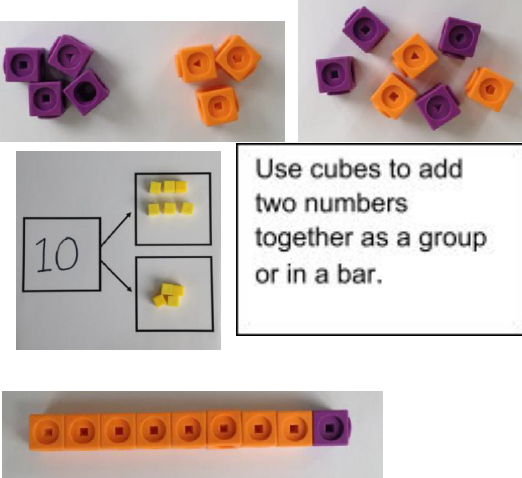
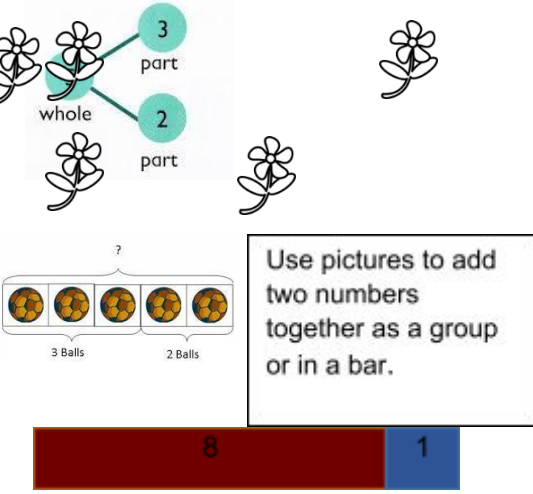


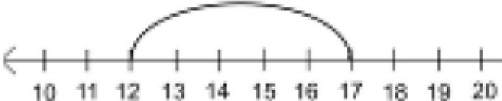
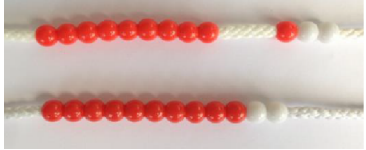
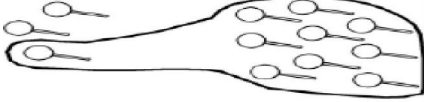




# Glebe Farm School

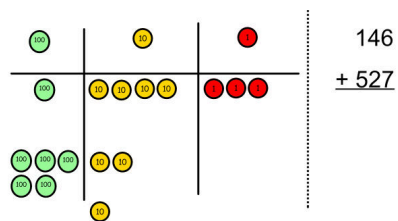
## Progression in Calculation Policy

## Progression in Calculations - Addition

Objective and Strategies	Concrete	Pictorial	Abstract
<p><b>Combining two parts to make a whole: part-whole model</b></p>	 <p>Use cubes to add two numbers together as a group or in a bar.</p>	 <p>Use pictures to add two numbers together as a group or in a bar.</p>	<p><math>4 + 3 = 7</math></p> <p><math>10 = 6 + 4</math></p>  <p>Use the part-part whole diagram as shown above to move into the abstract.</p>
<p><b>Starting at the bigger number and counting on</b></p>	 <p>Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer.</p>	<p><math>12 + 5 = 17</math></p>  <p>Start at the larger number on the number line and count on in ones or in one jump to find the answer.</p>	<p><math>5 + 12 = 17</math></p> <p>Place the larger number in your head and count on the smaller number to find your answer.</p>
<p><b>Regrouping to make 10</b></p>	 <p><math>6 + 5 = 11</math></p>	 <p>or partition the smaller</p> <p><math>3 + 9 =</math></p>	<p><math>7 + 4 = 11</math></p> <p>If I am at seven, how many more do I need to make 10. How many more do I add on now?</p>



Add up the units and exchange 10 ones for one 10.



Add up the rest of the columns, exchanging the 10 counters from one column for the next place value column until every column has been added.

This can also be done with Base 10 to help children clearly see that 10 ones equal 1 ten and 10 tens equal 100.

As children move on to decimals, money and decimal place value counters can be used to support learning.

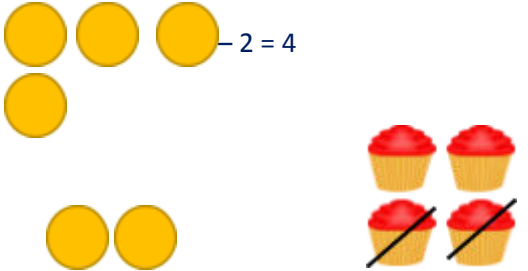
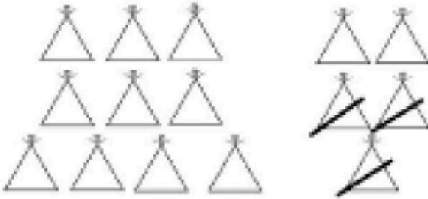


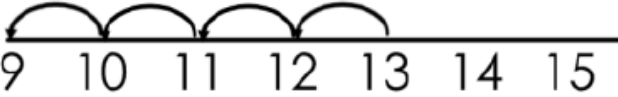
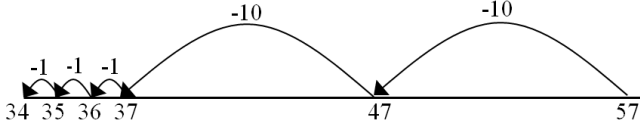
As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here.

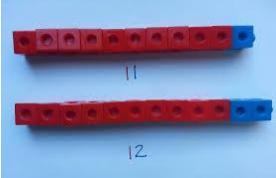
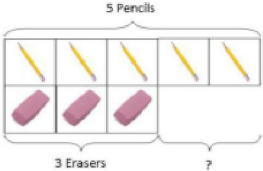
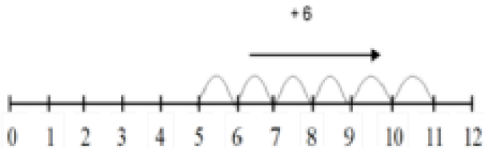
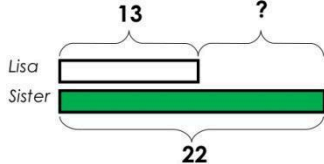
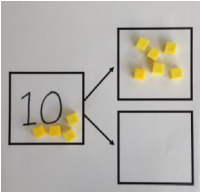
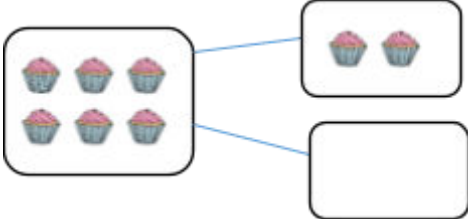
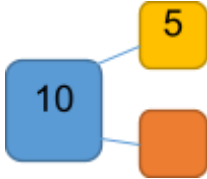

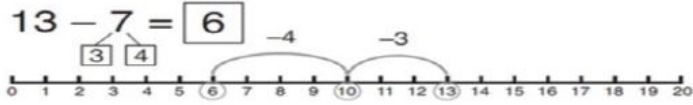
$$\begin{array}{r}
 72.8 \\
 + 54.6 \\
 \hline
 127.4
 \end{array}$$

$$\begin{array}{r}
 \pounds 23.59 \\
 + \pounds 7.55 \\
 \hline
 \pounds 31.14
 \end{array}$$

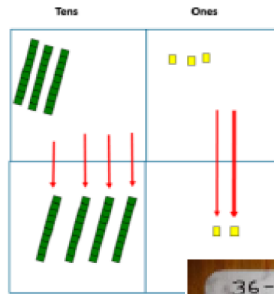
### Progression in Calculations - Subtraction

Objective and Strategies	Concrete	Pictorial	Abstract
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<p><b>Taking away ones</b></p>	<p>Use physical objects, counters, cubes etc to show how objects can be taken away.</p>  <p><math>5 - 2 = 3</math></p> <p><math>4 - 2 = 2</math></p>	<p>Cross out drawn objects to show what has been taken away.</p>  <p><math>15 - 3 = 12</math></p>	<p><math>18 - 3 = 15</math></p> <p><math>8 - 2 = 6</math></p>
<p><b>Counting back</b></p>	<p>Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones.</p>  <p><math>13 - 4</math></p> <p>Use counters and move them away from the group as you take them away counting backwards as you go.</p> 	<p>Count back on a number line or number track</p>  <p>Start at the bigger number and count back the smaller number showing the jumps on the number line.</p>  <p>This can progress all the way to counting back using two 2 digit numbers.</p>	<p>Put 13 in your head, count back 4. What number are you at? Use your fingers to help.</p>

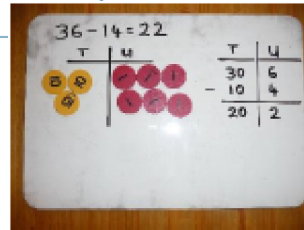
<h3>Find the difference</h3>	<p>Compare amounts and objects to find the difference.</p>  <p>Use cubes to build towers or make bars to find the difference</p>  <p>Use basic bar models with items to find the difference</p>	 <p>Count on to find the difference.</p> <h3>Comparison Bar Models</h3> <p>Draw bars to find the difference between 2 numbers.</p> <p><i>Lisa is 13 years old. Her sister is 22 years old. Find the difference in age between them.</i></p> 	<p>Hannah has 23 sandwiches, Helen has 15 sandwiches. Find the difference between the number of sandwiches.</p>
<h3>Part -Part -Whole Model</h3>	<p>Link to addition- use the part whole model to help explain the inverse between addition and subtraction.</p>  <p>If 10 is the whole and 6 is one of the parts. What is the other part?</p> <p><math>10 - 6 =</math></p>	<p>Use a pictorial representation of objects to show the part part whole model.</p> 	 <p>Move to using numbers within the part whole model.</p>
<h3>Make 10</h3>	<p><math>14 - 9 =</math></p>  <p>Make 14 on the ten frame. Take away the four first to make 10 and then takeaway one more so you have taken away 5. You are left with the answer of 9.</p>	<p><math>13 - 7 = 6</math></p>  <p>Start at 13. Take away 3 to reach 10. Then take away the remaining 4 so you have taken away 7 altogether. You have reached your answer.</p>	<p><math>16 - 8 =</math></p> <p>How many do we take off to reach the next 10?</p> <p>How many do we have left to take off?</p>

## Column method without regrouping



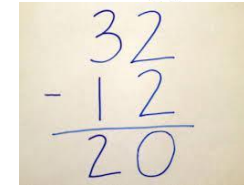
Use Base 10 to make the bigger number then take the smaller number away.

Show how you partition numbers to subtract. Again make the larger number first.



Draw the Base 10 or place value counters alongside the written calculation to help to show working.

$$47 - 24 = 23$$



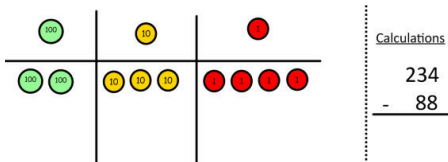
This will

lead to a clear written column subtraction.

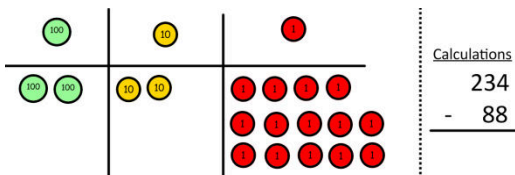
## Column method with regrouping

Use Base 10 to start with before moving on to place value counters. Start with one exchange before moving onto subtractions with 2 exchanges.

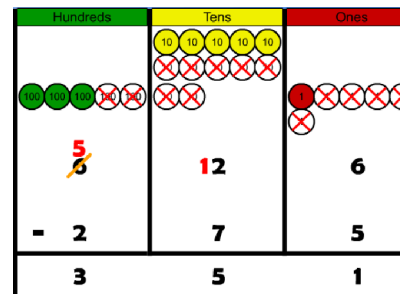
Make the larger number with the place value counters



Start with the ones, can I take away 8 from 4 easily? I need to exchange one of my tens for ten ones.



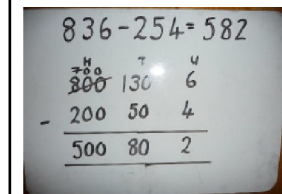
Now I can subtract my ones.



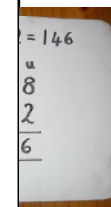
Draw the counters onto a place value grid and show what you have taken away by crossing the counters out as well as clearly showing the exchanges you make.

When confident, children can find their own way to record the exchange/regrouping.

Just writing the numbers as shown here shows that the child understands the method and knows when to exchange/regroup.



Children can start their formal written method by partitioning the number into clear place value columns.



Moving forward the children use a more compact method.

100	10	1
100 100	10 10	1 1 1 1 1 1

Calculations

$$\begin{array}{r} 234 \\ - 88 \\ \hline \end{array}$$

100	10	1
100	10 10 10 10 10 10 10 10	1 1 1 1 1 1 1 1

Calculations

$$\begin{array}{r} 234 \\ - 88 \\ \hline \end{array}$$

Now I can take away eight tens and complete my subtraction

100	10	1
100	10 10	1 1 1 1 1 1

Calculations

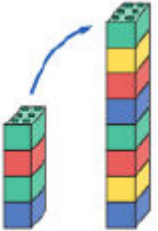

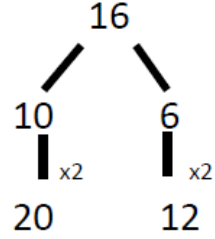

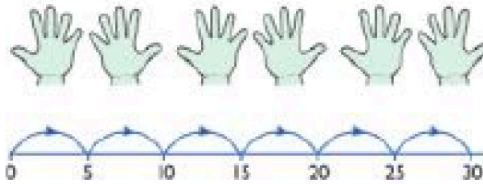
$$\begin{array}{r} 234 \\ - 88 \\ \hline 146 \end{array}$$

Show children how the concrete method links to the written method alongside your working. Cross out the numbers when exchanging and show where we write our new amount.

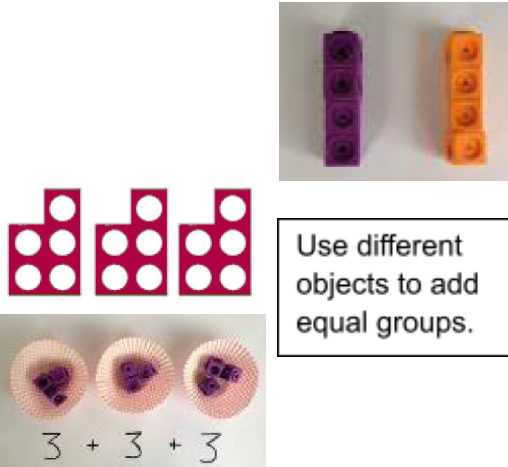
This will lead to an understanding of subtracting any number including decimals.

$$\begin{array}{r} 5 \quad 12 \quad 1 \\ 2 \quad \cancel{6} \quad \cancel{3} \quad . \quad 0 \\ - \quad 2 \quad 6 \quad . \quad 5 \\ \hline 2 \quad 3 \quad 6 \quad . \quad 5 \end{array}$$

Progression in Calculations - Multiplication

Objective and Strategies	Concrete	Pictorial	Abstract
<p><b>Doubling</b></p>	<p>Use practical activities to show how to double a number.</p>  <p>double 4 is 8  <math>4 \times 2 = 8</math></p>	<p>Draw pictures to show how to double a number.</p> <p>Double 4 is 8</p> 	 <p>Partition a number and then double each part before recombining it back together.</p>
<p><b>Counting in multiples</b></p>	 <p>Count in multiples supported by concrete objects in equal groups.</p>	 <p>Use a number line or pictures to continue support in counting in multiples.</p>	<p>Count in multiples of a number aloud.</p> <p>Write sequences with multiples of numbers.</p> <p>2, 4, 6, 8, 10</p> <p>5, 10, 15, 20, 25, 30</p>


## Repeated addition



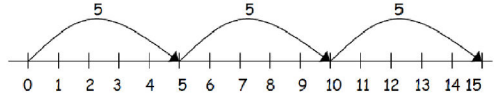
Use different objects to add equal groups.

$$3 + 3 + 3$$

There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there?



2 add 2 add 2 equals 6



$$5 + 5 + 5 = 15$$

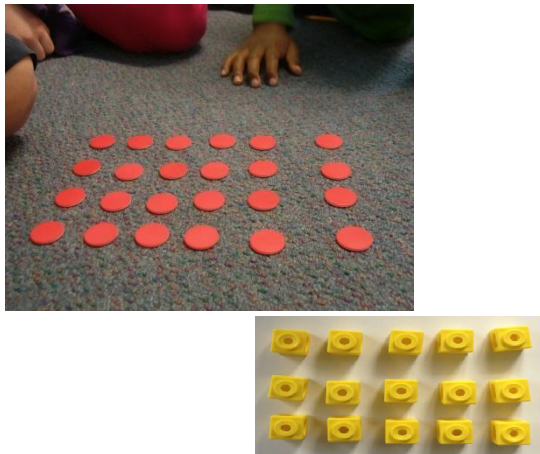
Write addition sentences to describe objects and pictures.



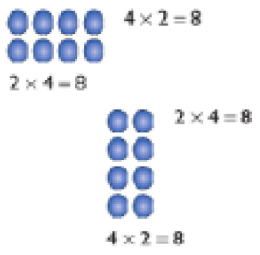
$$2 + 2 + 2 + 2 + 2 = 10$$

## Arrays- showing commutative multiplication

Create arrays using counters/ cubes to show multiplication sentences.



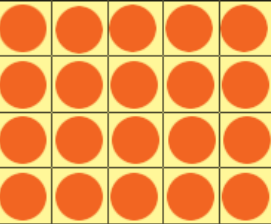
Draw arrays in different rotations to find **commutative** multiplication sentences.



$$4 \times 2 = 8$$


$$2 \times 4 = 8$$

$$2 \times 4 = 8$$

$$4 \times 2 = 8$$


Link arrays to area of rectangles.

Use an array to write multiplication sentences and reinforce repeated addition.



$$5 + 5 + 5 = 15$$

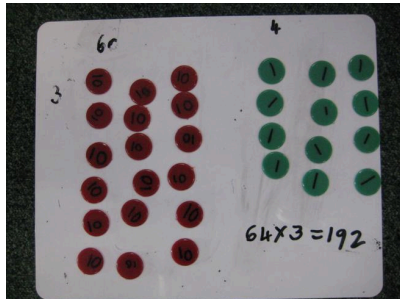
$$3 + 3 + 3 + 3 + 3 = 15$$

$$5 \times 3 = 15$$

$$3 \times 5 = 15$$

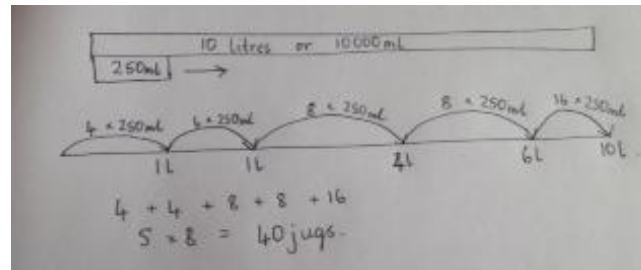
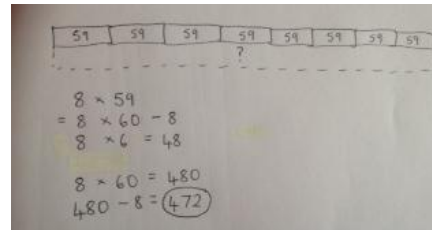
## Column multiplication

Children can continue to be supported by place value counters at the stage of multiplication.



It is important at this stage that they always multiply the ones first and note down their answer followed by the tens which they note below.

Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.



Start with long multiplication, reminding the children about lining up their numbers clearly in columns.

If it helps, children can write out what they are solving next to their answer.

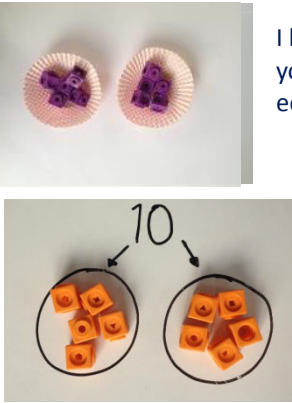
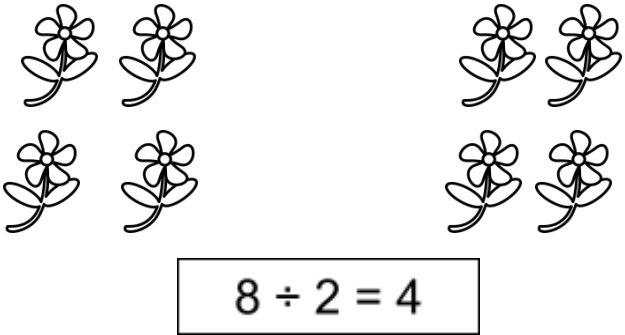
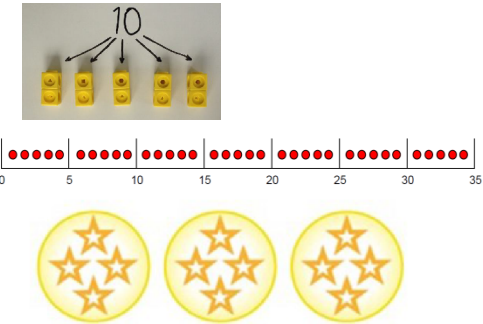

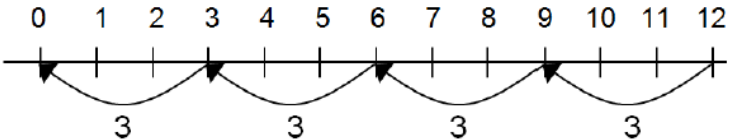
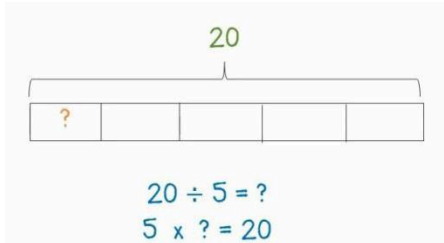
$$\begin{array}{r}
 32 \\
 \times 24 \\
 \hline
 128 \quad (4 \times 2) \\
 640 \quad (4 \times 30) \\
 \hline
 768
 \end{array}$$

1	2
2	1 0
2	4 0
2	0 0
6	6 2

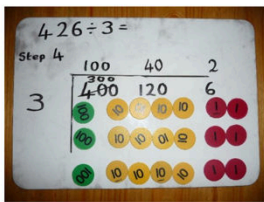
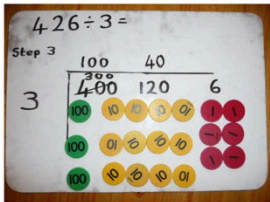
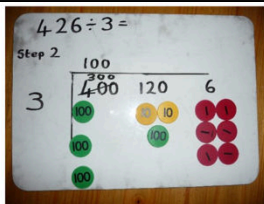
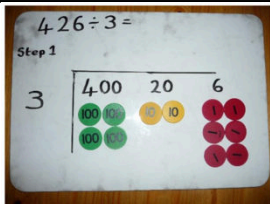
This moves to the more compact method.

$$\begin{array}{r}
 \phantom{0}2 \phantom{0}3 \phantom{0}1 \\
 1342 \\
 \times \phantom{0}18 \\
 \hline
 13420 \\
 10736 \\
 \hline
 24156 \\
 \hline
 1
 \end{array}$$

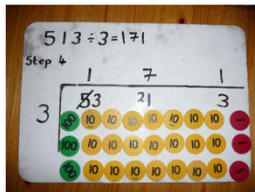
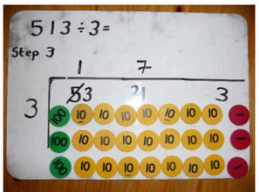
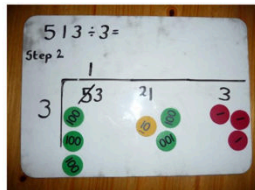
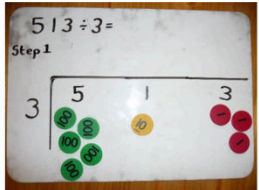
## Progression in Calculations - Division

Objective and Strategies	Concrete	Pictorial	Abstract
<p><b>Sharing objects into groups</b></p>	<p>I have 10 cubes, can you share them equally in 2 groups?</p> 	<p>Children use pictures or shapes to share quantities.</p> 	<p>Share 9 buns between three people.</p> $9 \div 3 = 3$
<p><b>Division as grouping</b></p>	<p>Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.</p>  <p><math>96 \div 3 = 32</math></p> 	<p>Use a number line to show jumps in groups. The number of jumps equals the number of groups.</p>  <p>Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group.</p> 	<p><math>28 \div 7 = 4</math></p> <p>Divide 28 into 7 groups. How many are in each group?</p>





Divide a three digit number, then moving to a four digit number, by a one digit number by using partitioning and place value counters.  
Divide a three digit number, then moving to a four digit number, by a one digit number without partitioning but using place value counters.



Finally move into decimal places to divide the total accurately.

$$\begin{array}{r}
 14.6 \\
 3 \overline{) 511.0} \\
 \underline{35} \phantom{0} \\
 16 \phantom{0} \\
 \underline{12} \phantom{0} \\
 40 \\
 \underline{30} \\
 10 \\
 \underline{9} \\
 10 \\
 \underline{9} \\
 10
 \end{array}$$

Long Division

Handwritten long division of 2974 by 13. The quotient is 228 with a remainder of 10. The work is shown in two columns. The first column shows the division steps: 13 goes into 29 (2 times, remainder 13), 13 goes into 137 (10 times, remainder 7), and 13 goes into 74 (5 times, remainder 9). The second column shows the multiplication of the quotient by the divisor: 13 times 2 is 26, 13 times 22 is 286, and 13 times 228 is 2964. The remainder 10 is shown at the bottom.

$$\begin{array}{r} 0228r10 \\ 13 \overline{) 2974} \\ \underline{26} \phantom{0} \\ 037 \phantom{0} \\ \underline{26} \phantom{00} \\ 114 \phantom{0} \\ \underline{104} \\ 010 \end{array}$$
$$\begin{array}{r} 13 \\ +13 \\ \hline 26 \\ +13 \\ \hline 39 \\ +13 \\ \hline 52 \\ +13 \\ \hline 65 \\ +13 \\ \hline 78 \\ +13 \\ \hline 91 \\ +13 \\ \hline 104 \end{array}$$