

LGCS Policy	Assessment					
Approved by		Issue Date	Oct 23	Review Date	Oct 24	
Audience	Trustees		Staff	✓	Pupils	✓
	Local Academy Council	✓	Parents	✓	General Public	✓



Calculation Policy 2023-2024

Reception – Year 6

This policy supports the White Rose maths scheme used throughout the school alongside Numicon, Nrich and NCTEM.

Progression within each area of calculation is in line with the programme of study in the 2014 National Curriculum.

This calculation policy should be used to support children to develop a deep understanding of number and calculation. This policy has been designed to teach children through the use of concrete, pictorial and abstract representations.

Concrete representation— a pupil is first introduced to an idea or skill by acting it out with real objects. This is a ‘hands-on’ component using real objects and is a foundation for conceptual understanding.

Pictorial representation – a pupil has sufficiently understood the ‘hands-on’ experiences performed and can now relate them to representations, such as a diagram or picture of the problem.

Abstract representation— a pupil is now capable of representing problems by using mathematical notation, for example, $12 \times 2 = 24$.

It is important that conceptual understanding, supported by the use of representation, is secure for all procedures. Reinforcement is achieved by going back and forth between these representations.

The Counting Principles

Following research from Gelman and Gallistel in 1978, it is vital that teachers understand the five counting principles. (Gelman, R. & Gallistel, C. (1978) *The Child's Understanding of Number*. Cambridge, MA: Harvard University Press.)

1

The one-one principle. This involves children assigning one number name to each object that is being counted. Children need to ensure that they count each object only once ensuring they have counted every object.

Children will sometimes count objects more than once or miss an object out that needs to be counted. Encourage children to line up objects and touch each one as they count saying one number name per object. This will also help to avoid children counting more quickly than they touch the objects which again shows they have not grasped one-one correspondence.



1



2



3



4



5

2

The stable-order principle. Children understand when counting, the numbers have to be said in a certain order.

Children need to know all the number names for the amount in the group they are counting. Teachers can therefore encourage children to count aloud to larger numbers without expecting them to count that number of objects immediately.

3

The cardinal principle. Children understand that the number name assigned to the final object in a group is the total number of objects in that group.

In order to grasp this principle, children need to understand the one-one and stable-order principle. From a larger group, children select a given number and count them out. When asked 'how many?', children should be able to recall the final number they said. Children who have not grasped this principle will recount the whole group again.

4

The abstraction principle. This involves children understanding that anything can be counted including things that cannot be touched including sounds and movements e.g. jumps.

When starting to count, many children rely on touching the objects in order to count accurately. Teachers can encourage abstraction on a daily basis by counting claps or clicks. They can also count imaginary objects in their head to encourage counting on, this involves the children visualising objects.

5

The order-irrelevance principle. This involves children understanding that the order we count a group of objects is irrelevant. There will still be the same number.

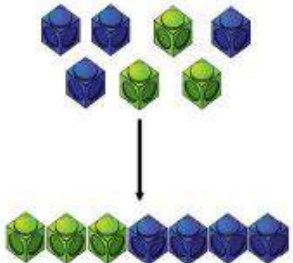
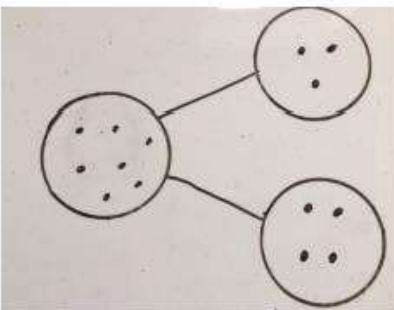
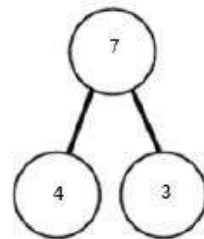
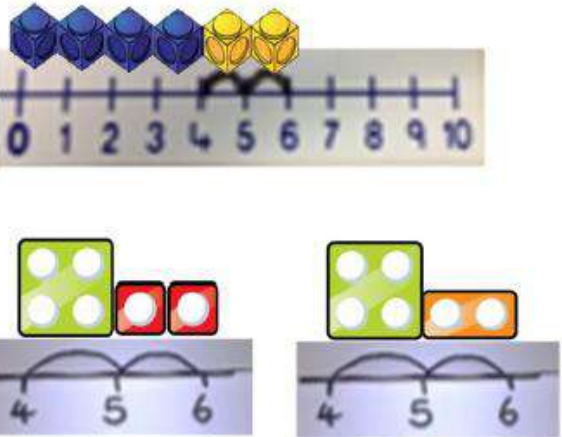
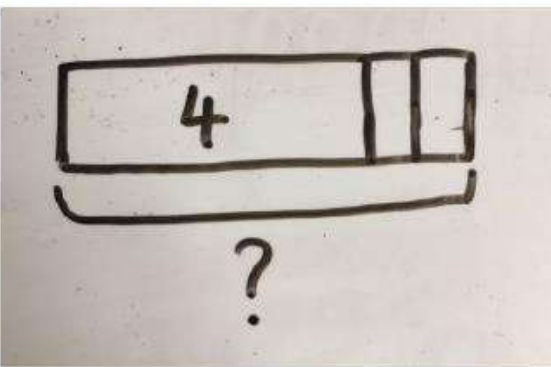
Encourage children to count objects, left to right, right to left, top to bottom and bottom to top. Once children have counted a group, move the objects and ask children how many there are, if they count them all again they have not fully grasped this principle.

	EYFS/Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Addition	Combining two parts to make a whole: part whole model. Starting at the bigger number and counting on- using cubes. Regrouping to make 10 using ten frame.	Adding three single digits. Use of base 10 to combine two numbers.	Column method- regrouping. Using place value counters (up to 3 digits).	Column method- regrouping. (up to 4 digits)	Column method- regrouping. Use of place value counters for adding decimals.	Column method- regrouping. Abstract methods. Place value counters to be used for adding decimal numbers.
Subtraction	Taking away ones Counting back Find the difference Part whole model Make 10 using the ten frame	Counting back Find the difference Part whole model Make 10 Use of base 10	Column method with regrouping. (up to 3 digits using place value counters)	Column method with regrouping. (up to 4 digits)	Column method with regrouping. Abstract for whole numbers. Start with place value counters for decimals- with the same amount of decimal places.	Column method with regrouping. Abstract methods. Place value counters for decimals- with different amounts of decimal places.

	EYFS/Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Multiplication	Recognising and making equal groups. Doubling Counting in multiples Use cubes, Numicon and other objects in the classroom	Arrays- showing commutative multiplication	Arrays 2d × 1d using base 10	Column multiplication- introduced with place value counters. (2 and 3 digit multiplied by 1 digit)	Column multiplication Abstract only but might need a repeat of year 4 first (up to 4 digit numbers multiplied by 1 or 2 digits)	Column multiplication Abstract methods (multi-digit up to 4 digits by a 2 digit number)
Division	Sharing objects into groups Division as grouping e.g. I have 12 sweets and put them in groups of 3, how many groups? Use cubes and draw round 3 cubes at a time.	Division as grouping Division within arrays- linking to multiplication Repeated subtraction	Division with a remainder- using lollipop sticks, times tables facts and repeated subtraction. 2d divided by 1d using base 10 or place value counters	Division with a remainder Short division (up to 3 digits by 1 digit- concrete and pictorial)	Short division (up to 4 digits by a 1 digit number including remainders)	Short division Long division with place value counters (up to 4 digits by a 2 digit number) Children should exchange into the tenths and hundredths column too

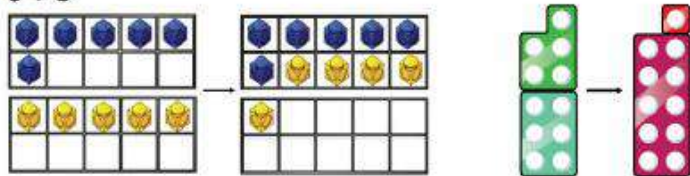
Calculation policy: Addition

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

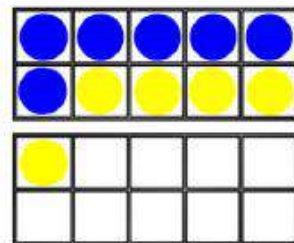
Concrete	Pictorial	Abstract
Combining two parts to make a whole (use other resources too e.g. eggs, shells, teddy bears, cars). 	Children to represent the cubes using dots or crosses. They could put each part on a part whole model too. 	$4 + 3 = 7$ Four is a part, 3 is a part and the whole is seven.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

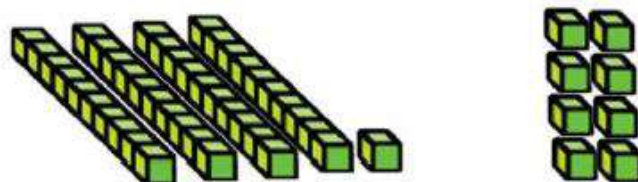
$$6 + \square = 11$$

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

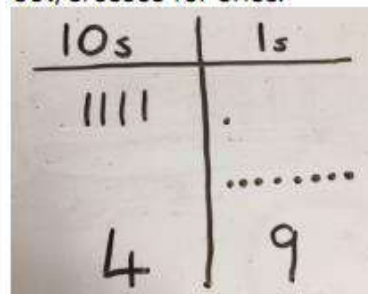
$$6 + 5 = \square + 4$$

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

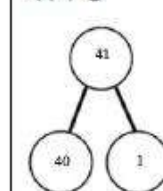
$$41 + 8$$



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

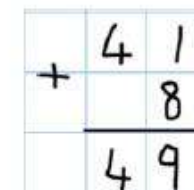


$$41 + 8$$



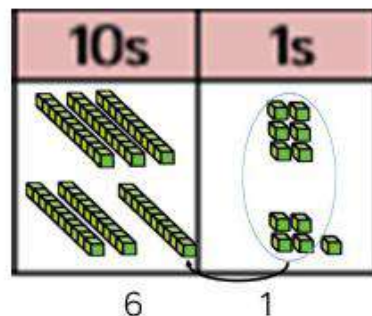
$$1 + 8 = 9$$

$$40 + 9 = 49$$

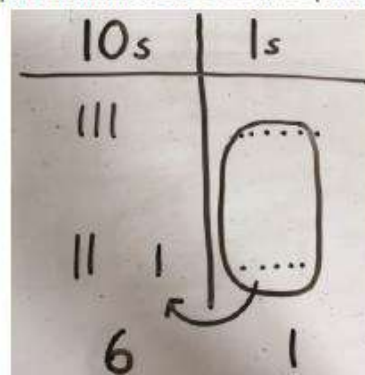


TO + TO using base 10. Continue to develop understanding of partitioning and place value.

$$36 + 25$$



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



Looking for ways to make 10.

$$36 + 25 =$$



$$30 + 20 = 50$$

$$5 + 5 = 10$$

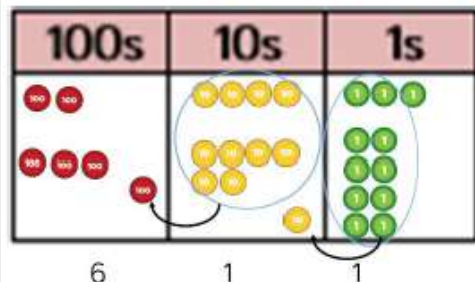
$$50 + 10 + 1 = 61$$

$$36$$

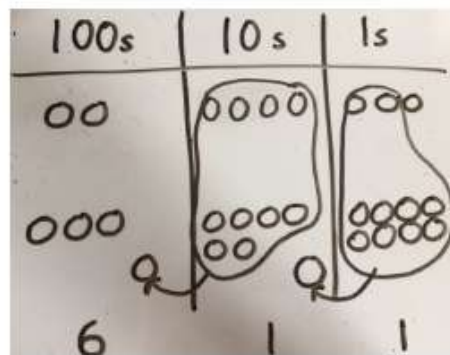
Formal method:

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

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



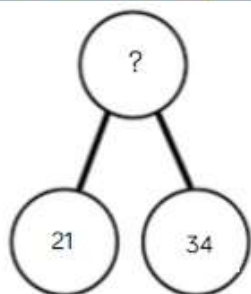
Children to represent the counters in a place value chart, circling when they make an exchange.



243

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

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?

$21 + 34 = 55$. Prove it

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

$$21 + 34 =$$

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

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

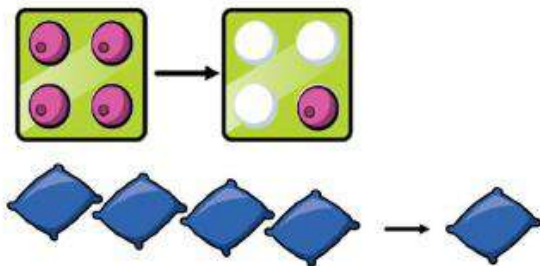
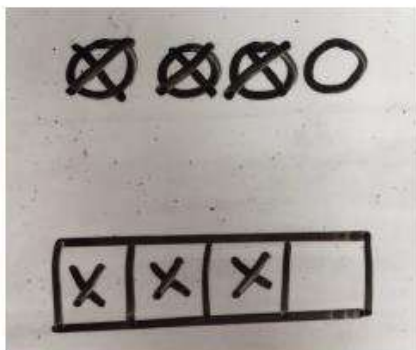
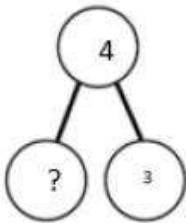
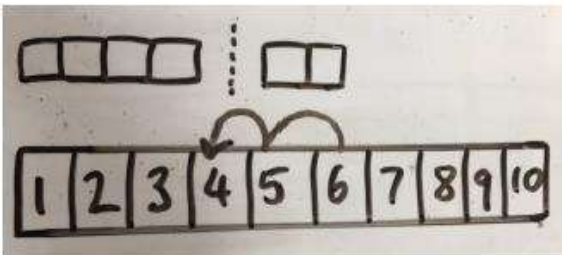
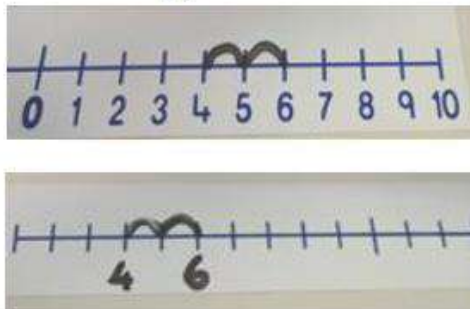


Missing digit problems:

10s	1s
20	1
30	?
?	5

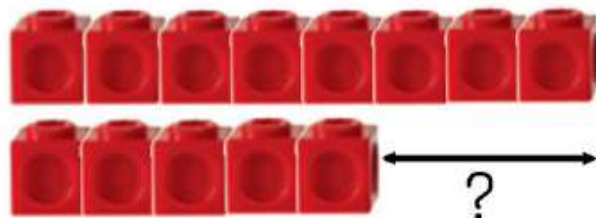
Calculation policy: Subtraction

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

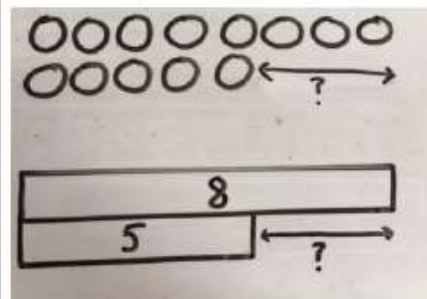
Concrete	Pictorial	Abstract				
Physically taking away and removing objects from a whole (ten frames, Numicon, cubes and other items such as beanbags could be used). $4 - 3 = 1$ 	Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also be used. 	$4 - 3 =$  $= 4 - 3$ <table border="1" data-bbox="1673 643 1980 722"><tr><td colspan="2">4</td></tr><tr><td>3</td><td>?</td></tr></table> 	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 and 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.



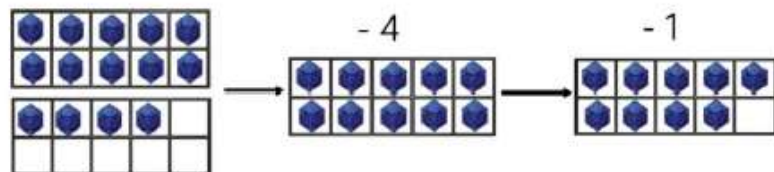
Find the difference between 8 and 5.

8 - 5, the difference is

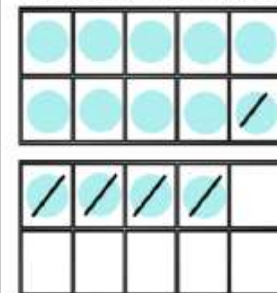
Children to explore why
 $9 - 6 = 8 - 5 = 7 - 4$ have the same difference.

Making 10 using ten frames.

14 - 5



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



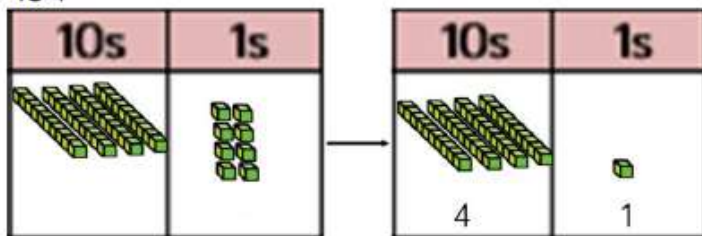
Children to show how they can make 10 by partitioning the subtrahend.

$$\begin{array}{r} 14 - 5 = 9 \\ \swarrow \quad \searrow \\ 4 \quad \quad 1 \end{array}$$

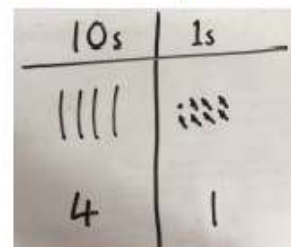
$$\begin{array}{l} 14 - 4 = 10 \\ 10 - 1 = 9 \end{array}$$

Column method using base 10.

48 - 7



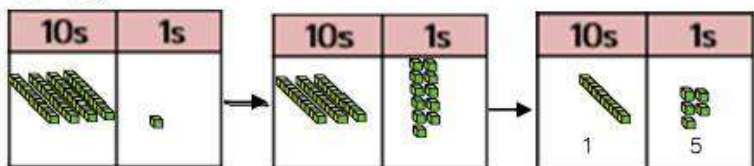
Children to represent the base 10 pictorially.



Column method or children could count back 7.

	4	8
-		7
	4	1

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



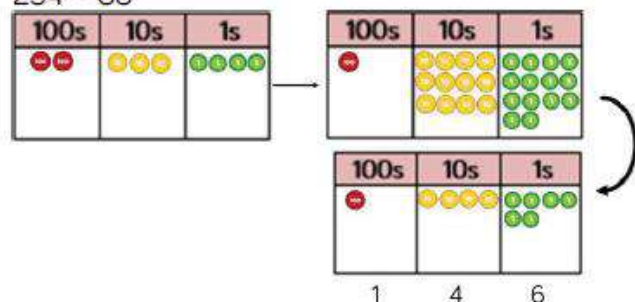
Represent the base 10 pictorially, remembering to show the exchange.



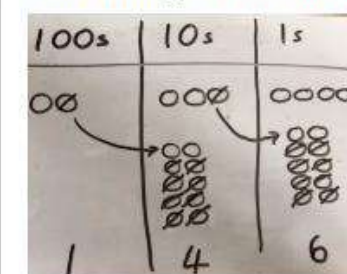
Formal column method. Children must understand that when they have exchanged the 10 they still have 41 because $41 = 30 + 11$.

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

Column method using place value counters.
234 - 88



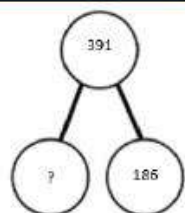
Represent the place value counters pictorially; remembering to show what has been exchanged.



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

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

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



	391
186	?

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

Calculate the difference between 391 and 186.

$$\boxed{} = 391 - 186$$

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

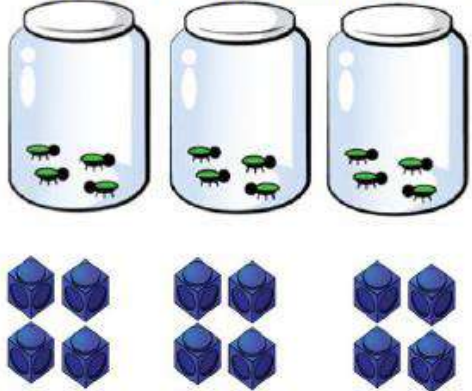
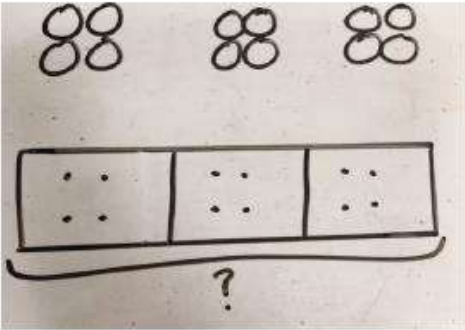
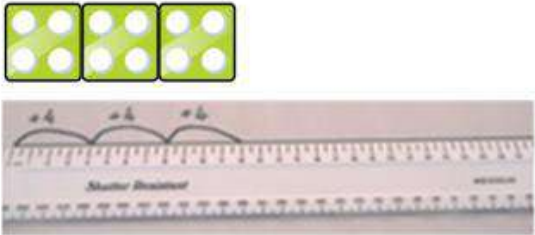
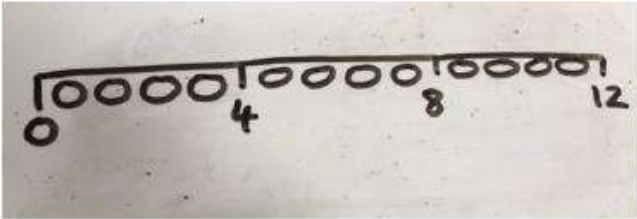
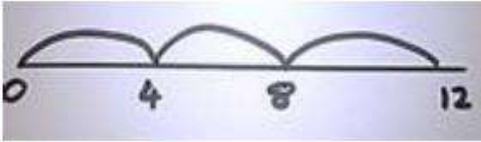
What is 186 less than 391?

Missing digit calculations

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

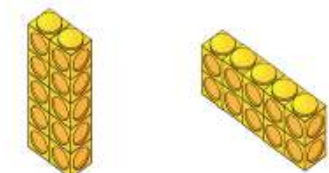
Calculation policy: Multiplication

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. 	$3 \times 4 = 12$ $4 + 4 + 4 = 12$
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. $3 \times 4 = 12$ 

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

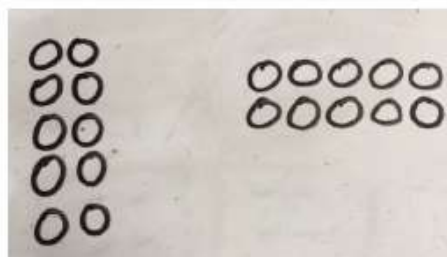
$$2 \times 5 = 5 \times 2$$



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.

$$10 = 2 \times 5$$

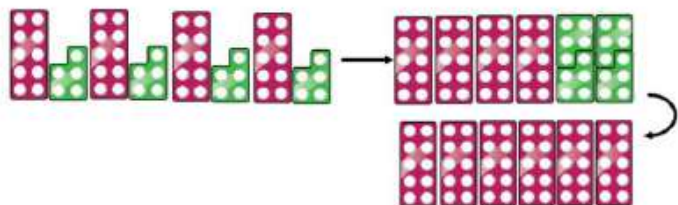
$$5 \times 2 = 10$$

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

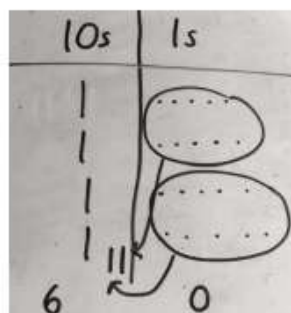
$$10 = 5 + 5$$

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

$$4 \times 15$$



Children to represent the concrete manipulatives pictorially.



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

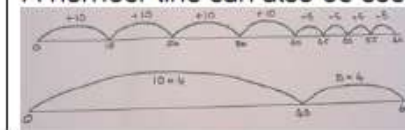
$$4 \times 15$$

$$10 \times 4 = 40$$

$$5 \times 4 = 20$$

$$40 + 20 = 60$$

A number line can also be used



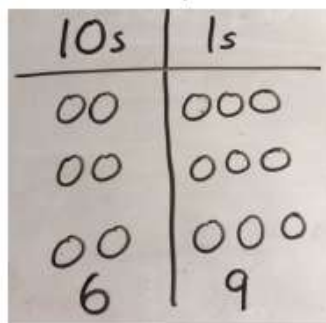
Formal column method with place value counters (base 10 can also be used.) 3×23



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

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

Formal column method with place value counters.

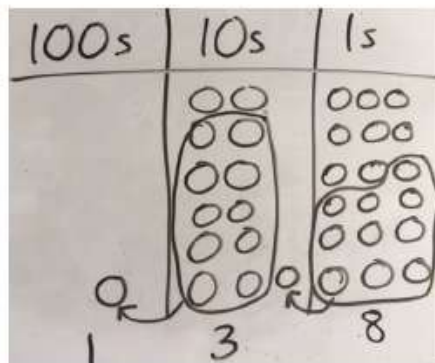
$$6 \times 23$$

100s	10s	1s
		



100s	10s	1s
		
		

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



Formal written method

$$6 \times 23 =$$

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

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

Answer: 3224

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 .

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

23	23	23	23	23	23
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?

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

$$6 \times 23 =$$

$$\boxed{} = 6 \times 23$$

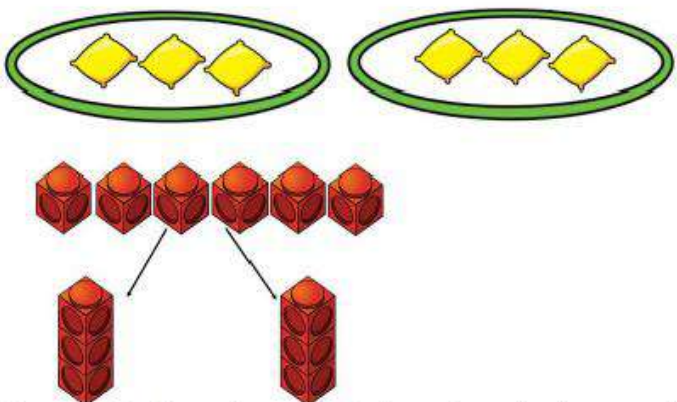
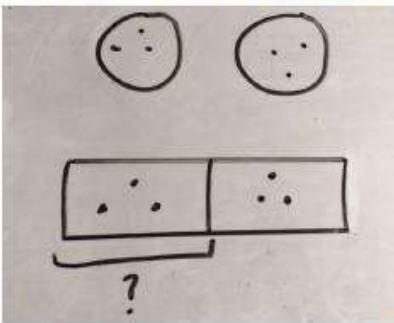
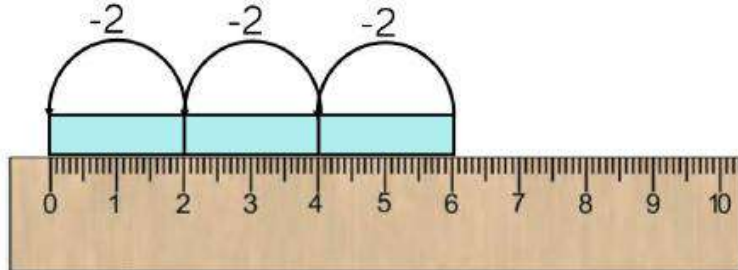
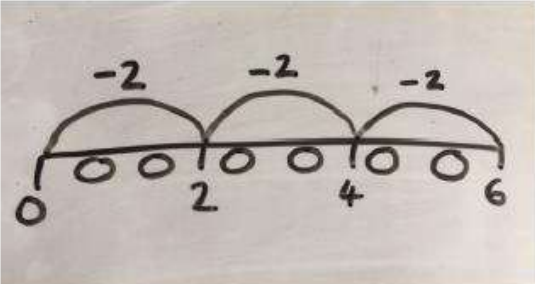
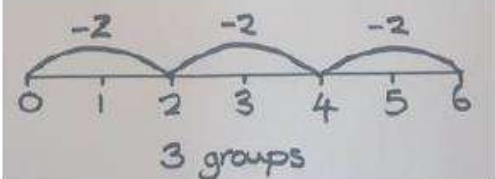
$$\begin{array}{r} 6 \\ \times 23 \\ \hline \end{array} \quad \begin{array}{r} 23 \\ \times 6 \\ \hline \end{array}$$

What is the calculation?
What is the product?

100s	10s	1s
		

Calculation policy: Division

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

Concrete	Pictorial	Abstract		
Sharing using a range of objects. $6 \div 2$  The diagram shows two green ovals, each containing three yellow diamonds. Below these, there are six red cubes arranged in a single row. Two lines branch out from the middle of this row, pointing to two separate stacks of three red cubes each, illustrating the division of six items into two equal groups of three.	Represent the sharing pictorially.  The diagram shows two circles, each containing three dots. Below them are two rectangles, each containing three dots. A bracket is drawn under the first rectangle with a question mark below it, suggesting a process of sharing or grouping.	$6 \div 2 = 3$ <table border="1" data-bbox="1579 601 2020 671"><tr><td>3</td><td>3</td></tr></table> Children should also be encouraged to use their 2 times tables facts.	3	3
3	3			
Repeated subtraction using Cuisenaire rods above a ruler. $6 \div 2$  The diagram shows a ruler from 0 to 10. Three light blue Cuisenaire rods, each labeled '-2', are placed end-to-end from 0 to 6. Below the ruler, the text '3 groups of 2' is written. 3 groups of 2	Children to represent repeated subtraction pictorially.  The diagram shows a number line from 0 to 6. Three circles are placed at 0, 2, 4, and 6. Three arcs, each labeled '-2', connect 0 to 2, 2 to 4, and 4 to 6, representing the repeated subtraction of 2 from 6.	Abstract number line to represent the equal groups that have been subtracted.  The diagram shows a number line from 0 to 6. Three arcs, each labeled '-2', connect 0 to 2, 2 to 4, and 4 to 6. Below the line, the text '3 groups' is written.		

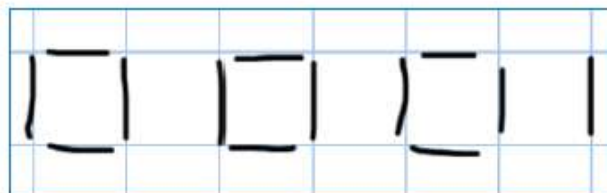
2d ÷ 1d with remainders using lollipop sticks. Cuisenaire rods, above a ruler can also be used.
 $13 \div 4$

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



There are 3 whole squares, with 1 left over.

Children to represent the lollipop sticks pictorially.

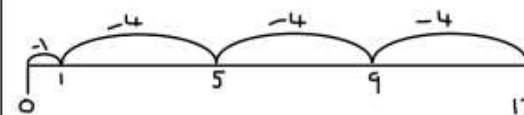


There are 3 whole squares, with 1 left over.

$13 \div 4 = 3$ remainder 1

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

'3 groups of 4, with 1 left over'



Sharing using place value counters.
 $42 \div 3 = 14$



10s	1s

→



10s	1s
●	
●	
●	



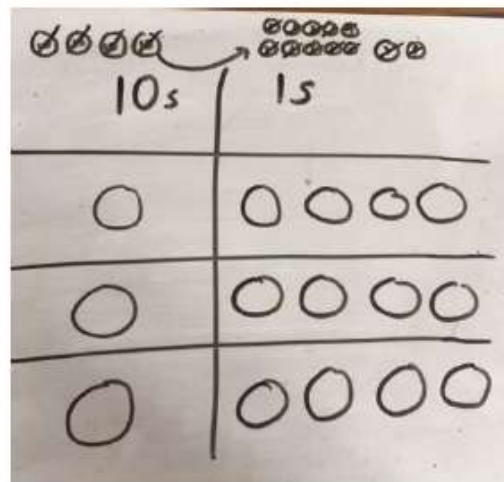
10s	1s
●	●●●●
●	●●●●
●	●●●●

= 14



10s	1s
●	
●	
●	

Children to represent the place value counters pictorially.



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

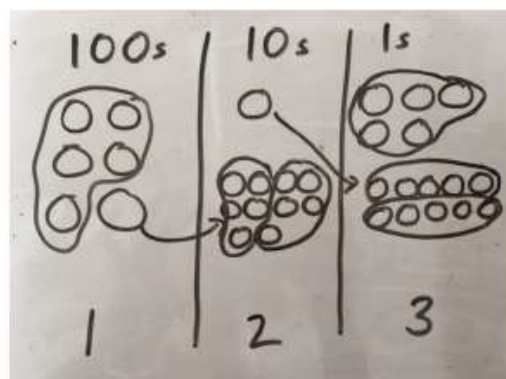
$42 \div 3$
 $42 = 30 + 12$
 $30 \div 3 = 10$
 $12 \div 3 = 4$
 $10 + 4 = 14$

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

100s	10s	1s
		
1	2	3

1. Make 615 with place value counters.
2. How many groups of 5 hundreds can you make with 6 hundred counters?
3. Exchange 1 hundred for 10 tens.
4. How many groups of 5 tens can you make with 11 ten counters?
5. Exchange 1 ten for 10 ones.
6. How many groups of 5 ones can you make with 15 ones?

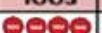
Represent the place value counters pictorially.



Children to the calculation using the short division scaffold.

$$\begin{array}{r} 123 \\ 5 \overline{) 615} \\ \underline{5} \\ 11 \\ \underline{10} \\ 15 \\ \underline{15} \\ 0 \end{array}$$

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

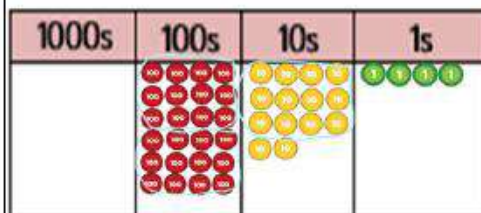
1000s	100s	10s	1s
			

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

1000s	100s	10s	1s
			

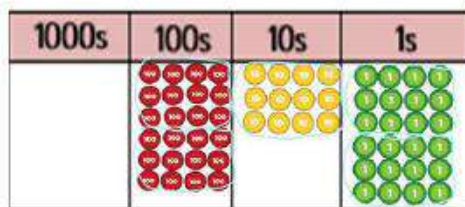
We can group 24 hundreds into groups of 12 which leaves with 1 hundred.

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



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

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

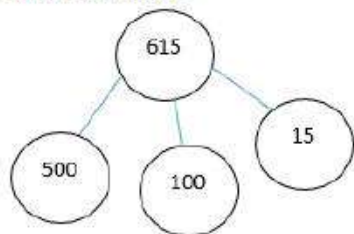


After exchanging the 2 tens, we have 24 ones. We can group 24 ones into 2 group of 12, which leaves no remainder.

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

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

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?

