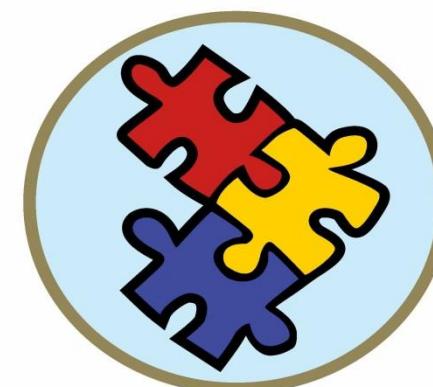




# Hollinswood Primary School & Nursery

## Calculation Policy

Presented – July 2018

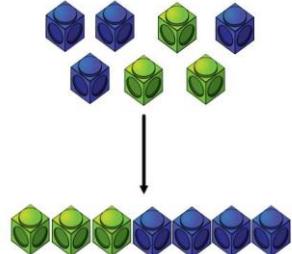
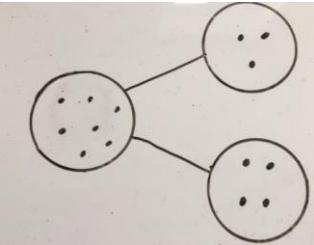
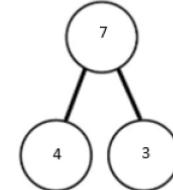
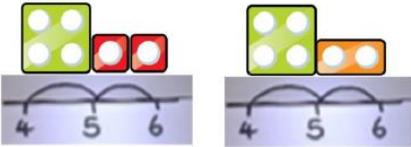
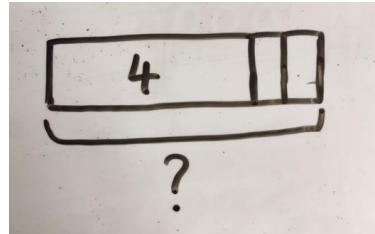
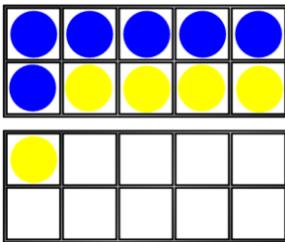


## Calculation policy: Guidance

	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.
Multiplication	Recognising and making equal groups.  Doubling  Counting in multiples Use cubes, Numicon and other objects in the classroom	Arrays- showing commutative multiplication	Arrays  $2d \times 1d$ 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

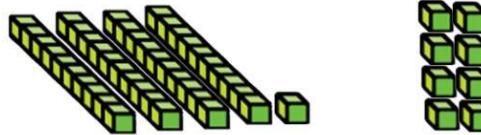
## Calculation policy: Addition

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

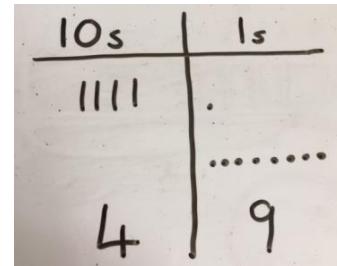
Concrete	Pictorial	Abstract
Combining two parts to make a whole (use other resources too e.g. eggs, shells, teddy bears, cars).  	Children to represent the cubes using dots or crosses. They could put each part on a part whole model too.  	$4 + 3 = 7$ Four is a part, 3 is a part and the whole is seven.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

$$41 + 8$$

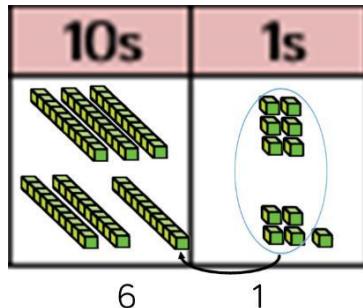


Children to represent the base 10 e.g. lines for tens and dot/crosses for ones.

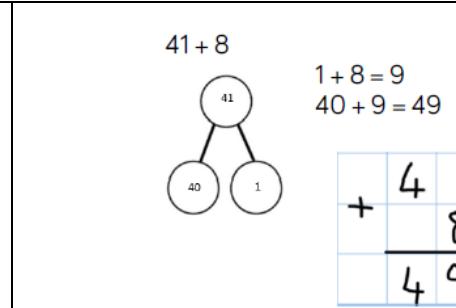
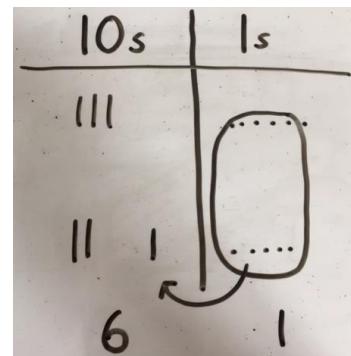


TO + TO using base 10. Continue to develop understanding of partitioning and place value.

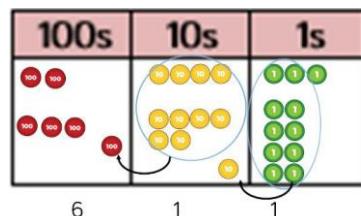
$$36 + 25$$



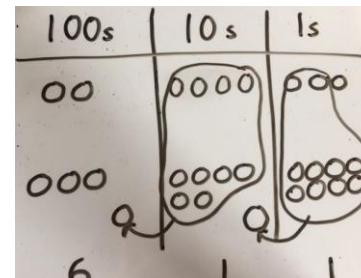
Children to represent the base 10 in a place value chart.



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.



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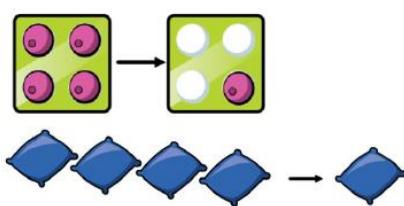
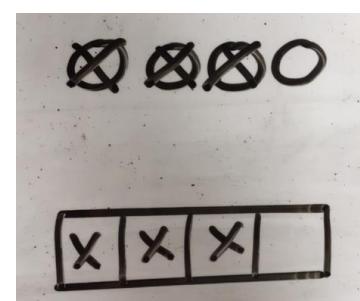
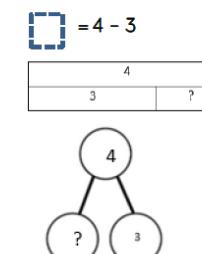
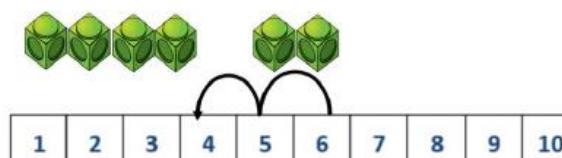
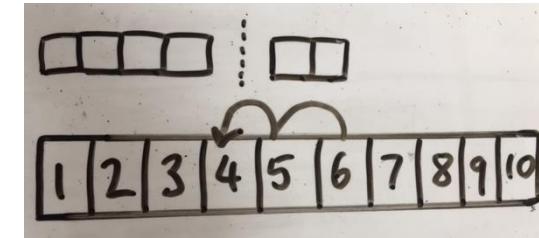
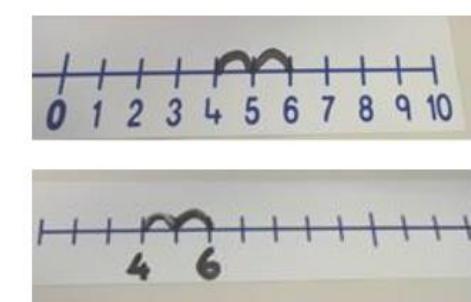
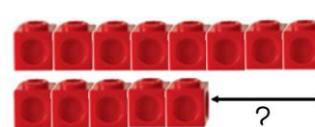
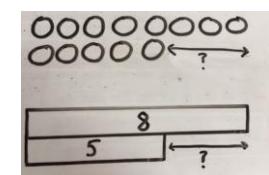
$\begin{array}{r} +368 \\ \hline 611 \end{array}$

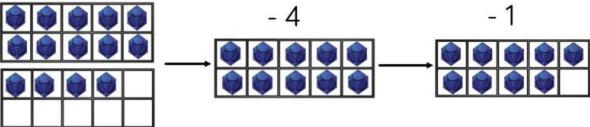
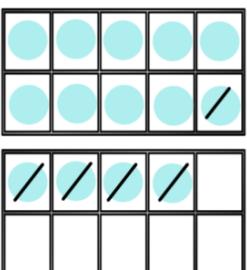
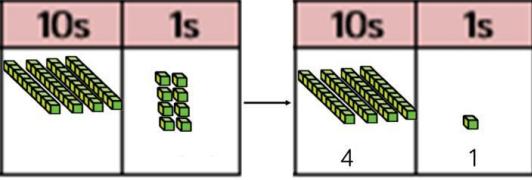
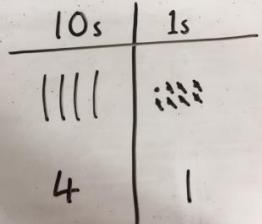
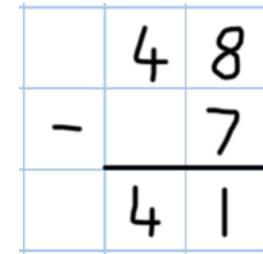
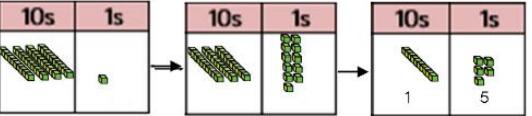
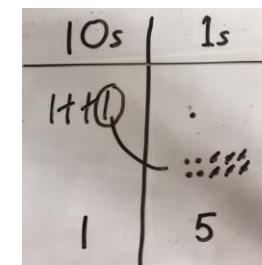
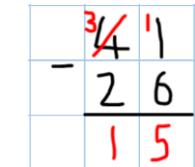
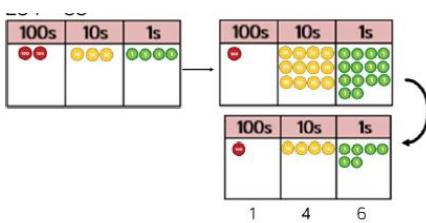
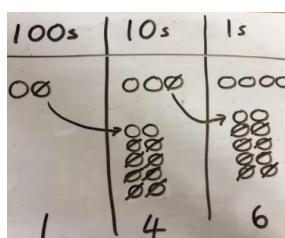
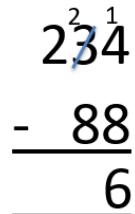
$$\begin{array}{r} 30 + 20 = 50 \\ 5 + 5 = 10 \\ 50 + 10 + 1 = 61 \end{array}$$

$$\begin{array}{r} 36 + 25 = \\ 1 \quad 5 \\ \hline 36 \\ +25 \\ \hline 61 \\ 1 \end{array}$$

## Calculation policy: Subtraction

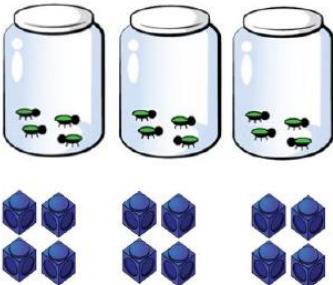
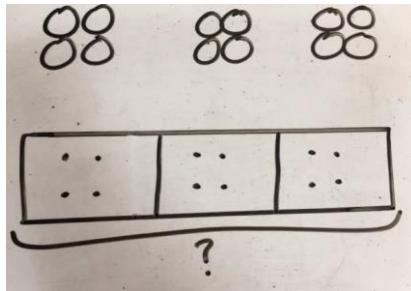
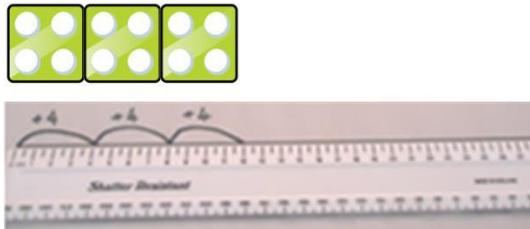
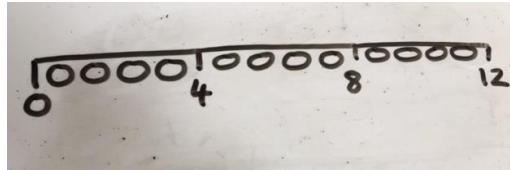
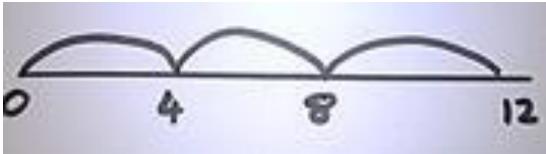
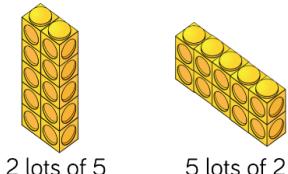
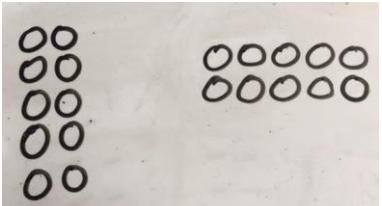
**Key language:** take away, less than, the difference, subtract, minus, fewer, decrease.

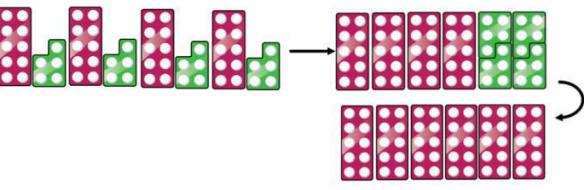
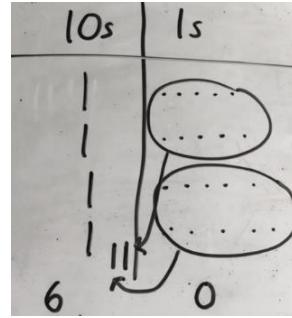
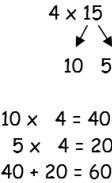
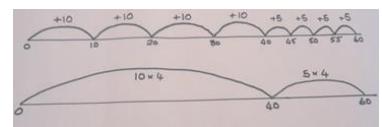
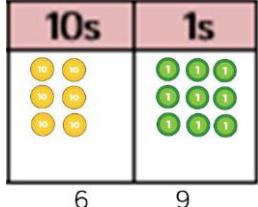
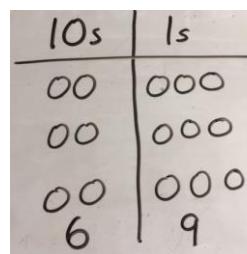
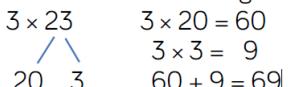
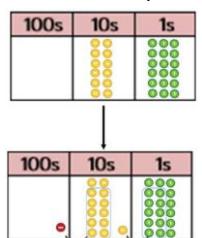
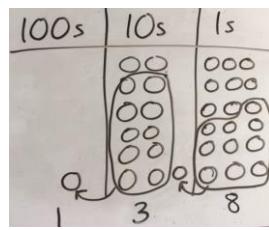
Concrete	Pictorial	Abstract
<p>Physically taking away and removing objects from a whole (ten frames, Numicon, cubes and other items such as beanbags could be used).</p> <p><math>4 - 3 = 1</math></p> 	<p>Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also be used.</p> 	<p><math>4 - 3 =</math></p> <p><math>\square = 4 - 3</math></p> 
<p>Counting back (using number lines or number tracks) children start with 6 and count back 2.</p> <p><math>6 - 2 = 4</math></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> 
<p>Finding the difference (using cubes, Numicon or Cuisenaire rods, other objects can also be used). Calculate the difference between 8 and 5.</p> 	<p>Children to draw the cubes/other concrete objects which they have used or use the bar model to illustrate what they need to calculate.</p> 	<p>Find the difference between 8 and 5.</p> <p><math>8 - 5</math>, the difference is <math>\square</math></p> <p>Children to explore why <math>9 - 6 = 8 - 5 = 7 - 4</math> have the same difference.</p>

<p>Making 10 using ten frames. 14 – 5</p> 	<p>Children to present the ten frame pictorially and discuss what they did to make 10.</p> 	<p>Children to show how they can make 10 by partitioning the subtrahend.</p> $14 - 5 = 9$ $4 \quad 1$ $14 - 4 = 10$ $10 - 1 = 9$
<p>Column method using base 10. 48 – 7</p> 	<p>Children to represent the base 10 pictorially.</p> 	<p>Column method or children could count back 7.</p> 
<p>Column method using base 10 and having to exchange. 41 – 26</p> 	<p>Represent the base 10 pictorially, remembering to show the exchange.</p> 	<p>Formal column method. Children must understand that when they have exchanged the 10 they still have 41 because <math>41 = 30 + 11</math>.</p> 
<p>Column method using place value counters. 234 – 88</p> 	<p>Represent the place value counters pictorially; remembering to show what has been exchanged.</p> 	<p>Formal column method. Children must understand what has happened when they have crossed out digits.</p> 

## Calculation policy: multiplication

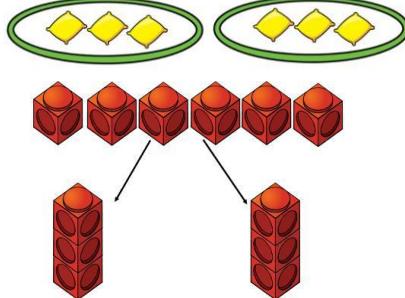
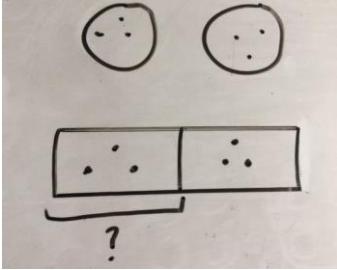
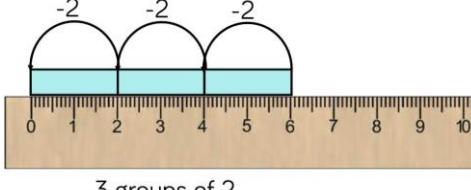
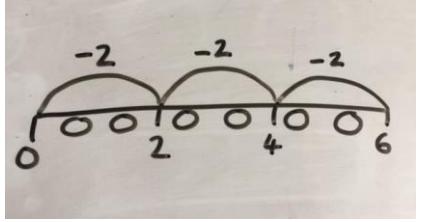
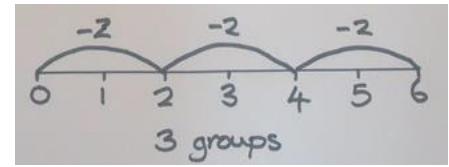
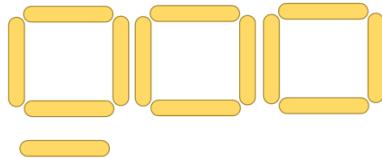
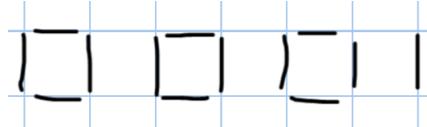
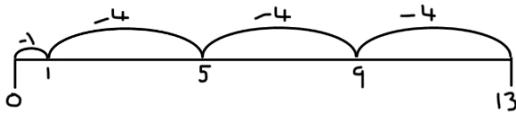
Key language: double, times, multiplied by, the product of, groups of, lots of, equal groups.

Concrete	Pictorial	Abstract
<p>Repeated grouping/repeated addition  <math>3 \times 4</math>  <math>4 + 4 + 4</math></p> <p>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> 	$3 \times 4 = 12$ $4 + 4 + 4 = 12$
<p>Number lines to show repeated groups-  <math>3 \times 4</math></p> 	<p>Represent this pictorially alongside a number line e.g.:</p> 	<p>Abstract number line showing three jumps of four.  <math>3 \times 4 = 12</math></p> 
<p>Cuisenaire rods can be used too.</p> <p>Use arrays to illustrate commutativity counters and other objects can also be used.</p> <p><math>2 \times 5 = 5 \times 2</math></p> 	<p>Children to represent the arrays pictorially</p> 	<p>Children to be able to use an array to write a range of calculations e.g.</p> $10 = 2 \times 5$ $5 \times 2 = 10$ $2 + 2 + 2 + 2 + 2 = 10$ $10 = 5 + 5$

<p>Partition to multiply using Numicon, base 10 or Cuisenaire rods.  <math>4 \times 15</math></p> 	<p>Children to represent the concrete manipulatives pictorially.</p> 	<p>Children to be encouraged to show the steps they have taken.</p> <p><math>4 \times 15</math></p>  <p>A number line can also be used</p> 
<p>Formal column method with place value counters  (base 10 can also be used.) <math>3 \times 23</math></p> 	<p>Children to represent the counters pictorially.</p> 	<p>Children to record what it is they are doing to show understanding.</p> <p><math>3 \times 23</math></p>  <p><math>\begin{array}{r} 23 \\ \times 3 \\ \hline 69 \end{array}</math></p>
<p>Formal column method with place value counters.  <math>6 \times 23</math></p> 	<p>Children to represent the counters/base 10, pictorially e.g. the image below.</p> 	<p>Formal written method</p> <p><math>6 \times 23 =</math></p> <p><math>\begin{array}{r} 23 \\ \times 6 \\ \hline 138 \end{array}</math></p>
<p>When children start to multiply 3d x 3d and 4d x 2d etc., they should be confident with the abstract:  To get 744 children have solved <math>6 \times 124</math>.  To get 2480 they have solved <math>20 \times 124</math>.</p>		<p><math>\begin{array}{r} 1 &amp; 2 &amp; 4 \\ \times &amp; 2 &amp; 6 \\ \hline 7 &amp; 4 &amp; 4 \\ 2 &amp; 4 &amp; 8 &amp; 0 \\ \hline 3 &amp; 2 &amp; 2 &amp; 4 \\ 1 &amp; 1 \end{array}</math></p> <p>Answer: 3224</p>

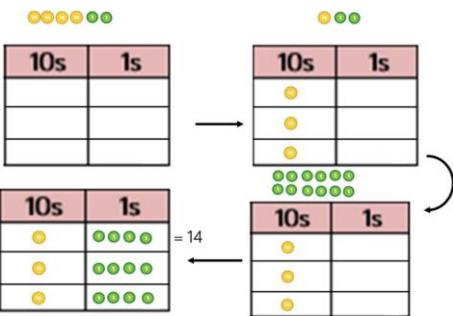
## Calculation policy: Division

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

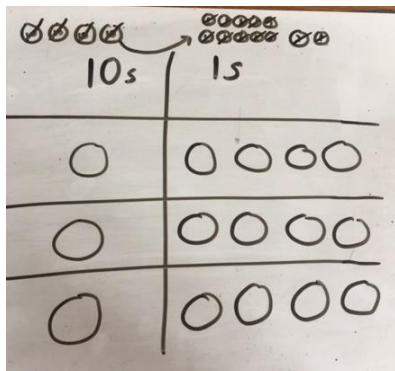
Concrete	Pictorial	Abstract		
<p>Sharing using a range of objects.  <math>6 \div 2</math></p> 	<p>Represent the sharing pictorially.</p> 	$6 \div 2 = 3$ <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">3</td> </tr> </table> <p>Children should also be encouraged to use their 2 times tables facts.</p>	3	3
3	3			
<p>Repeated subtraction using Cuisenaire rods above a ruler. <math>6 \div 2</math></p>  <p>3 groups of 2</p>	<p>Children to represent repeated subtraction pictorially.</p> 	<p>Abstract number line to represent the equal groups that have been subtracted.</p> 		
<p>2d <math>\div</math> 1d with remainders using lollipop sticks. Cuisenaire rods, above a ruler can also be used.  <math>13 \div 4</math></p> <p>Use of lollipop sticks to form wholes- squares are made because we are dividing by 4.</p>  <p>There are 3 whole squares, with 1 left over.</p>	<p>Children to represent the lollipop sticks pictorially.</p>  <p>There are 3 whole squares, with 1 left over.</p>	<p><math>13 \div 4 = 3</math> remainder 1</p> <p>Children should be encouraged to use their times table facts; they could also represent repeated addition on a number line.</p> <p>'3 groups of 4, with 1 left over'</p> 		

Sharing using place value counters.

$$42 \div 3 = 14$$



Children to represent the place value counters pictorially.



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

$$42 \div 3$$

$$42 = 30 + 12$$

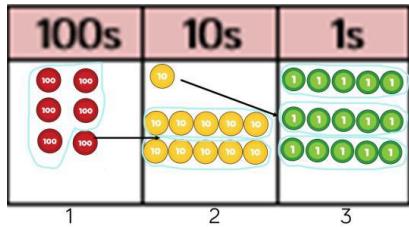
$$30 \div 3 = 10$$

$$12 \div 3 = 4$$

$$10 + 4 = 14$$

Short division using place value counters to group.

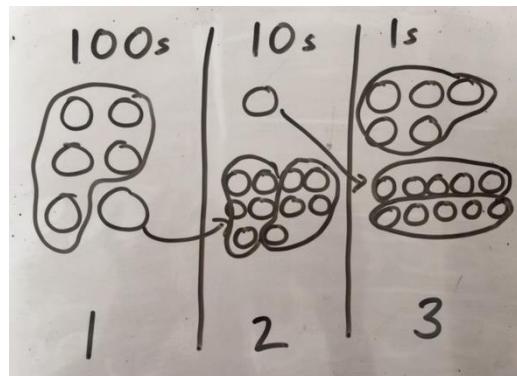
$$615 \div 5$$



1. Make 615 with place value counters.

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

Represent the place value counters pictorially.



Children to the calculation using the short division scaffold.

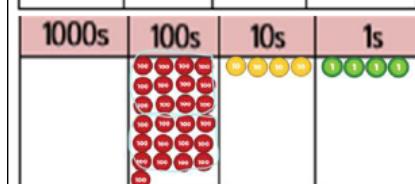
$$\begin{array}{r} 123 \\ 5 \overline{)615} \\ \end{array}$$

Long division using place value counters

$$2544 \div 12$$



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



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

$$\begin{array}{r} 0.2 \\ 12 \overline{)2544} \\ -24 \\ \hline 14 \\ -12 \\ \hline 2 \end{array}$$

1000s	100s	10s	1s
	100s 100s 100s 100s 100s 100s	10s 10s 10s 10s 10s 10s	1s 1s 1s 1s 1s 1s 1s

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

$$\begin{array}{r} 0.21 \\ 12 \overline{)2544} \\ 24 \\ \hline 14 \\ 12 \\ \hline 2 \end{array}$$

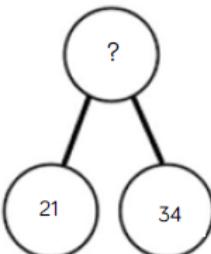
1000s	100s	10s	1s
	100s 100s 100s 100s 100s 100s	10s 10s 10s 10s 10s 10s	1s 1s 1s 1s 1s 1s 1s 1s

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

$$\begin{array}{r} 0.212 \\ 12 \overline{)2544} \\ 24 \\ \hline 14 \\ 12 \\ \hline 24 \\ 24 \\ \hline 0 \end{array}$$

Calculation policy: Conceptual Variation

## 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?

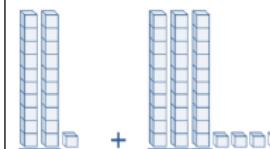
$$21 + 34 = 55. \text{ Prove it}$$

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

$$21 + 34 =$$

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

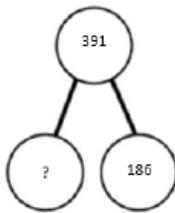
Calculate the sum of twenty-one and thirty-four.



Missing digit problems:

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

## 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

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

## Conceptual variation; different ways to ask children to solve $6 \times 23$

$$\begin{array}{ccccccc} 23 & | & 23 & | & 23 & | & 23 \\ \hline \end{array}$$

?

Mai had to swim 23 lengths, 6 times a week.  
How many lengths did she swim in one week?

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

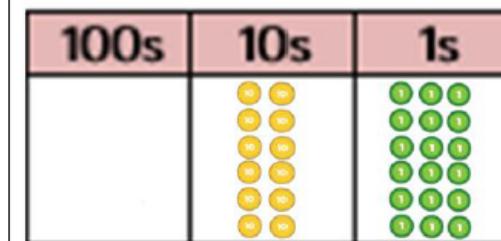
Find the product of 6 and 23

$$6 \times 23 =$$

$$\square = 6 \times 23$$

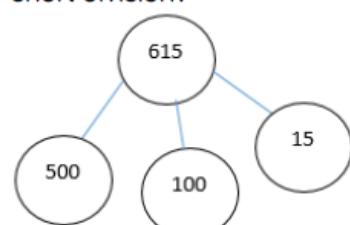
$$\begin{array}{r} 6 & 23 \\ \times 23 & \times 6 \\ \hline \end{array}$$

What is the calculation?  
What is the product?



## 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?

