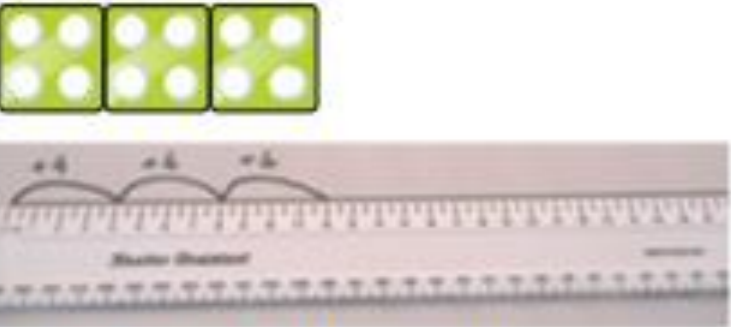
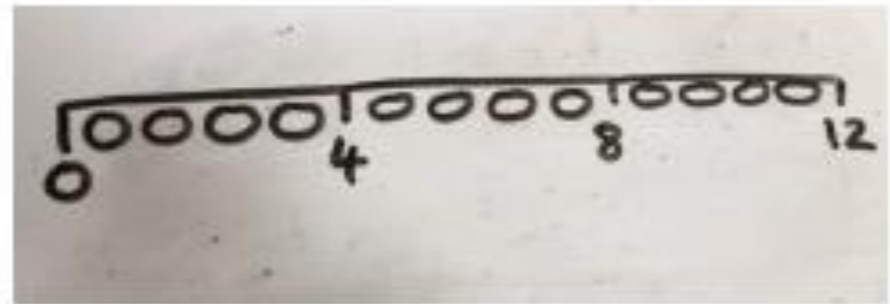
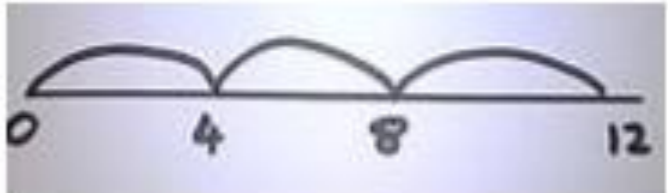
$$\square = 391 - 186$$

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

What is 186 less than 391?

Missing digit calculations

$$\begin{array}{r} 39\square \\ -\square\square 6 \\ \hline \square 0 5 \end{array}$$

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.</p> <p>$3 \times 4 = 12$</p> 

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

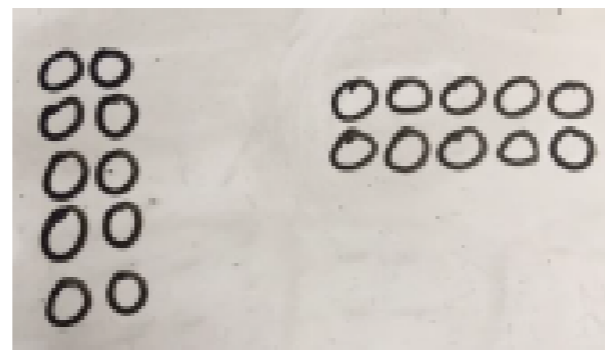
$$2 \times 5 = 5 \times 2$$



2 lots of 5

5 lots of 2

Children to represent the arrays pictorially.



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

$$10 = 2 \times 5$$

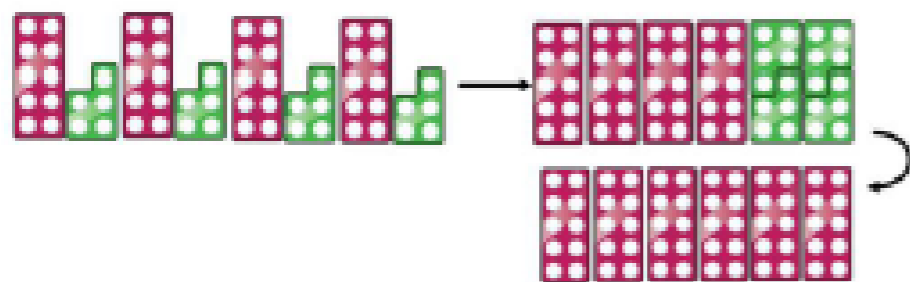
$$5 \times 2 = 10$$

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

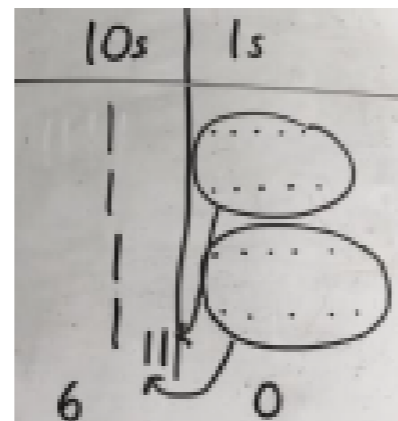
$$10 = 5 + 5$$

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.

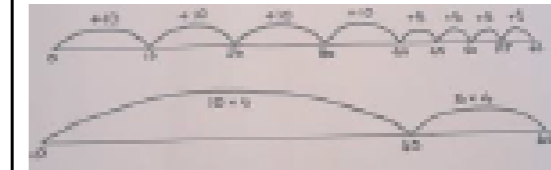
$$4 \times 15$$

$$10 \times 4 = 40$$

$$5 \times 4 = 20$$

$$40 + 20 = 60$$

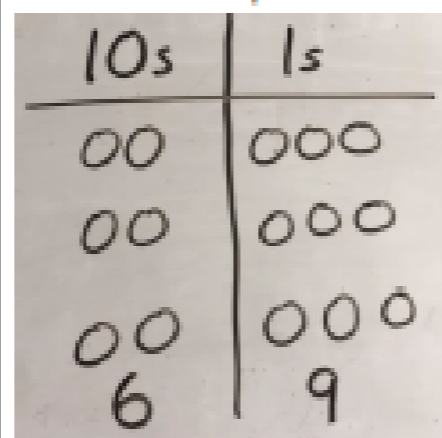
A number line can also be used



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

10s	1s
6	9

Children to represent the counters pictorially.



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

$$3 \times 23$$

$$20 \quad 3$$

$$3 \times 20 = 60$$

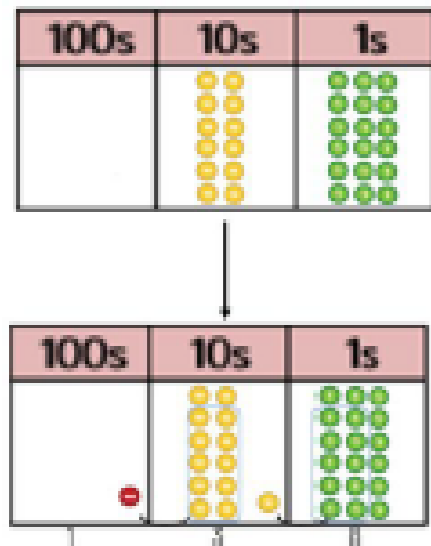
$$3 \times 3 = 9$$

$$60 + 9 = 69$$

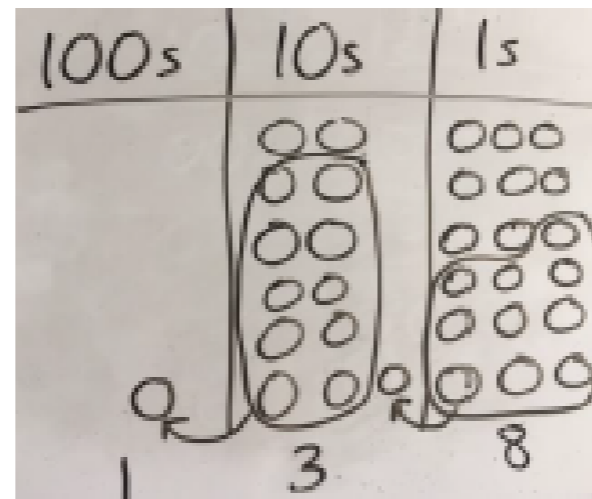
$$23$$

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

Formal column method with place value counters.
 6×23



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



Formal written method

$$6 \times 23 =$$

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

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

$$6 \times 23 =$$

$$\square = 6 \times 23$$

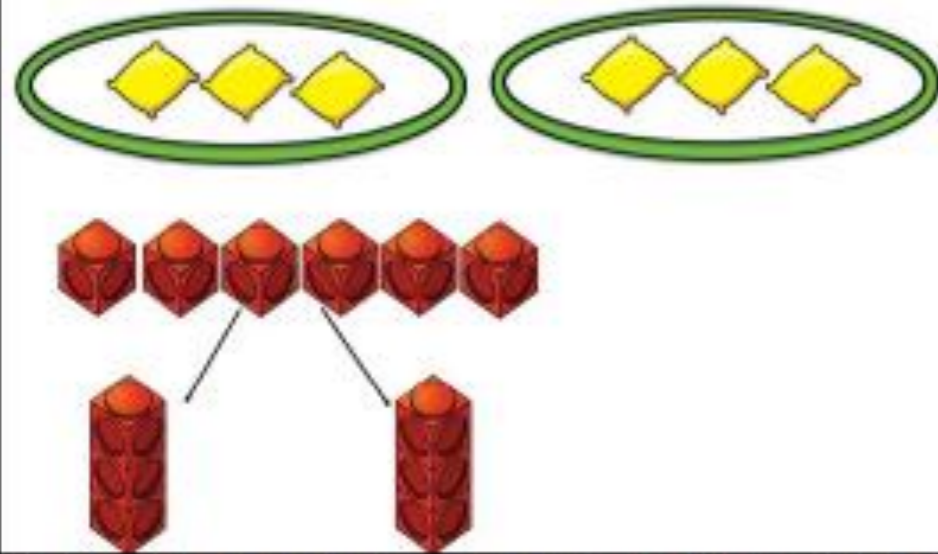
$$\begin{array}{r} 6 \quad 23 \\ \times 23 \quad \times 6 \\ \hline \quad \quad \quad \end{array}$$

What is the calculation?
 What is the product?



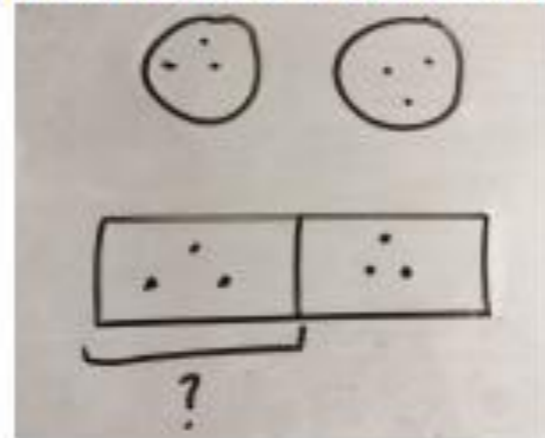
Concrete

Sharing using a range of objects.
 $6 \div 2$



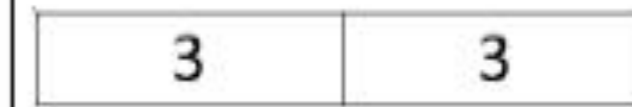
Pictorial

Represent the sharing pictorially.



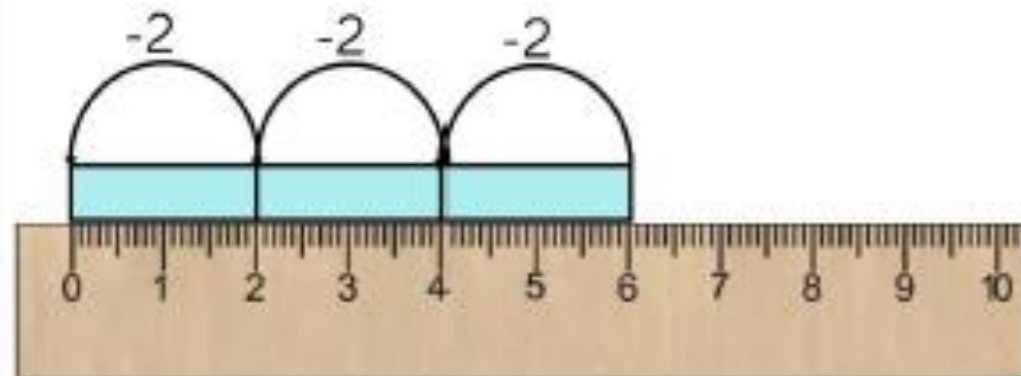
Abstract

$$6 \div 2 = 3$$



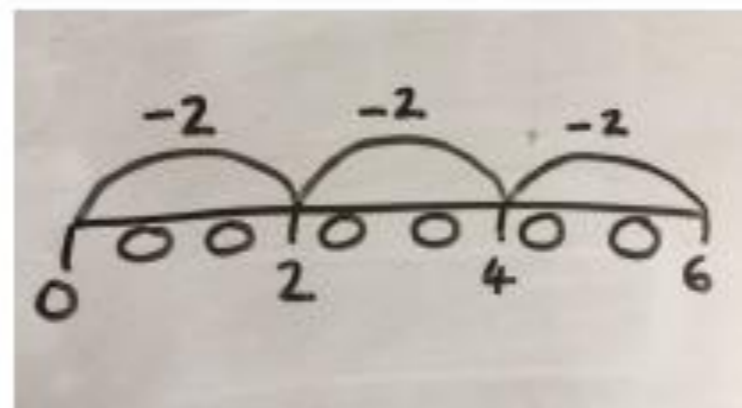
Children should also be encouraged to use their 2 times tables facts.

Repeated subtraction using Cuisenaire rods above a ruler.
 $6 \div 2$

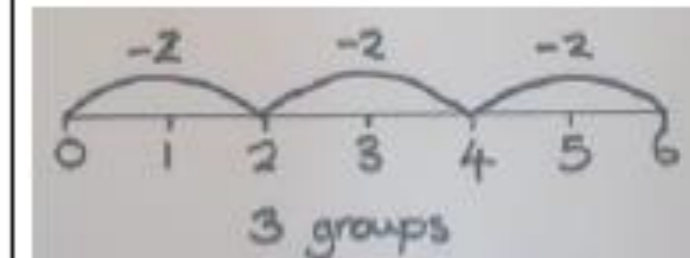


3 groups of 2

Children to represent repeated subtraction pictorially.



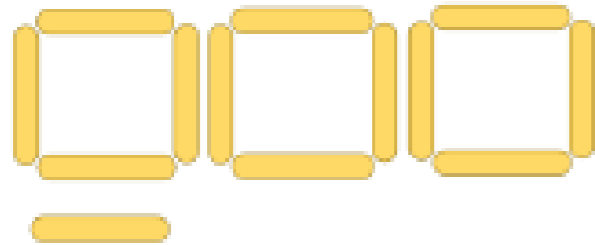
Abstract number line to represent the equal groups that have been subtracted.



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

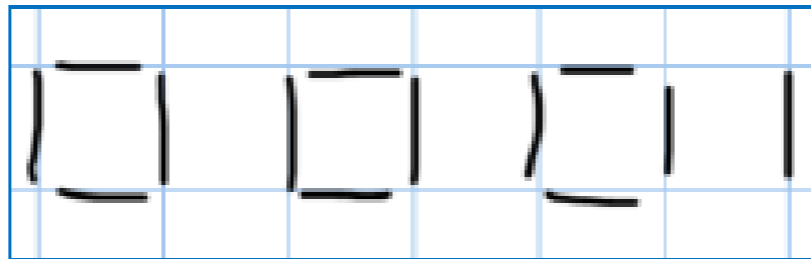
$$13 \div 4$$

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.

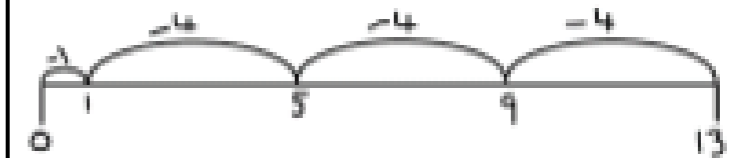


There are 3 whole squares, with 1 left over.

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

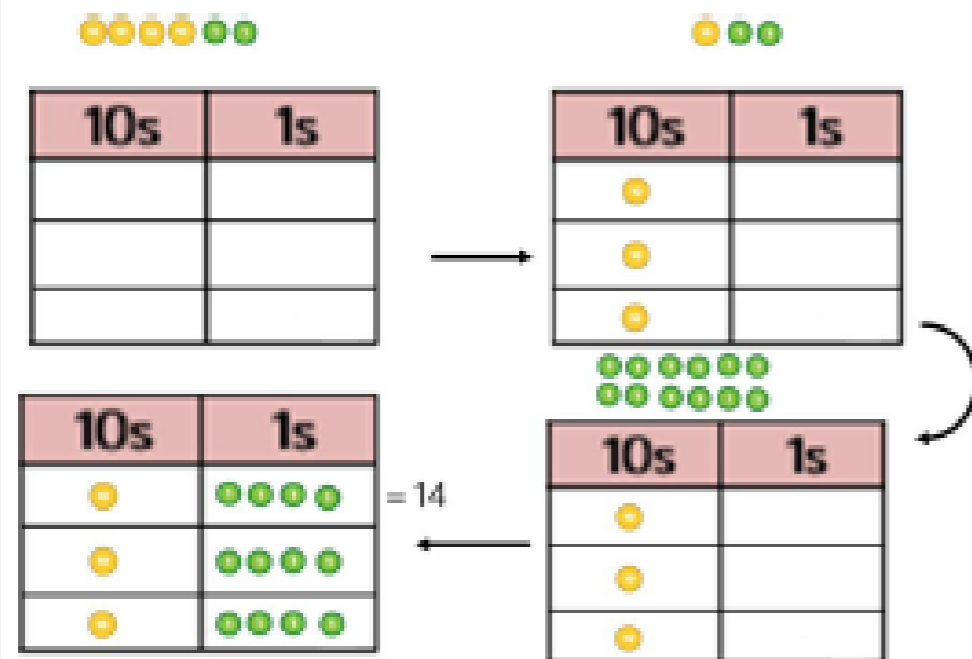
Children should be encouraged to use their times table facts; they could also represent repeated addition on a number line.

'3 groups of 4, with 1 left over'

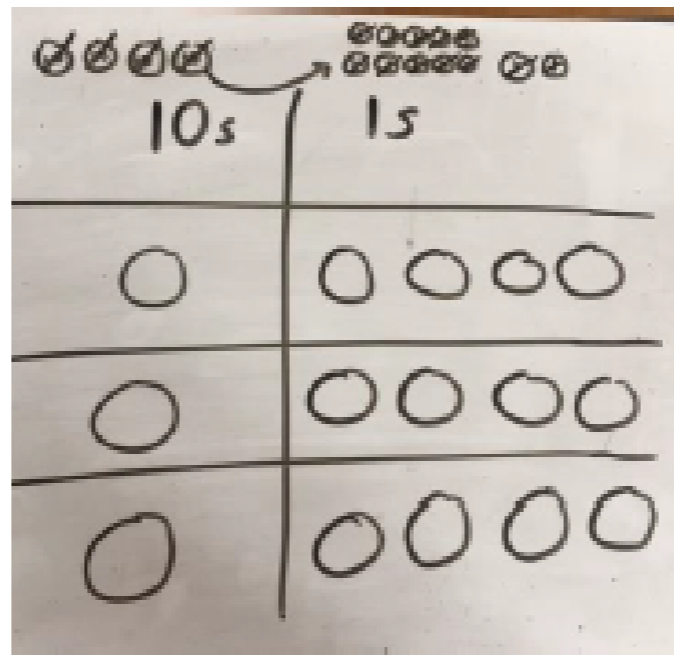


Sharing using place value counters.

$$42 \div 3 = 14$$



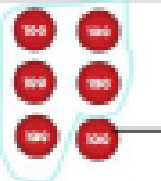
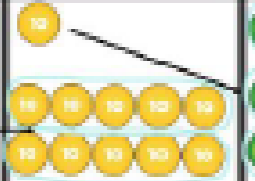

Children to represent the place value counters pictorially.



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

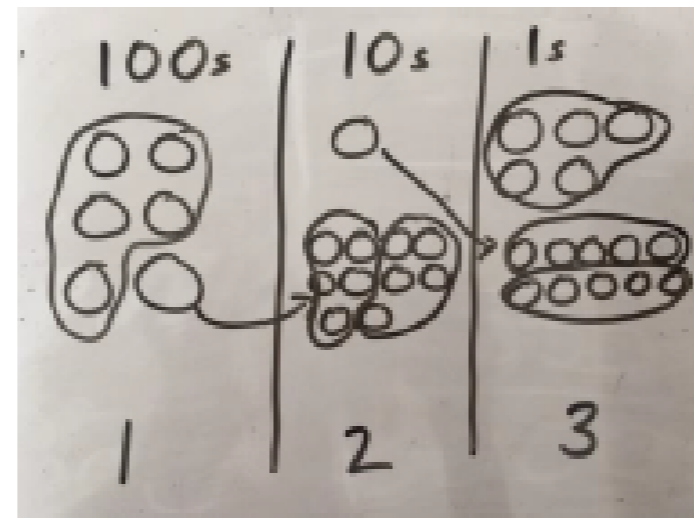
$$\begin{aligned} 42 \div 3 \\ 42 &= 30 + 12 \\ 30 \div 3 &= 10 \\ 12 \div 3 &= 4 \\ 10 + 4 &= 14 \end{aligned}$$

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.



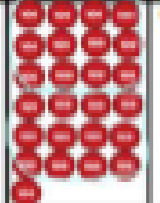


Children to the calculation using the short division scaffold.

$$5 \overline{) 615} \begin{matrix} 123 \\ \underline{615} \\ 0 \end{matrix}$$

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

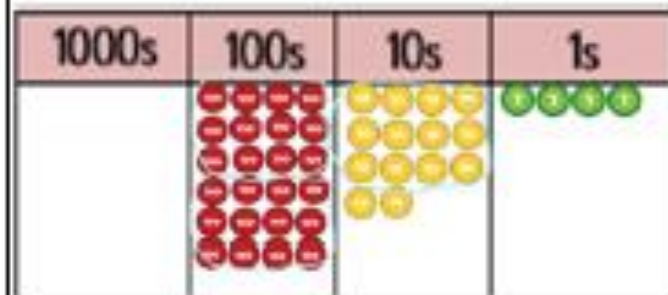
1000s	100s	10s	1s
			

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

1000s	100s	10s	1s
			

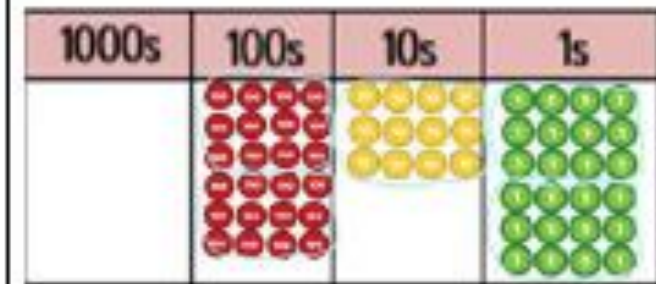
We can group 24 hundreds into groups of 12 which leaves with 1 hundred.

$$12 \overline{) 2544} \begin{matrix} 212 \\ \underline{24} \\ 1 \end{matrix}$$



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

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

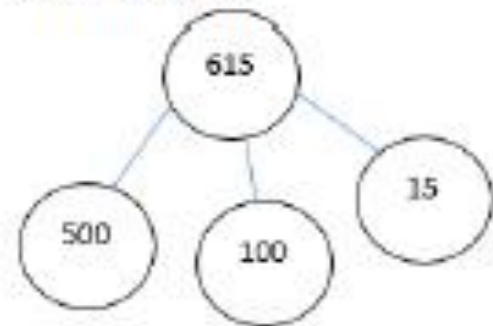


After exchanging the 2 tens, we have 24 ones. We can group 24 ones into 2 groups of 12, which leaves no remainder.

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

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

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?

