

Calculations Written Method Guidelines

This is the Knowles Primary School progression for teaching written calculations, however we acknowledge that children will have other experiences of methods from other schools. These children should be allowed to continue with these methods if they are secure with them. It is important to us that children have secure processes for mathematical calculations. This has been written in conjunction with the resources from the White Rose Maths Hub.

	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.	add three single-digit numbers use of the base 10 to combine two numbers.	Column method - regrouping. using place value counters (up to 3 digits)	Column method - regrouping. using place value counters (up to 4 digits)	Column method - regrouping. use of Place Value counters for adding decimals.	column method - regrouping abstract methods use of Place Value counters for adding decimal numbers.
Subtraction	Taking away ones counting back find the difference part whole model making 10 using tens frame	counting back find the difference part whole model make 10 Use of base 10	column method - regrouping (up to 3 digits using place value counters)	column method - regrouping (up to 4 digits using place value counters)	column method - regrouping abstract methods start with place value counters for decimals - with the same amount of decimal places.	column method - regrouping abstract methods place value counters for decimals - with different amounts of decimal places
Division	sharing objects into groups	division as grouping division within arrays	division with remainder - using lollipop sticks, times	division with remainder	short division (up to 4-digit by	short division Long division with

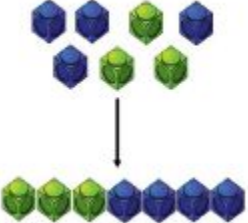
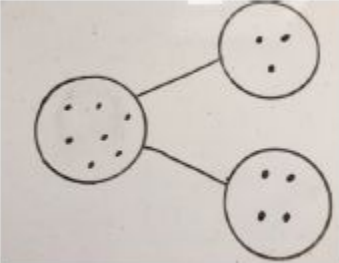
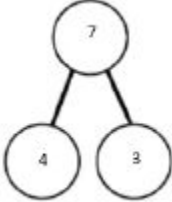
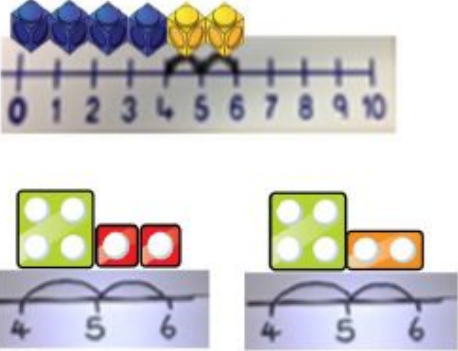
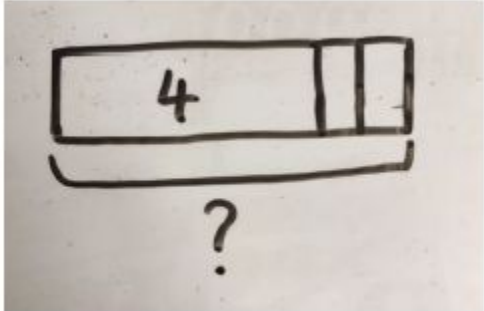
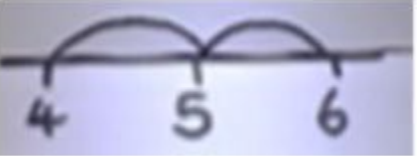
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	<p>division as grouping e.g I have 12 sweets and put them in groups of 3, how many groups?</p> <p>use of cubes and draw round <i>amount</i> cubes at a time. e.g draw round 3 cubes each time out of 12 to make 4 groups.</p>	<p>- linking to multiplication</p> <p>repeated subtraction</p>	<p>tables facts and repeated subtraction.</p> <p>2d divided by 1d using base 10 or place value counters.</p>	<p>short division (up to 3-digits by 1-digit - concrete and pictorial)</p>	<p>1-digit number including remainders)</p>	<p>place value counters (up to 4-digit by a 2-digit number)</p> <p>children should exchange into the tenths and hundredths column too.</p>
Multiplication	<p>recognising and making equal groups</p> <p>doubling</p> <p>counting in multiples use of cubes, numicon and other objects in the classroom</p>	<p>arrays - showing commutative multiplication</p> <p>repeated addition</p>	<p>arrays</p> <p>2d x 1d using base 10</p>	<p>column multiplication - introduced with place value counters.</p> <p>(2 and 3 digit multiplied by 1 digit)</p>	<p>Column multiplication</p> <p>abstract only but might need a repeat of Year 4 first (up to 4 digit numbers multiplied by 1 or 2 digits)</p>	<p>Column multiplication</p> <p>abstract methods (multi-digit up to 4 digits by 2 digit number)</p>

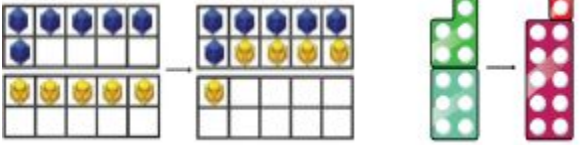
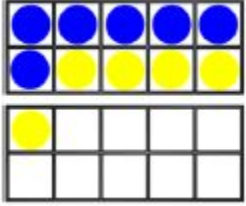

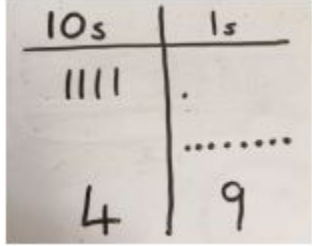
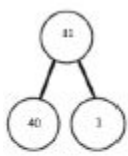
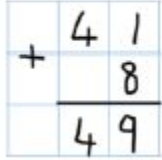
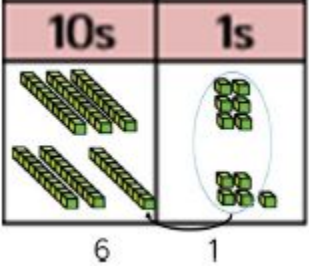
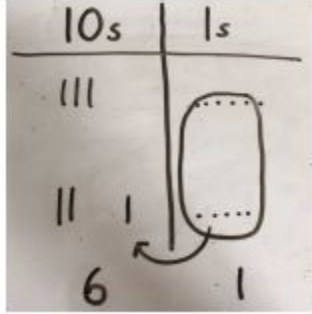
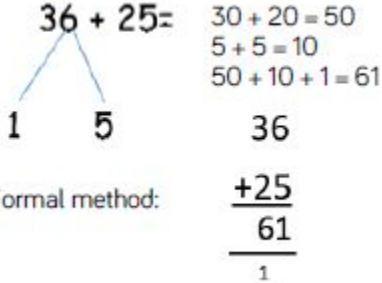
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Addition

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

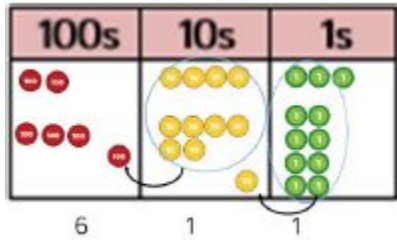
Concrete	Pictorial	Abstract
<p>Combining two parts to make a whole (use other resources e.g eggs, shells, teddy bars, cars).</p> 	<p>Children to represent the cubes using dots. They could put each part on a whole part model too.</p> 	<p>$4 + 3 = 7$ Four is a part, 3 is a part and the whole is seven.</p> 
<p>Counting on using a number line 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 2 and 4? $4 + 2$</p> 

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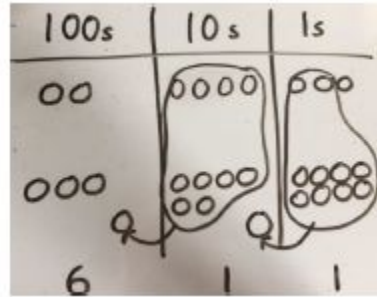
<p>Regrouping to make 10; using ten frames and counters/cubes or using numicon. 6 + 5</p> 	<p>Children to draw the ten frame and counters/cubes</p> 	<p>Children to develop an understanding of equality e.g</p> $6 + \square = 11$ $6 + 5 = 5 + \square$ $6 + 5 = \square + 4$
<p>TO + 0 using base 10. Continue to develop understanding of partitioning place value. 41 + 8</p> 	<p>Children to represent the base 10 e.g lines for tens and dots for ones.</p> 	<p>41 + 8</p>  
<p>TO + TO using base 10. Continue to develop understanding and partitioning and place value. 36 + 25</p> 	<p>Children to represent the base 10 in a place value chart.</p> 	<p>Looking for ways to make 10.</p>  <p>Formal method:</p> $\begin{array}{r} +25 \\ 36 \\ \hline 61 \\ 1 \end{array}$

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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.

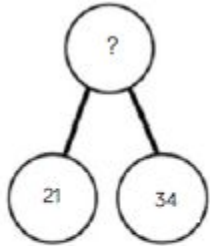


Children to represent the counters in a place value chart, circling when they make an exchange.



$$\begin{array}{r} 243 \\ +368 \\ \hline 611 \\ \hline 11 \end{array}$$

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?

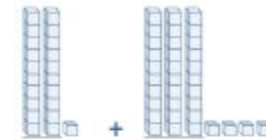
$21 + 34 = 55$. Prove it.

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

$21 + 34 =$

= 21 + 34

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



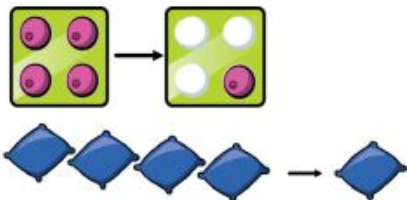
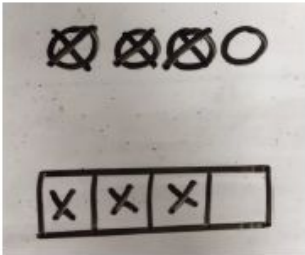
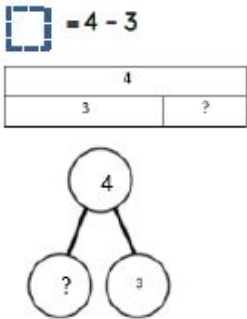

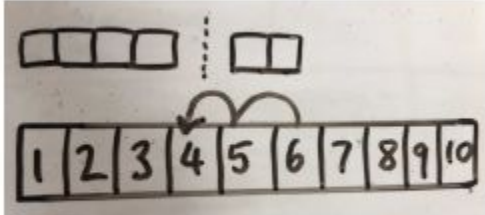
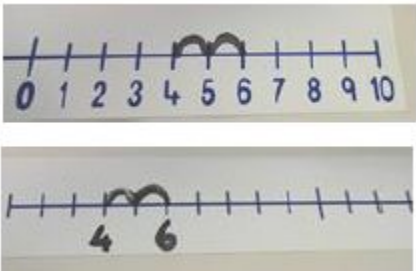
Missing digit problems:

10s	1s
2	1
3	?
?	5


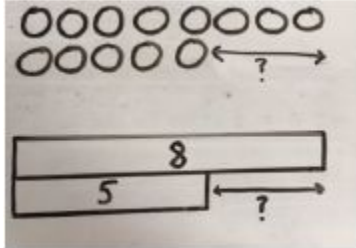
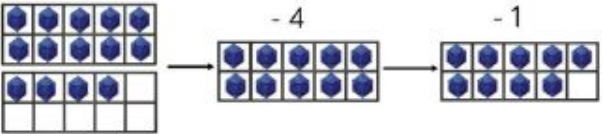
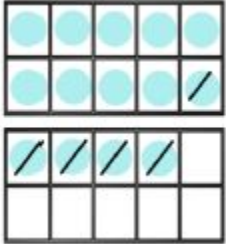
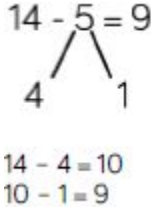
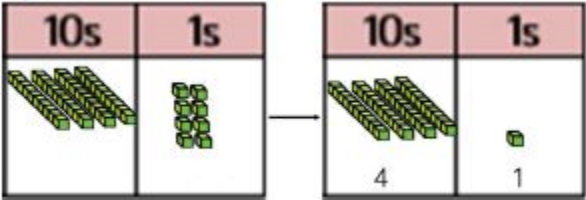
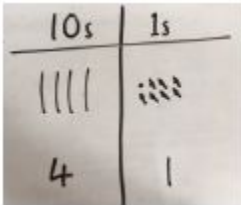
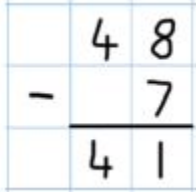
Calculations Written Method Guidelines

Subtraction

Key Language: take away, minus, subtract, less than, the difference, 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 correct amount. The bar model can also be used.</p> 	<p>$4 - 3 =$</p> <p></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.</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> 

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<p>Finding the difference (using cubes, Numicon or Cuisenaire rods, other objects can also be used)</p> <p>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>$8 - 5$, the difference is <input type="text"/></p> <p>Children to explore why $9 - 6 = 8 - 5 = 7 - 4$ have the same difference.</p>
<p>Making 10 using ten frames.</p> <p>$14 - 5$</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> $14 - 5 = 9$ 
<p>Column Method using Base 10.</p> <p>$48 - 7$</p> 	<p>Children to present the base 10 pictorially.</p> 	<p>Column method or children could count back to 7.</p> 
<p>Column Method using base 10 and having to</p>	<p>Represent the base 10 pictorially, remembering to</p>	<p>Formal Column Method. Children must understand</p>

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<p>exchange. 41 - 26</p>	<p>show the exchange.</p>	<p>that when they have exchanged the 10 they still and have 41 because $41 = 30 + 11$.</p>
<p>Column Method using place value counters. 234 - 88</p>	<p>Represent the place value order counters pictorially; remembering to show that it has been exchanged.</p>	<p>Formal column method. children must understand what has happened when they have crossed out digits.</p>

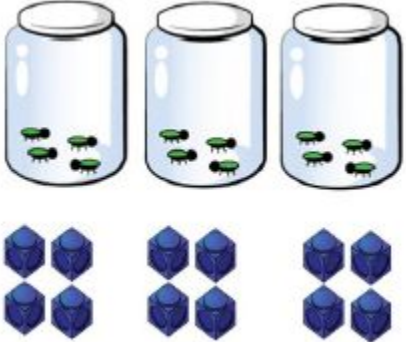
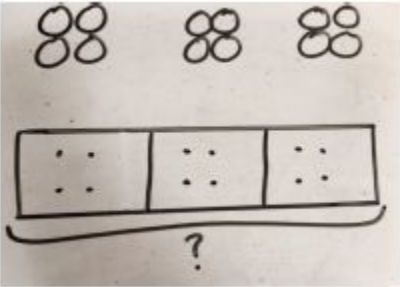
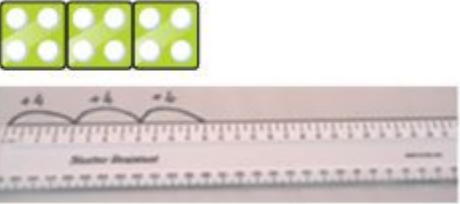
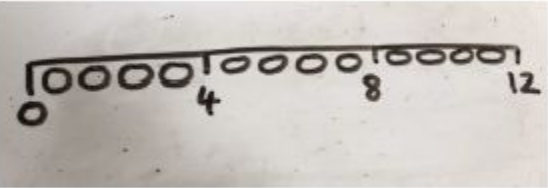
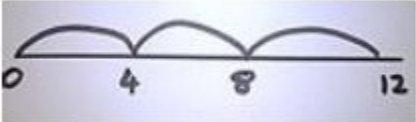
Conceptual variation; different ways to ask children to solve 391 - 186

	<p>Raj spent £391, Timmy spent £186. How much more did Raj spend?</p> <p>Calculate the difference between 391 and 186.</p>	<p>$\square = 391 - 186$</p> <p>What is 186 less than 391?</p>	<p>Missing digit calculations</p>
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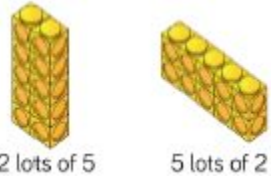
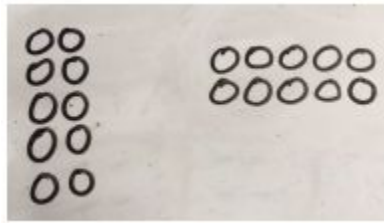
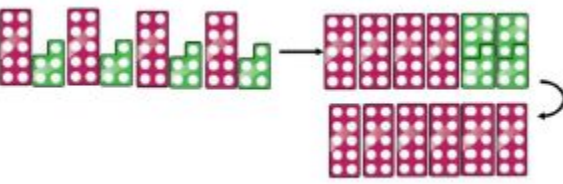
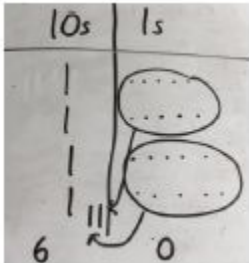
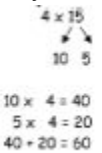
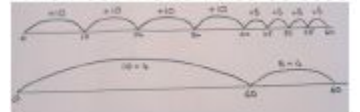
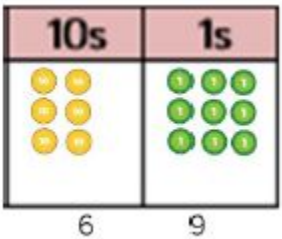
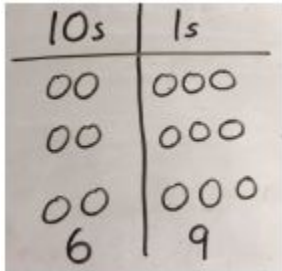
Calculations Written Method Guidelines

Multiplication

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

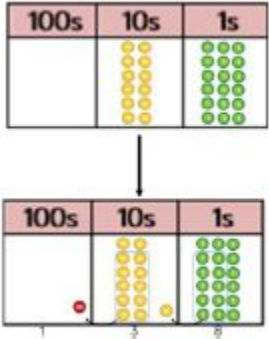
Concrete	Pictorial	Abstract
<p>Repeated grouping / repeated addition. 3×4 $4 + 4 + 4$ There are 3 equal groups, with 4 in each group.</p>  <p>The concrete representation shows three jars, each containing four green ants. Below the jars are three groups of four blue blocks, each group consisting of two blocks stacked on top of each other.</p>	<p>Children to represent the practical resources in a picture and use bar model.</p>  <p>The pictorial representation shows three groups of two circles each. Below this is a bar model divided into three equal sections, each containing two dots. A bracket underneath the bar model is labeled with a question mark.</p>	<p>$3 \times 4 = 12$ $4 + 4 + 4 = 12$</p>
<p>Number lines to show repeated groups - 3×4</p>  <p>The number lines show three jumps of 4 units each, starting from 0 and ending at 12. The Cuisenaire rods are three green rods, each 4 units long, placed end-to-end.</p> <p>Cuisenaire rods can be used too.</p>	<p>Represent this pictorially alongside a number line e.g.</p>  <p>The number line shows three jumps of 4 units each, starting from 0 and ending at 12. The jumps are represented by three groups of four small circles each, placed above the number line.</p>	<p>Abstract number line showing three jumps of four.</p> <p>$3 \times 4 = 12$</p>  <p>The abstract number line shows three jumps of 4 units each, starting from 0 and ending at 12. The jumps are represented by three curved lines above the number line.</p>

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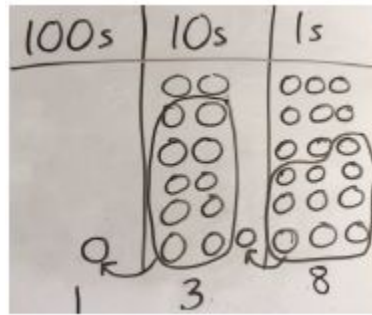
<p>Use arrays to illustrate commutativity counters and other objects can be used. $2 \times 5 = 5 \times 2$</p>  <p>2 lots of 5 5 lots of 2</p>	<p>Children to represent these pictorially.</p> 	<p>Children to be able to use an array to write a range of calculations e.g</p> $10 = 2 \times 5$ $5 \times 2 = 10$ $2 + 2 + 2 + 2 + 2 = 10$ $10 = 5 + 5$
<p>Partition to multiply using numicon, base 10 or cuisenaire rods. 4×15</p> 	<p>Children to represent the concrete manipulatives pictorially.</p> 	<p>Children to have been encouraged to show steps they have taken.</p>  <p> 4×15 $10 \quad 5$ $10 \times 4 = 40$ $5 \times 4 = 20$ $40 + 20 = 60$ </p> <p>A number line can also be used.</p> 
<p>Formal column method with place value counters (base 10 can also be used) 3×23</p> 	<p>Children to represent the counters pictorially.</p> 	<p>Children to record what it is that they are doing to show understanding.</p> $3 \times 23 \quad 3 \times 20 = 60$ $20 \quad 3 \quad 3 \times 3 = 9$ $60 + 9 = 69$ $\begin{array}{r} 23 \\ \times 3 \\ \hline 69 \end{array}$

Calculations Written Method Guidelines

Formal column method with place value counters.
 6×23



Children to represent the counters / base 10, pictorially



Formal written method

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

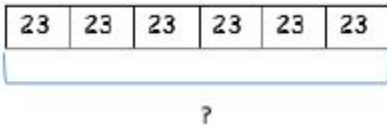
When children start to multiply $3d \times 3d$ and $4d \times 2d$ etc, they should be confident with the abstract:

To get 744 children have solved 6×124
To get to 2480 children 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



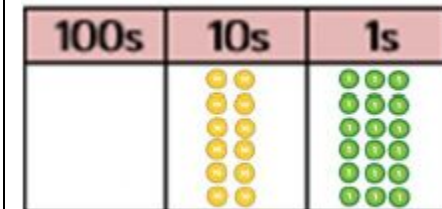
Mai had to swim 23 lengths, 6 times a week.
How many lengths did she swim in one week?

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

Find the product of 6 and 23

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

What is the calculation?
what is the product?



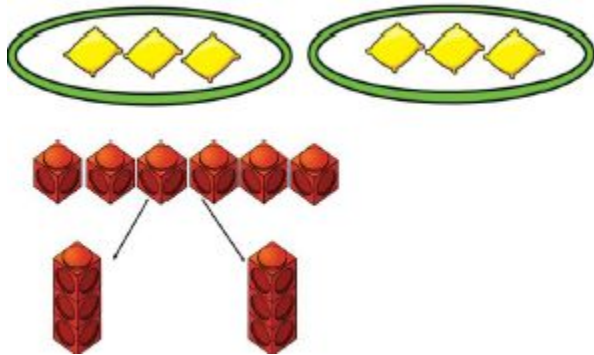
Calculations Written Method Guidelines

Division

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

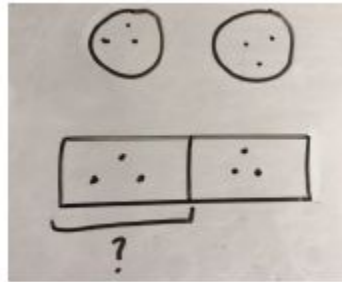
Concrete

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



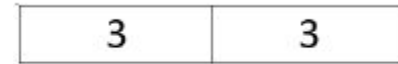
Pictorial

Represent the sharing pictorially.



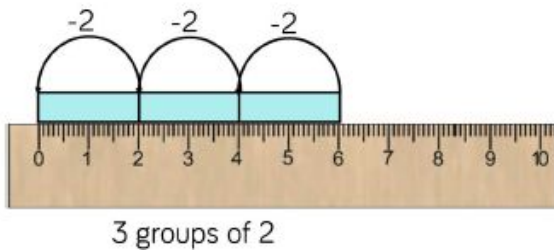
Abstract

$6 \div 2 = 3$

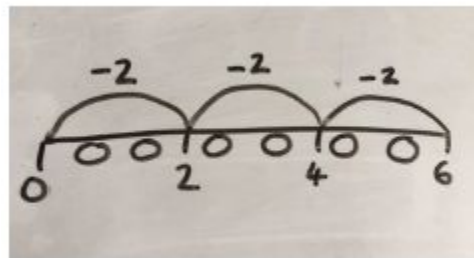


Children should be encouraged to use their 2 times tables facts.

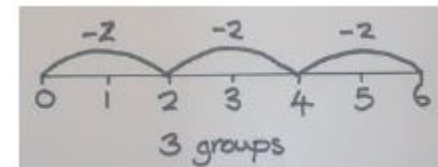
Repeated Subtraction using Cuisenaire rods above a ruler.
 $6 \div 2$



Children to represent repeated subtraction pictorially.



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



Calculations Written Method Guidelines

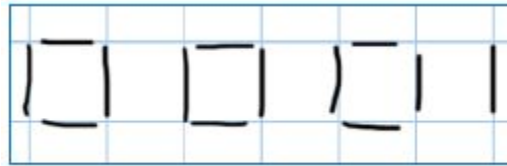
2d ÷ 1d with remainders using lollipop sticks.
Cuisenaire rods, above a ruler can also be used.
 $13 \div 4$

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



There are three whole squares, with 1 left over.

Children to represent the lollipop sticks pictorially.

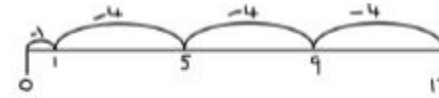


There are three whole squares, 1 left over.

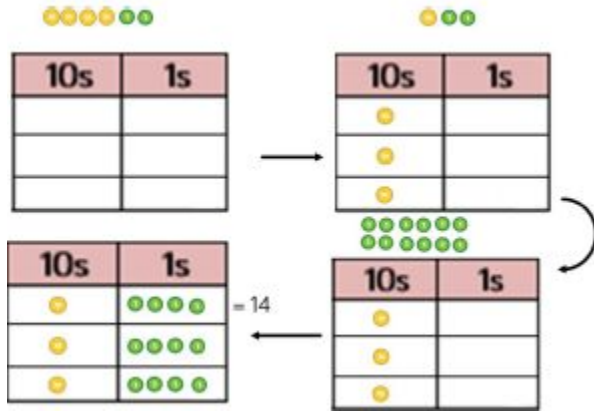
$13 \div 4 = 3$ remainder 1

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

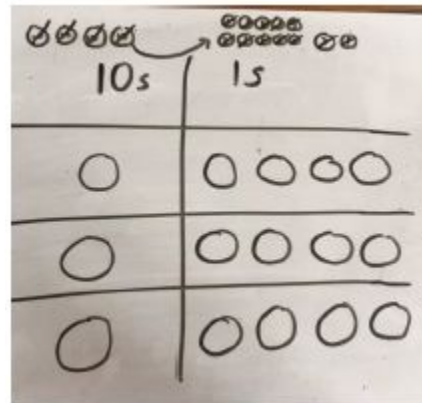
'3 groups of 4, with 1 left over'.



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.

$$42 \div 3$$

$$42 = 30 + 12$$

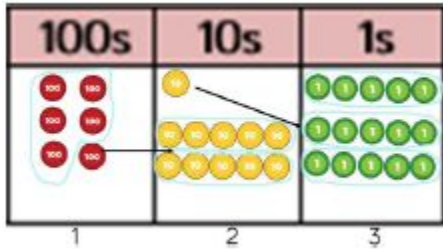
$$30 \div 3 = 10$$

$$12 \div 3 = 4$$

$$10 + 4 = 14$$

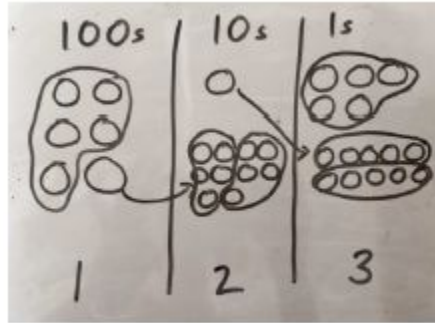
Calculations Written Method Guidelines

Short division using place value counters to group.
615 ÷ 5



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

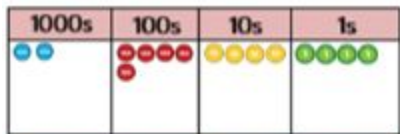
Represent the place value counters pictorially.



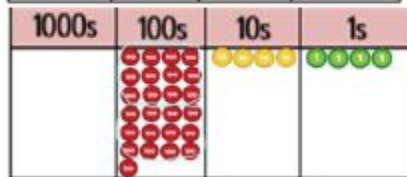
Children do the calculation using short division scaffold.

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

Long division using place value counters
2544 ÷ 12



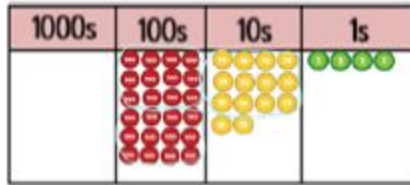
We can't group 2 thousands into groups of 12 so will exchange them.



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

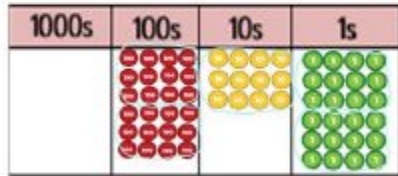
$$12 \overline{) 2544} \begin{matrix} 02 \\ \underline{24} \\ 1 \end{matrix}$$

Calculations Written Method Guidelines



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

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

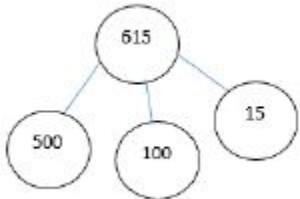


After exchanging the 2 tens, we have 24 ones. We can group 24 ones into 2 group of 12, which leaves no remainder.

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

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 in 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?

