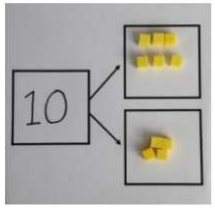
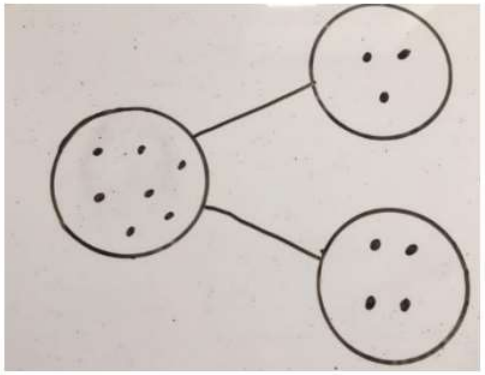
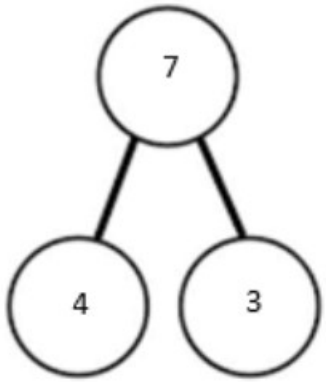
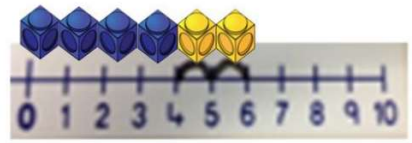
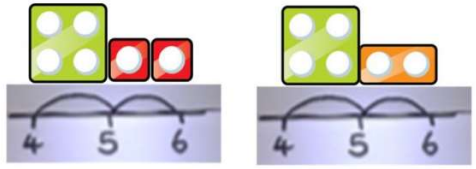
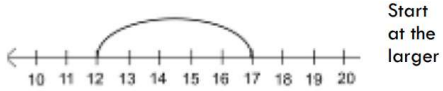
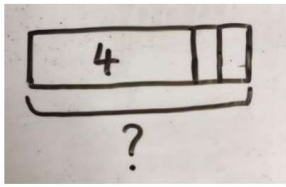
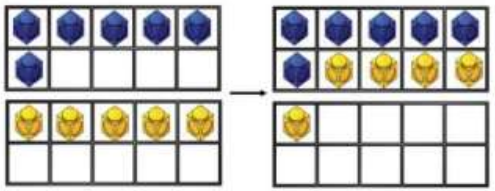
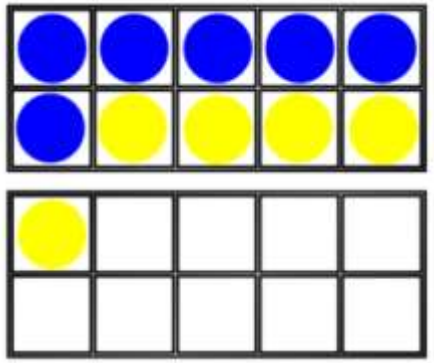
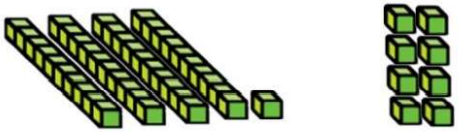
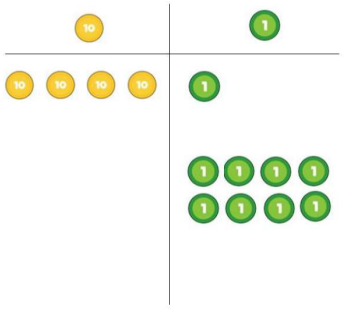
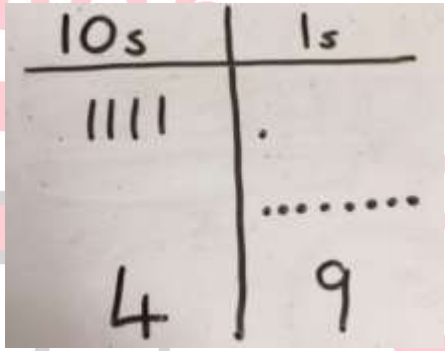
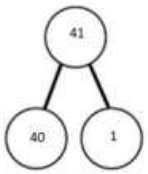
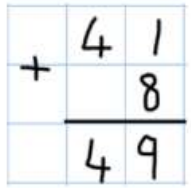
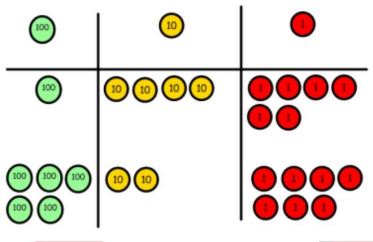
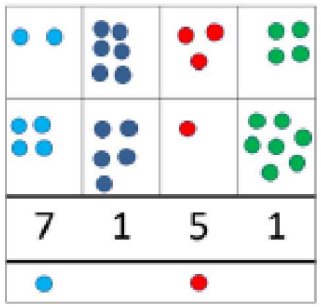
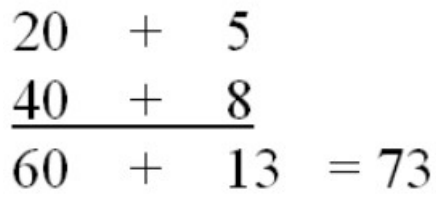
Whitkirk Primary School – Calculation Procedure

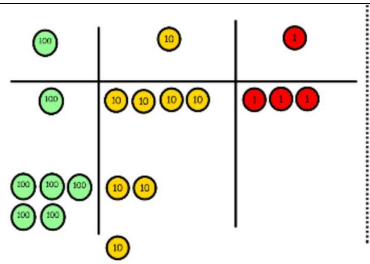
Addition:

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

Objective and strategy	Concrete	Pictorial	Abstract
Combining two parts to make a whole: part-whole model (aggregation) *Suggested year group(s): R, Year 1*	   Use cubes to add two numbers together as a group or in a bar.   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. 

Starting at the larger number and counting on (augmentation) *Suggested year group(s): R, Year 1*	  	12 + 5 = 17  Start at the larger number on the number line or hundred square and count on in ones or in one jump to find the answer.  A bar model which encourages the children to count on, rather than count all.	5 + 12 = 17 'Place the largest number in your head and count on the smaller number to find your answer.' What is 5 more than 12? What is the sum of 12 and 5? What is the total of 5 and 12?
Regrouping to make 10 *Suggested year group(s): Year 1 and Year 2*	6 + 5  Start with the larger number and use the smaller number to make 10.	Children to draw the ten frame and counters/cubes. 	7 + 4 = 11 'If I am at seven, how many more do I need to make 10? How many more do I add on now?' Children to develop an understanding of equality e.g. 6 + □ = 11 6 + 5 = 5 + □ 6 + 5 = □ + 4

Column method – no regrouping *Suggested year group(s): Year 2, Year 3*	41 + 8 = Add together the ones first and then add the tens. Use the Base 10 blocks first before moving onto place value counters.  	Children to represent the base 10 e.g. lines for tens and dot/crosses for ones. 	41 + 8  1 + 8 = 9 40 + 9 = 49 
Column method – regrouping Suggested year group(s): Year 2, Year 3, Year 4, Year 5, Year 6	Make both numbers on a place value grid.  146 + 527 Add up the ones and exchange 10 ones for one 10.	Children can draw a pictorial representation of the columns and place value counters to further support their learning and understanding. 	Start by partitioning the numbers before moving on to clearly show the exchange below the addition. 

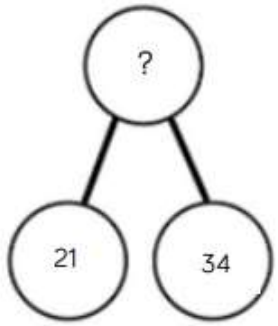
<table>
<tr>
<td></td>
<td> 

146
+ 527

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

72.8
+ 54.6
127.4
1 1

£ 2 3 . 5 9
+ £ 7 . 5 5
£ 3 1 . 1 4
1 1 1</td>
</tr>
<tr>
<td colspan="4">Conceptual variation; different ways to ask children to solve 21 + 34.</td>
</tr>
</table>



?	
21	34

Word problems:

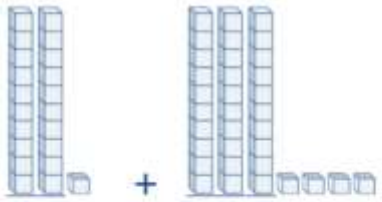
In Year 3, there are 21 children and in year 4, there are 34 children.
How many children in total?
21 + 34 = 55. Prove it

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

21 + 34 =

$\square$ = 21 + 34

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



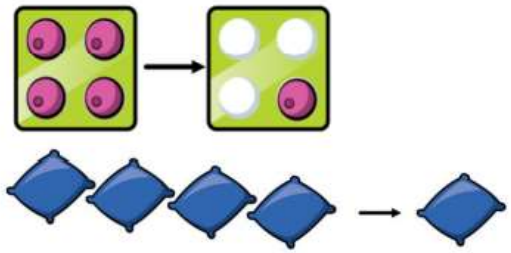
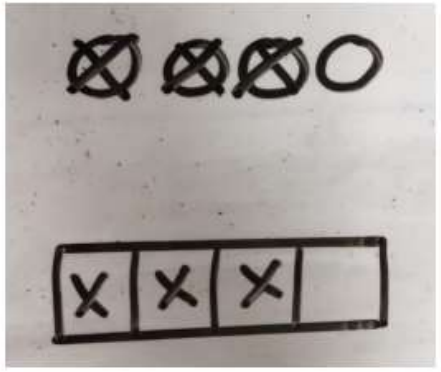
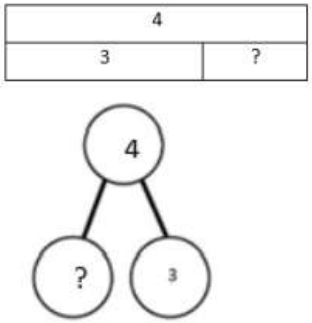
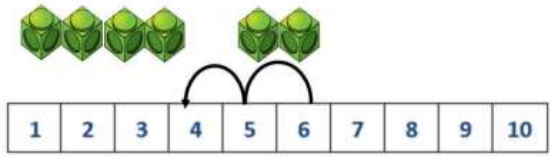
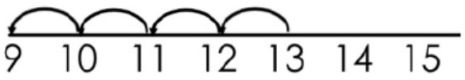
Missing digit problems:

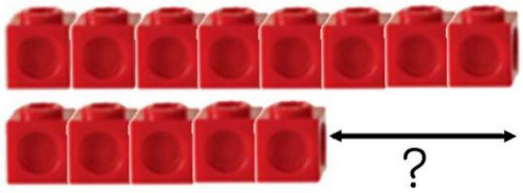
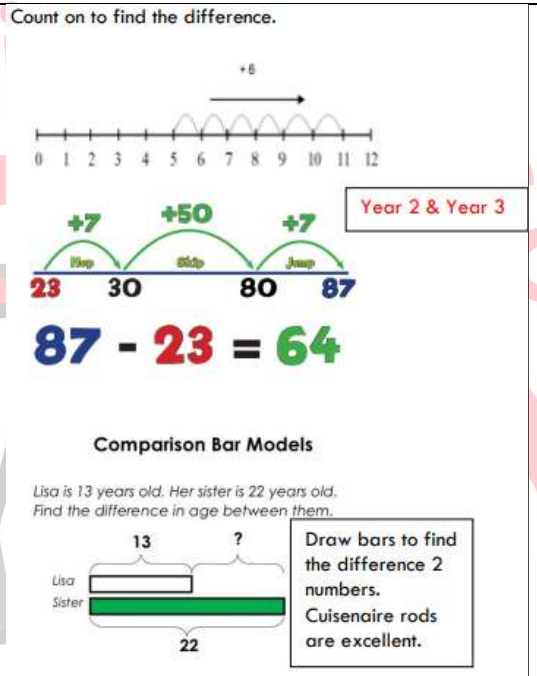
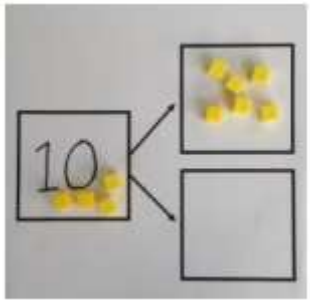
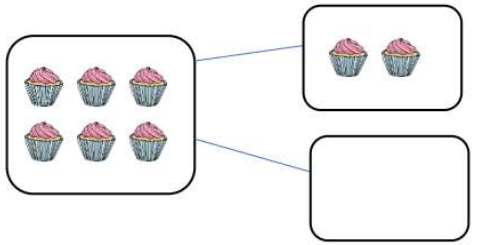
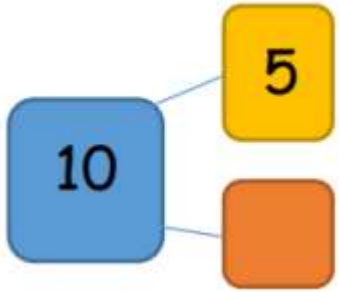
10s	1s
10 10	1
10 10 10	?
?	5

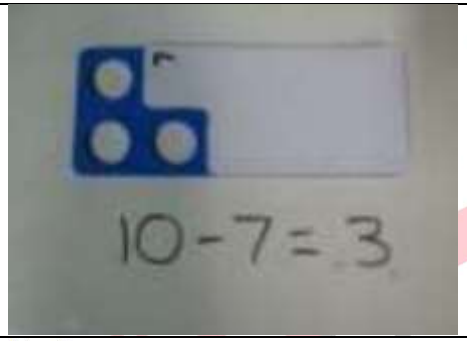
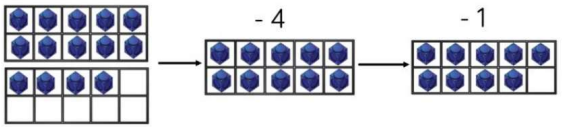
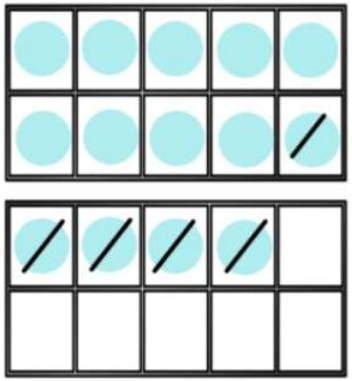
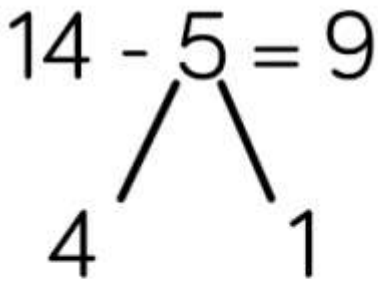
Subtraction:

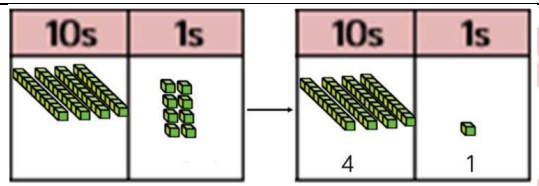
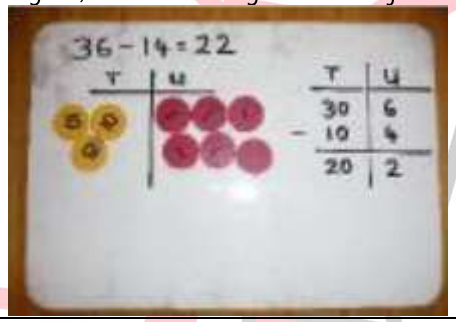
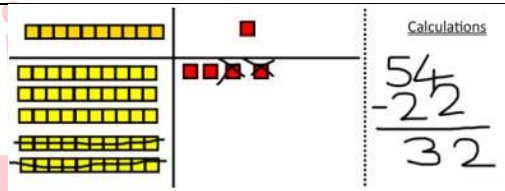
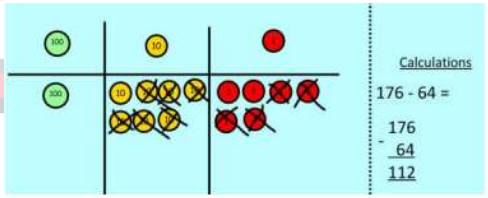
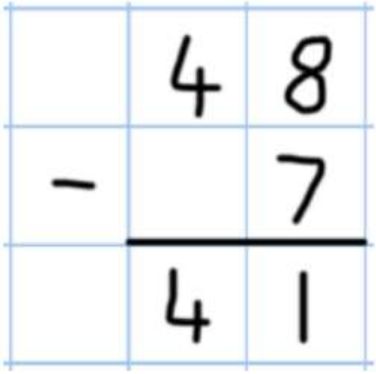
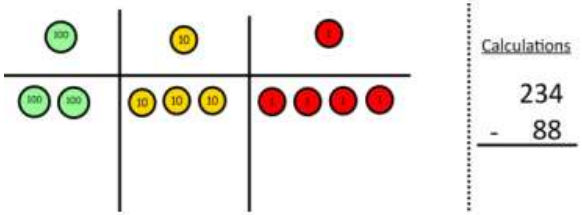
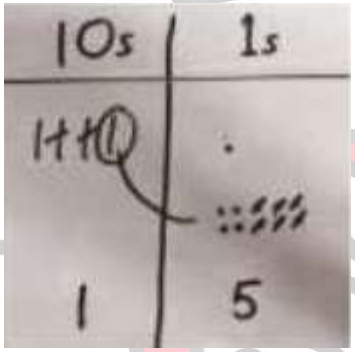
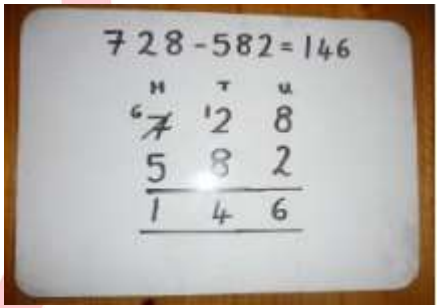
Key vocabulary: take away, less than, the difference, subtract, minus, fewer, decrease, subtrahend, minuend, wholes and parts

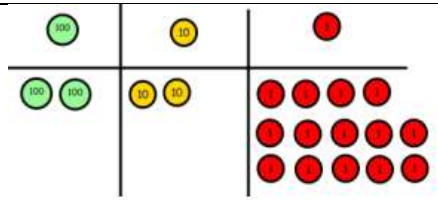
Objective and strategy	Concrete	Pictorial	Abstract

Physically taking away and removing objects from a whole (ten frames, Numicon, cubes and other items such as beanbags could be used). *Suggested year group(s): Reception and Year 1*	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 
Counting back (using number lines or number tracks) children start with 6 and count back 2. *Suggested year group(s): Reception and Year 1*	6 – 2 = 4  1 2 3 4 5 6 7 8 9 10	Children to represent the calculation on a number line or number track and show their jumps. A hundred square can also be used.  9 10 11 12 13 14 15 Start at the bigger number and count back the smaller number showing the jumps on the number line.	Put 13 in your head, count back 4. What number are you at? Encourage the use of 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. *Suggested year group(s): Year 1*			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.
Part-part whole model *Suggested year group(s):* *Rec, Year 1, Year 2*	Link to addition - use the part whole model to help explain the inverse between addition and subtraction.  If 10 is the whole and 7 is one of the parts. What is the other part? 10 – 7 =	Use a pictorial representation of objects to show the part-part whole model. 	Move to using numbers within the part whole model. 

			
Making 10 using ten frames. *Suggested year group(s): Year 2, Year 3, Year 4*	14 – 5 	Children to present the ten frame pictorially and discuss what they did to make 10. 	Children to show how they can make 10 by partitioning the subtrahend.  14 – 4 = 10 10 – 1 = 9 How many do we take off to reach the next 10? How many do we have left to take off?
Column method using base 10 – without regrouping	Use Base 10 to make the bigger number then take the smaller number away 48 – 7 =	Draw the Base 10 or place value counters alongside the written calculation to help to show working.	Column method or children could count back 7

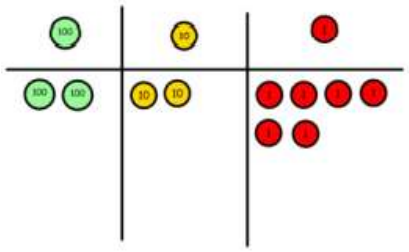
Suggested year group(s): Year 4	 Show how you partition numbers to subtract. Again, make the larger number first. 	 	
Column method using place value counters – with regrouping *Suggested year group(s): Year 4, Year 5, Year 6*	Use Base 10 to start with before moving on to place value counters. Start 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.	Represent the Base 10 pictorially, remembering to show the exchange.  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.	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. This will lead to an understanding of subtracting any number including decimals.



Calculations

234
- 88

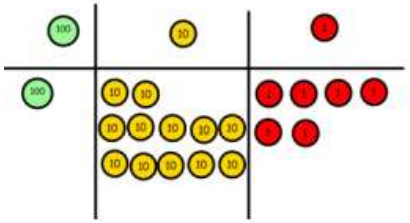
Now I can subtract my ones.



Calculations

234
- 88

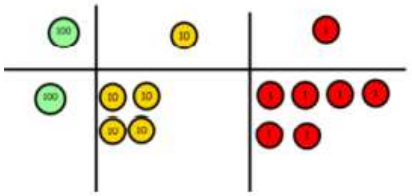
Now look at the tens, can I take away 8 tens easily? I need to exchange one hundred for ten tens.



Calculations

234
- 88

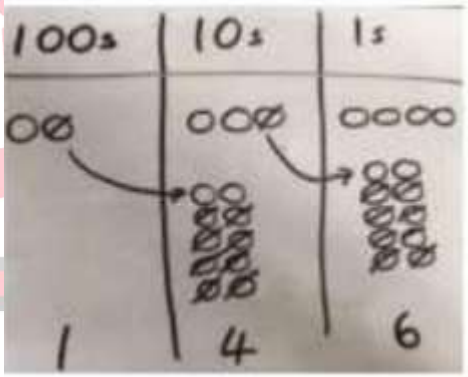
Now I can take away eight tens and complete my subtraction.



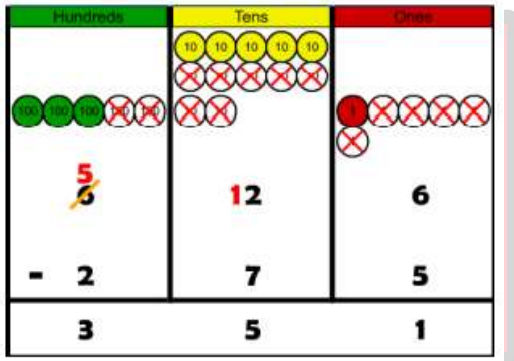
Calculations

234
- 88
146

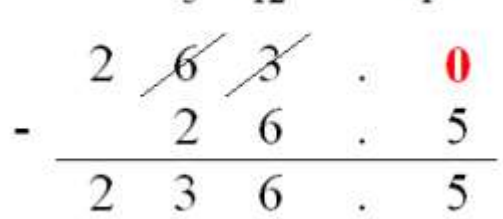
Show children how the concrete method links to the written method alongside your working. Cross out

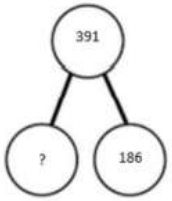


When confident, children can find their own way to record the exchange/regrouping.

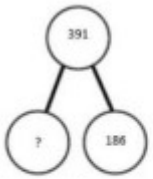


Show children how the concrete method links to the written method alongside your working. Cross out the numbers when exchanging and show where we write our new amount.



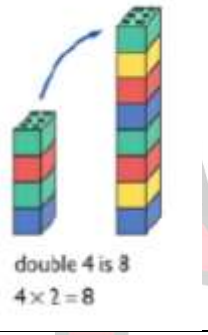
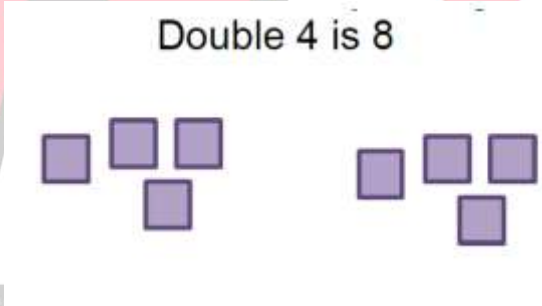
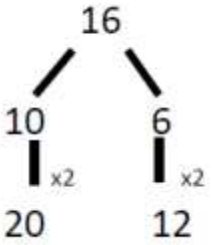
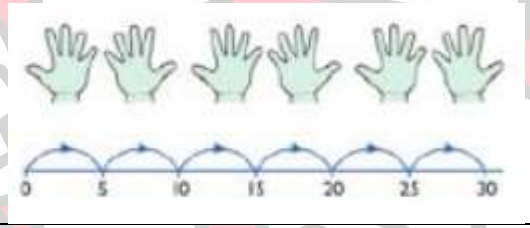
	the numbers when exchanging and show where we write our new amount.	 391 186 ?	

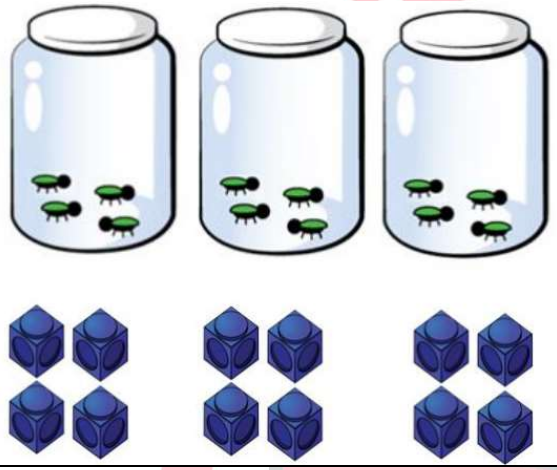
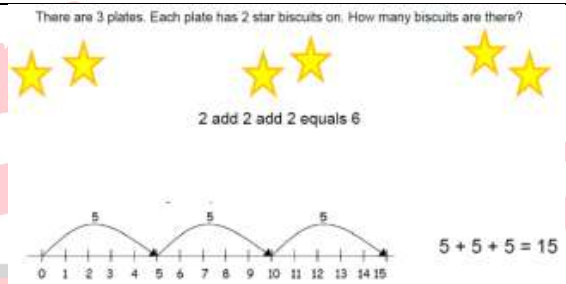
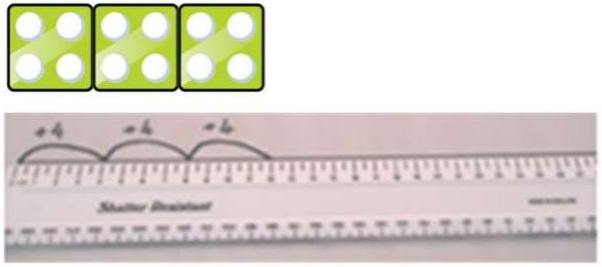
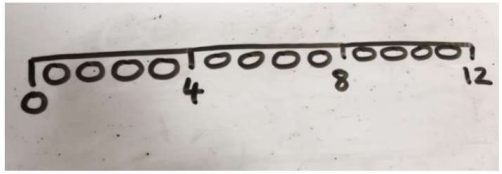
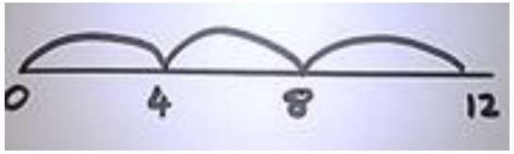
Conceptual variation; different ways to ask children to solve 391 – 186

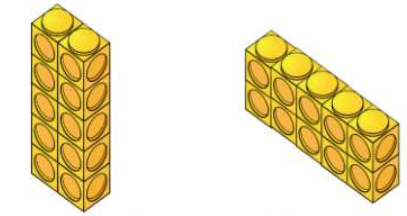
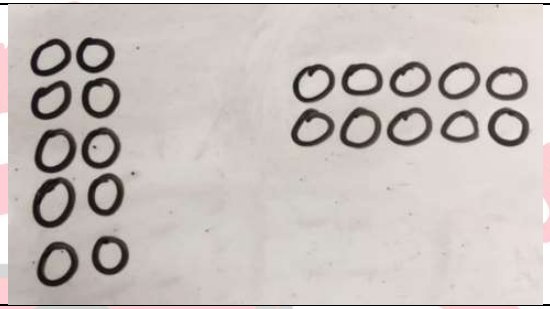
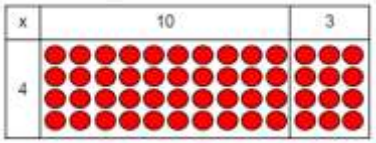
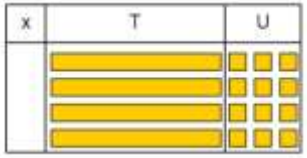
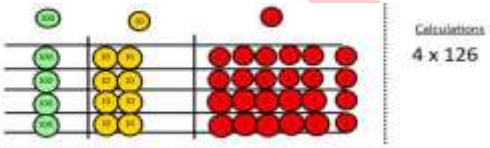
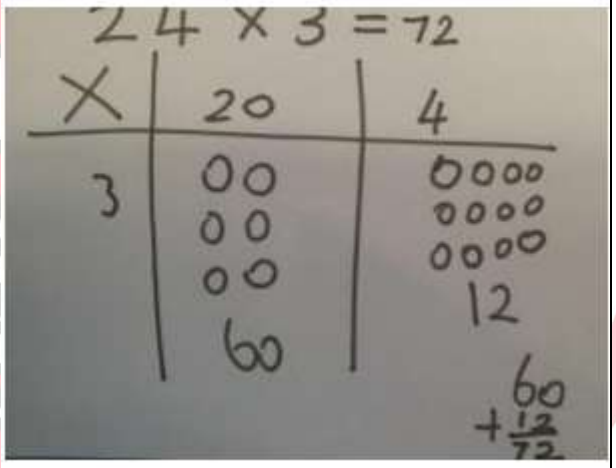
 391 186 ?	Raj spent £391and Timmy spent £186. How much more did Raj spend? Calculate the difference between 391 and 186.	What is 186 less than 391? □ = 391 – 186 391 -186 ___	Missing digit calculations 3 9 □ - □ □ 6 □ 0 5

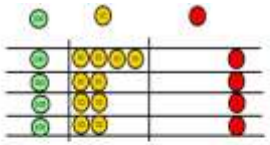
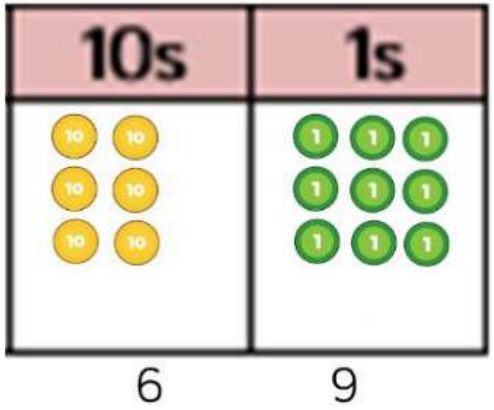
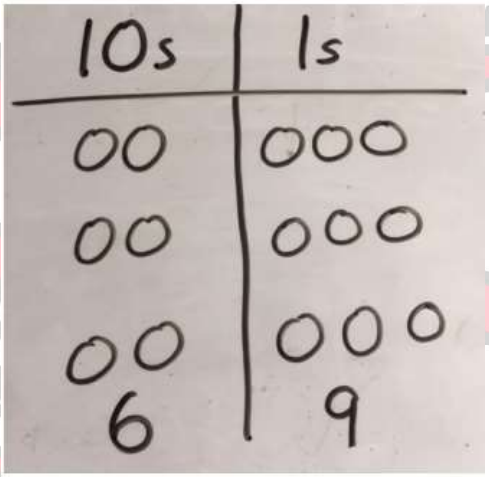
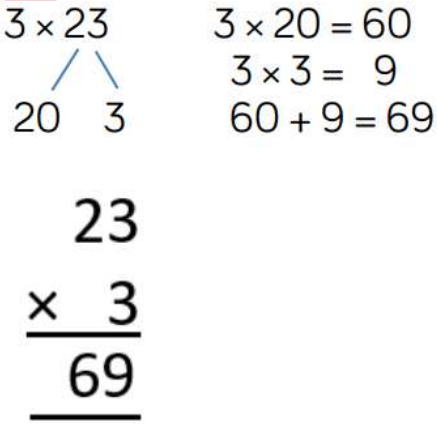
Multiplication:

Key vocabulary: double, times, multiplied by, the product of, groups of, lots of, equal groups, factor, product

Objective and strategy	Concrete	Pictorial	Abstract
Doubling *Suggested year group(s): Rec, Year 1*	Use practical activities to show how to double a number.  	Draw pictures to show how to double a number.  	Year 3 upwards: Partition a number and then double each part before recombining it back together. 
Counting in multiples *Suggested year group(s): All year groups learning*	Count in multiples supported by concrete objects in equal groups. 	Use a number line or pictures to continue support in counting in multiples.  	Count in multiples of a number aloud. Write sequences with multiples of numbers. 2, 4, 6, 8, 10 5, 10, 15, 20, 25, 30

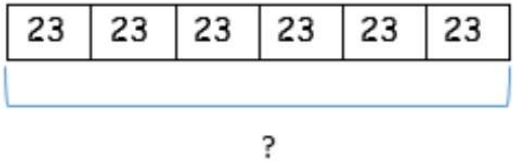
Repeated grouping/repeated addition *Suggested year group(s): Year 2*	3 × 4 4 + 4 + 4 There are 3 equal groups, with 4 in each group 		3 × 4 = 12 4 + 4 + 4 = 12
Number lines to show repeated groups	3 × 4  Cuisenaire rods can be used too.	Represent this pictorially alongside a number line e.g.: 	Abstract number line showing three jumps of four. 3 × 4 = 12 
Arrays – showing commutativity *Suggested year group(s): Year 1, Year 2, Year 3*	Use arrays to illustrate commutativity counters and other objects can also be used. 2 × 5 = 5 × 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 × 5 5 × 2 = 10 2 + 2 + 2 + 2 + 2 = 10 10 = 5 + 5 Factor x Factor = Product

			
Grid method *Suggested year group(s): Year 3, Year 4*	Show the link with arrays to first introduce the grid method. 4 rows of 10. 4 rows of 3.  Move on to using Base 10 to move towards a more compact method. 4 rows of 13.  Move on to place value counters to show how we are finding groups of a number. We are multiplying by 4 so we need 4 rows. 	Children can represent the work they have done with place value counters in a way that they understand. They can draw the counters, using colours to show different amounts or just use circles in the different columns to show their thinking as shown below. 	Start with multiplying by one-digit numbers and showing the clear addition alongside the grid. 	×	30	5
---	---	---
7	210	35	 **210 + 35 = 245** Moving forward, multiply by a 2-digit number showing the different rows within the grid method. 		10	8
---	---	---
10	100	80
3	30	24 | | X	1000	300	40	2
---	---	---	---	---
10	10000	3000	400	20
8	8000	2400	320	16

	Add up each column, starting with the ones making any exchanges needed.  Then you have your product. 		
Formal column method *Suggested year group(s): Year 5, Year 6*	Formal column method with place value counters (base 10 can also be used.) 3 × 23  	Children to represent the counters pictorially  	Children to record what it is they are doing to show understanding. 

Formal column method	When children start to multiply 3d × 3d and 4d × 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	1 2 4 × 2 6 7 4 4 1 2 2 4 8 0 3 2 2 4 1 1 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 x 23 = 138

Find the product of 6 and 23

6 × 23 =

□ = 6 × 23

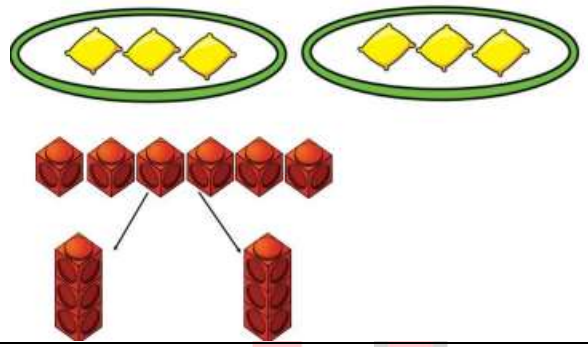
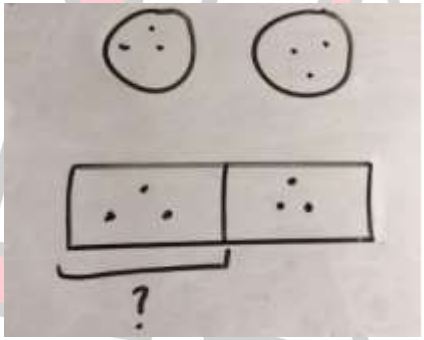
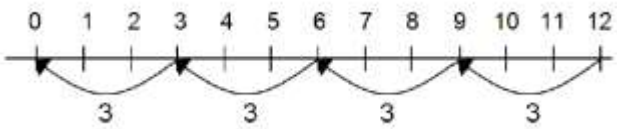
6	23
× 23	× 6
___	___

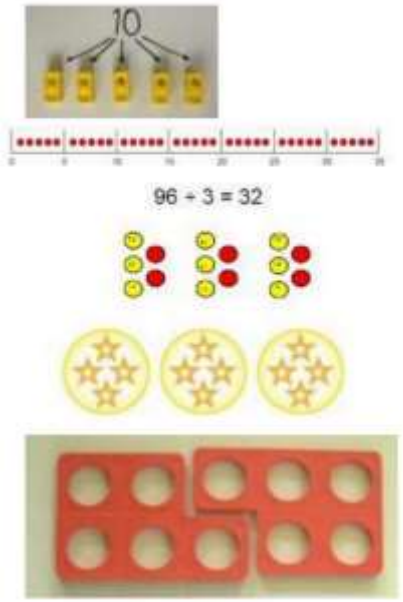
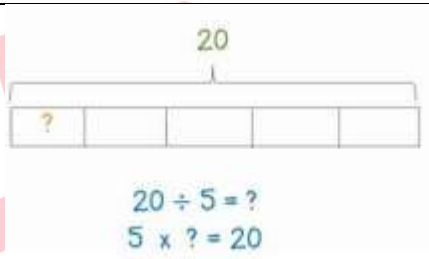
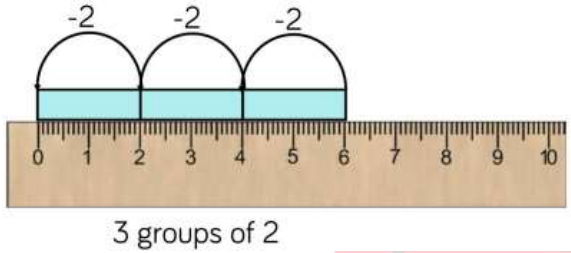
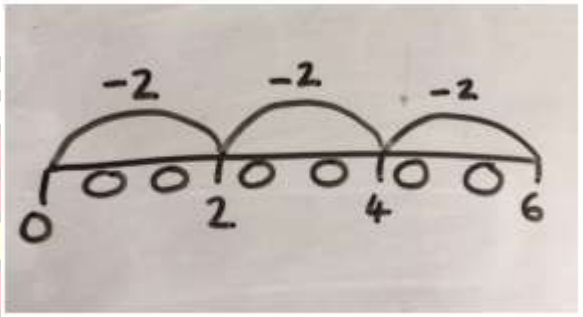
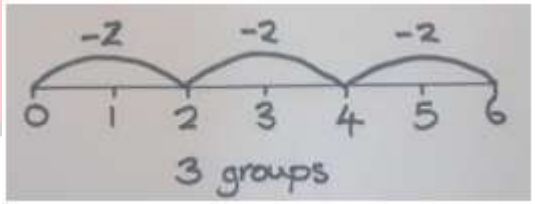
What is the calculation?
What is the product?

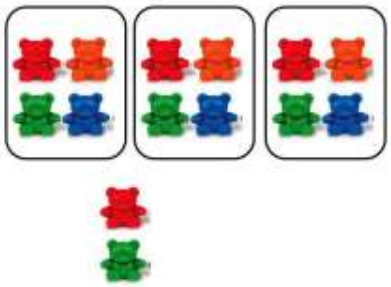
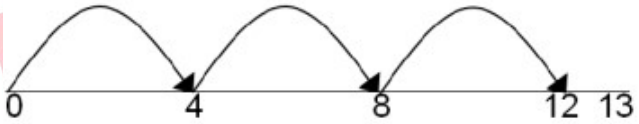
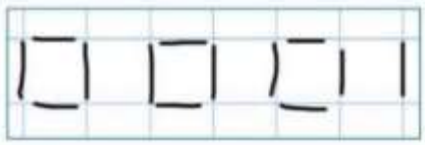
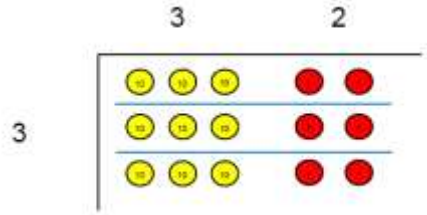
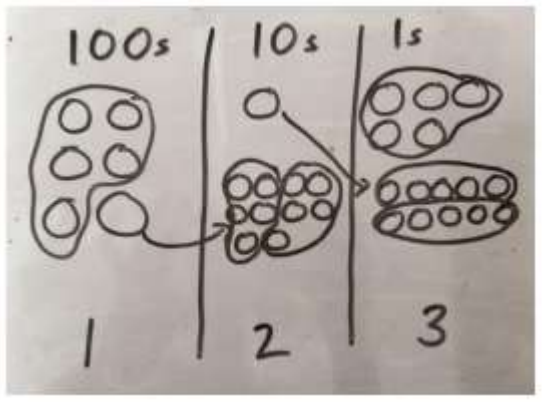
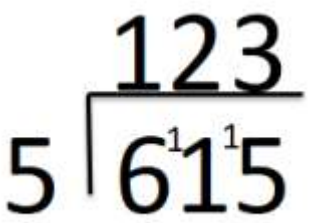
100s	10s	1s
		

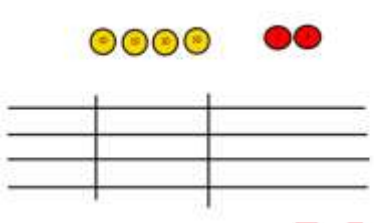
Division:

Key vocabulary: share, group, divide, divided by, half, dividend, divisor, quotient

Objective and strategy	Concrete	Pictorial	Abstract
Division as sharing *Suggested year group(s): Rec, Year 1*	Sharing using a range of objects. 6 ÷ 2 	Represent the sharing pictorially. 	6 ÷ 2 = 3  Children should also be encouraged to use their 2 times tables facts.
Division as grouping *Suggested year group(s): Year 1, Year 2, Year 3*	Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.	Use a number line to show jumps in groups. The number of jumps equals the number of groups.  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.	28 ÷ 7 = 4 Divide 28 into 7 groups. How many are in each group?

	 Ten divided into two groups.		
Repeated subtraction *Suggested year group(s): Year 2, Year 3*	Repeated subtraction using Cuisenaire rods above a ruler. 6 ÷ 2  3 groups of 2	Children to represent repeated subtraction pictorially. 	Abstract number line to represent the equal groups that have been subtracted. 
Division with a remainder	14 ÷ 3 = Divide objects between groups and see how much is left over.	Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder.	Complete written divisions and show the remainder using r.

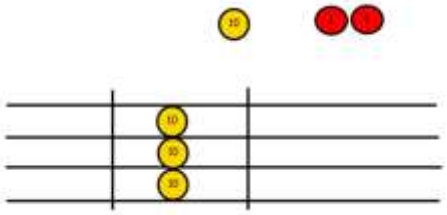
Suggested year group(s): Year 3, Year 4	 Use small sticks/lollipop sticks for 2-digit ÷ 1-digit with remainders. Use lollipop sticks to form wholes. E.g. 13 ÷ 4 squares are made because we are dividing by 4.  There are 3 whole squares, with 1 left over	 Draw dots and group them to divide an amount and clearly show a remainder.  Represent lollipop sticks pictorially. 	 13 ÷ 4 = 3 r1 Children should be encouraged to use their times tables facts; they could also represent repeated addition on a number line.
Short division Suggested year group(s): Year 4, Year 5, Year 6	 Use place value counters to divide using the bus stop method alongside an array/grid.	Represent the place value counters pictorially. 	Children to the calculation using the short division scaffold. 



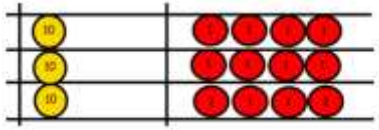
Calculations

42 ÷ 3

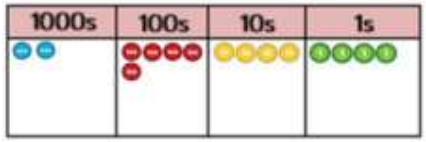
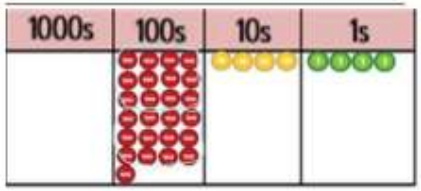
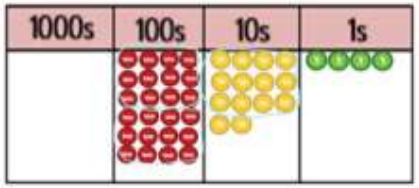
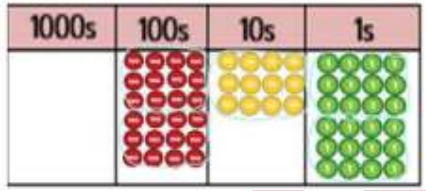
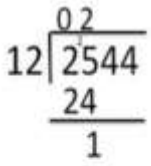
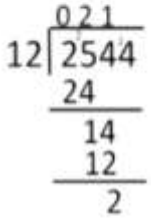
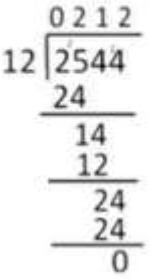
42 ÷ 3= Start with the biggest place value, we are sharing 40 into three groups. We can put 1 ten in each group and we have 1 ten left over.

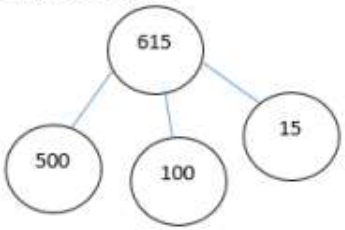


We exchange this ten for ten ones and then share the ones equally among the groups.



We look how much is in 1 group so the answer is 14.

Long division *Suggested year group(s): Year 6*	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  After exchanging the hundred, we have 14 tens. We can group 12 tens into a group of 12, which leaves 2 tens.  After exchanging the 2 tens, we have 24 ones. We can group 24 ones into 2 groups of 12, which leaves no remainder.	  
Conceptual variation; different ways to ask children to solve 615 ÷ 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 ÷ 5 = ☐ = 615 ÷ 5	What is the calculation? What is the answer?