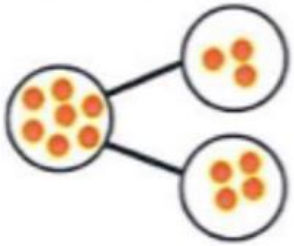
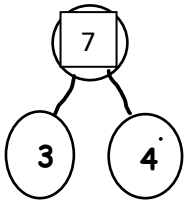
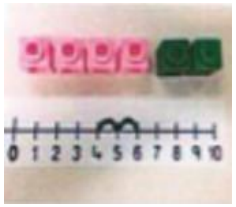
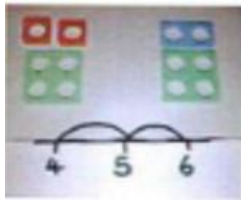
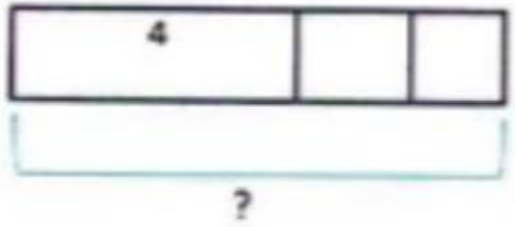
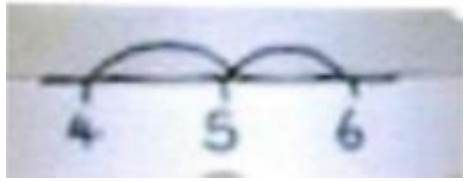
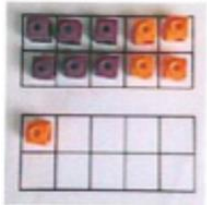
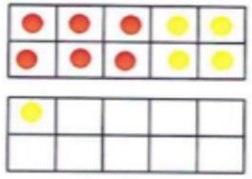
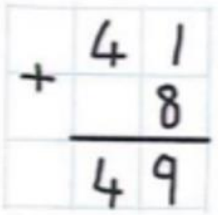
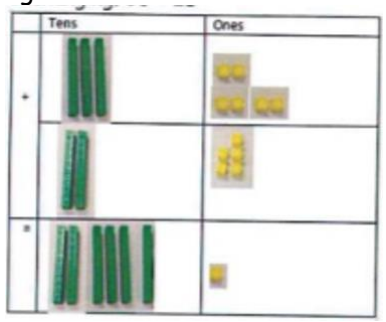
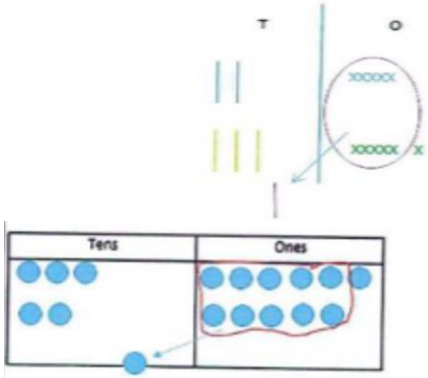
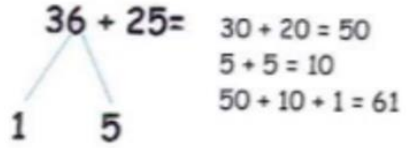
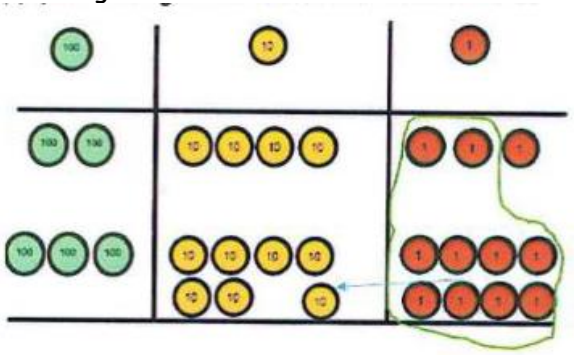
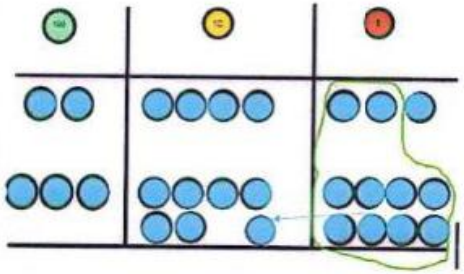
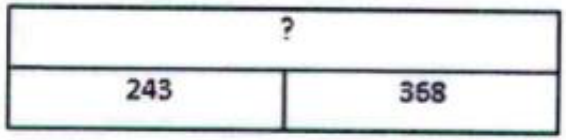
THE DUCHY SCHOOL

MATHS CALCULATION POLICY

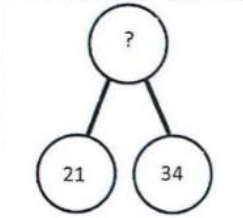
ADDITION – *key language which should be used: sum, total, parts and wholes, plus, add, altogether, more than "is equal to", "is the same as"*

Concrete	Pictorial	Abstract
Combining two parts to make a whole (use other resources too eg eggs, shells, teddy bears etc) 		**4 + 3 = 7 (four is a part, 3 is a part and whole is seven)** 
Counting on using number lines by using cubes or numicon  	A bar model which encourages the children to count on 	The abstract number line: What is 2 more than 4? What is the sum of 4 and 4 the total of 4 and 2? 4 + 2 
Regrouping to make 10 by using ten frames and counters/cubes or using numicon: 6 + 5  	Children to draw the ten frame and counters/cubes 	Children to develop an understanding of equality eg 6 + ☐ = 11 and 6 + 5 = 5 + ☐ 6 + 5 = ☐ + 4

Concrete	Pictorial	Abstract
T O + O using base 10. Continue to develop understanding of partitioning and place value 41 + 8	**Children to represent the concrete using a particular symbol eg lines for tens and dot/cross for ones** 	**41 + 8** 
TO + TO using base 10. Continue to develop understanding of partitioning and place value and use this to support addition. Begin with no exchanging 36 + 25 	This could be done one of two ways 	Looking for ways to make 10  Formal method: 36 +25 61 1

Concrete	Pictorial	Abstract
Use of place value counters to add HTO to TO, HTO + HTO etc. Once the children have had practice with this, they should be able to apply it to larger numbers and the abstract 	Children to represent the counters as the image below  If the children are completing a word problem, draw a bar model to represent what it is asking them to do 	243 +368 611 1 1

Fluency variation, different ways to ask children to solve 21 + 34



Sam saved £21 one week and £34 another week. How much did he save in total?

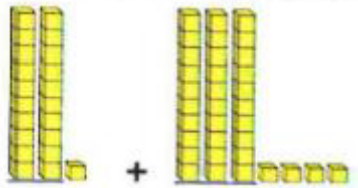
21 + 34 = 55. Prove it! (reasoning but the children need to be fluent in representing this)

21
+34
___

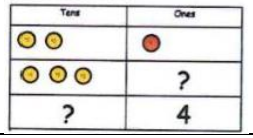
21 + 34 =

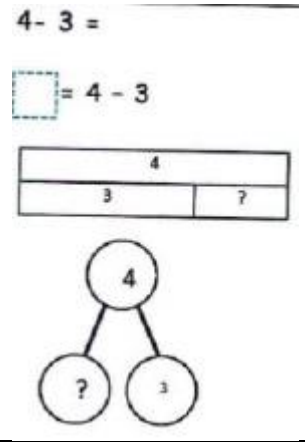
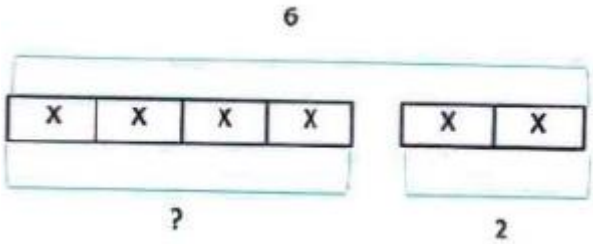
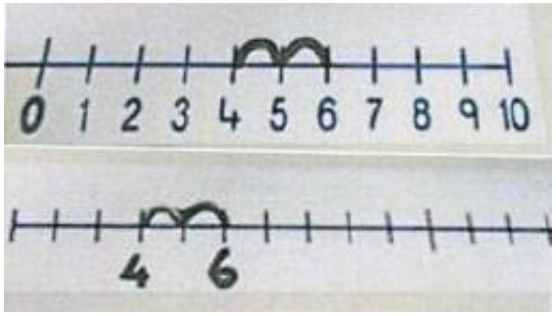
☐ = 21 + 34

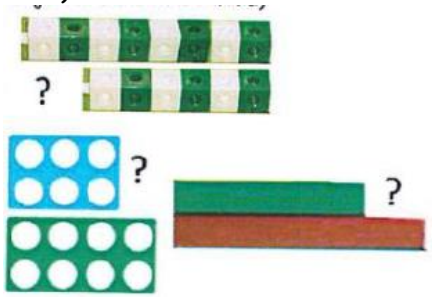
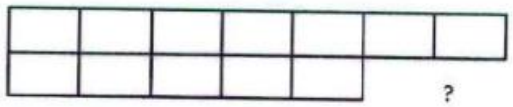
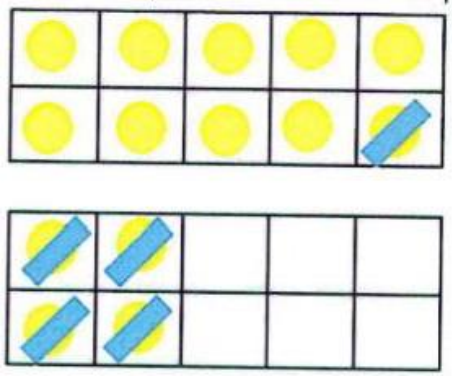
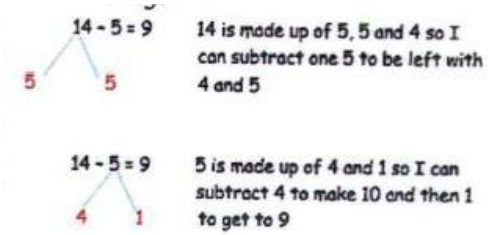
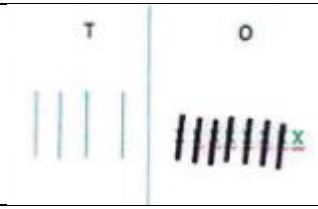
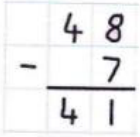
What's the sum of 21 and 34?

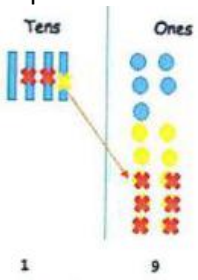
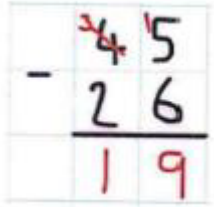
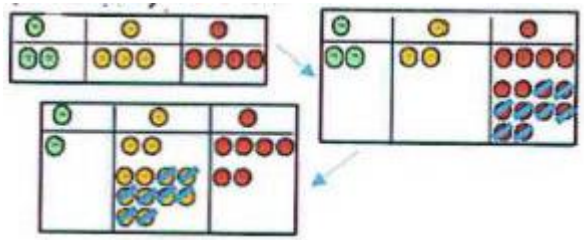


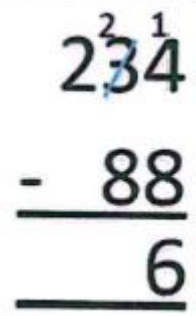
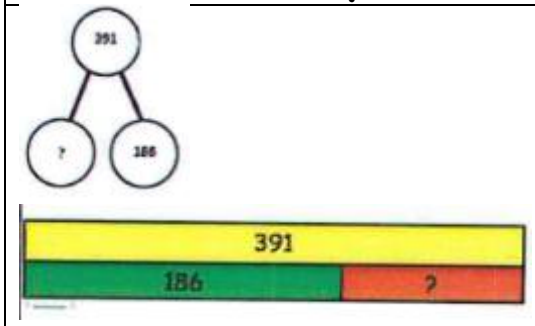
Always use missing digit problems too

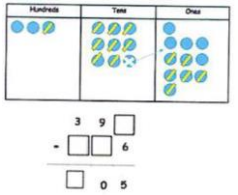


SUBTRACTION – *key language which should be used: take away, less than, the difference, subtract, minus, fewer, decrease, '7 take away 3', 'the difference is 4'*		
Concrete	**Pictorial**	**Abstract**
Physically taking away and removing objects from a whole (use various objects too) rather than crossing out, children will physically remove the objects 	Children to draw the concrete resources they are using and cross out  Use of the bar model: 	
Counting back (using number lines or counting tracks) 	Children to represent what they see pictorially 	

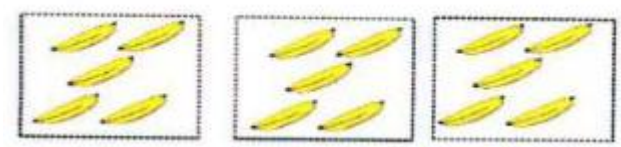
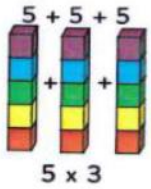
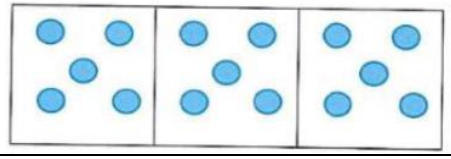
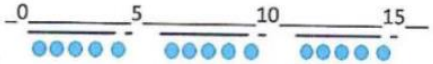
Concrete	Pictorial	Abstract
Finding the difference (using cubes, numicon, cuisenaire rods, other objects can also be used) 	Children to draw the cubes, other concrete objects they have used XXXXXXXX XXXXXX Use of the bar model 	**Find the difference between 8 and 6** **8 – 6, the difference is ?** **Children to also explore why** **9 – 7 = 8 – 6 (the difference of each digit has changed by 1 so the difference is the same – this will help when solving** **10 000 – 9 987**
Making 10 (using numicon or 10 frames) 14 – 5  Children could also do this by subtracting a 5 from the 10 	Children to present the ten frame pictorially 	14 – 5 = 9 You also want children to see related facts: 15 – 9 = 5 Children to represent how they have solved it eg 
Column method (using base 10) 48 – 7 		48 – 7 = 

<table>
<tr><th>Concrete</th><th>Pictorial</th><th>Abstract</th></tr>
<tr>
<td>Colum method (using base 10 and having to exchange)
 
45-26
1. Start by partitioning 45
2. Exchange one ten for ten more ones
3. Subtract the ones, then the tens</td>
<td>Represent the base 10 pictorially
 
</td>
<td>It's crucial that the children understand that when they have exchanged the 10, they still have 45 45=30+15
  </td>
</tr>
<tr>
<td>Column method (using place value counters)
234 – 88
  </td>
<td>Once children have had practice with the concrete, they should be able to apply it to any subtraction.

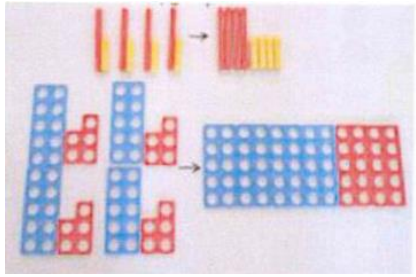
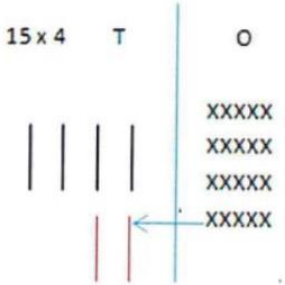
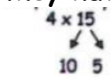
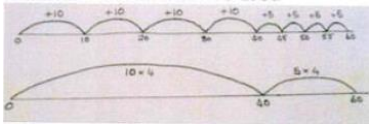
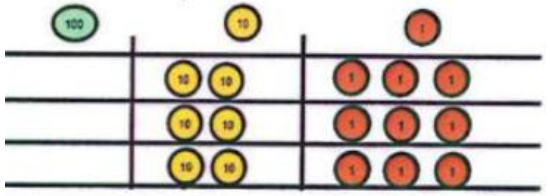
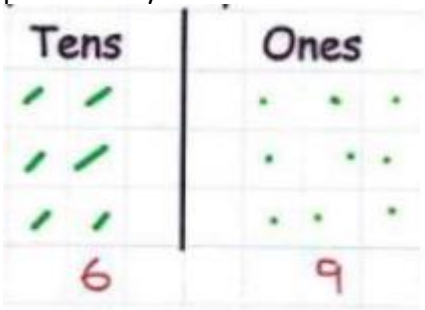
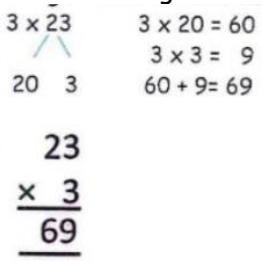
Like the other pictorial representations, children to represent the counters.</td>
<td>  </td>
</tr>
<tr>
<td colspan="3">Fluency variation, different ways to ask children to solve 391 - 186</td>
</tr>
<tr>
<td> 
</td>
<td>Raj spent £391, Timmy spent £186. How much more did Raj spend?

I had 391 metres to run. After 186 m I stopped. How many metres do I have left to run?</td>
<td>391 – 186
☐ = 391 - 186
391
-186
___
Find the difference between 391 and 186
Subtract 186 from 391
What is 186 less than 391?</td>
<td>What's the calculation? What's the answer?
  </td>
</tr>
</table>

MULTIPLICATION – *key language which should be used: doubled, multiplied by, the product of, groups of, times, lots of, is equal to, is the same as*

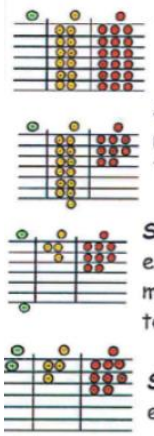
Concrete	Pictorial	Abstract
Repeated grouping/repeated addition  **5 bananas, 3 times** **5 x 3 or 5 three times**	Children to represent the practical resources in a picture xxxxx xxxxx xxxxx  Use of a bar model for a more structured method 	**5 x 3** **5 + 5 + 5**
Use number lines or bead strings to show repeated groups: 5 x 3 	Represent this pictorially alongside a number line eg: 	Abstract number line 5 x 3 = 15 
Use arrays to illustrate commutativity (counters and other objects can also be used)	Children to draw the arrays	Children to be able to use an array to write a rage of calculations eg 3 x 5 = 15

		5 x 3 = 15 5 + 5 + 5 = 15 3 + 3 + 3 + 3 + 3 = 15

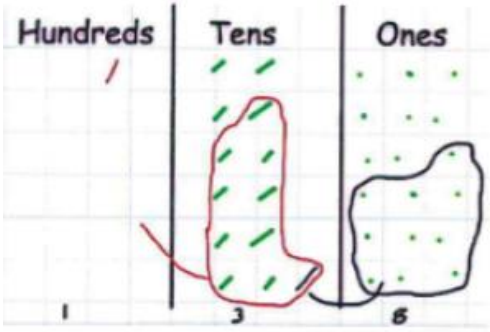
Concrete	Pictorial	Abstract
Partition to multiply (use numicon, base 10 , cuisinaire rods) 4 x 15 = 	Children to represent the concrete manipulatives in a picture eg base 10 can be represented like: 	**Children to be encouraged to show the steps they have taken**  10 x 4 = 40 5 x 4 = 20 40 + 20 = 60 **A number line can also be used** 
Formal column method with place value counters or base 10 (at the first stage, no exchanging) Make 23, 3 times. Se how many ones, then how may tens 	Children to represent the counters in a pictorial way 	Children to record what they are doing to show understanding 

Formal column method with place value counters (children need this stage, initially, to understand how the column method works)

6 x 23



Children to represent the counters/base 10 pictorially eg the image below



6 x 23

6 x 3 = 18

6 x 20 = 120

120 + 18 = 138

The aim is to get the formal method but the children need to understand how it works

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

1 1

When children start to multiply 3 d x 3d and 4d x 2d, they should be confident with the abstract:

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

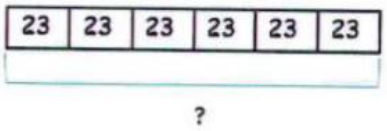
1 1 2 1

Answer: 3224

To get 744 children have solved 6 x 124

To get 2 420 children have solved 20 x 124

Fluency variation, different ways to ask children to solve 6 x 123



With the counters, prove that
6 x 23 = 128
Why is 6 x 23 = 32 x 6?

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

Tom saved 23p three days a week. How much did he save in 2 weeks?

Find the product of 6 and 23

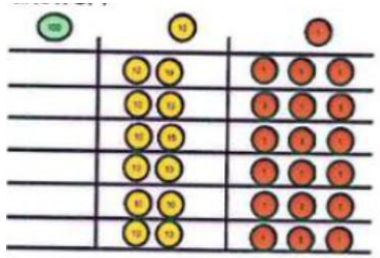
6 x 23 =

6 x 23 =

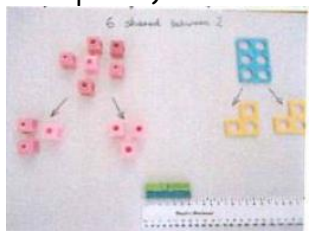
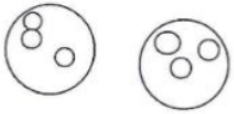
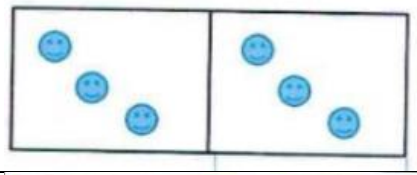
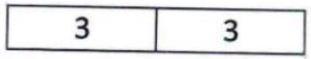
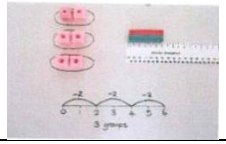
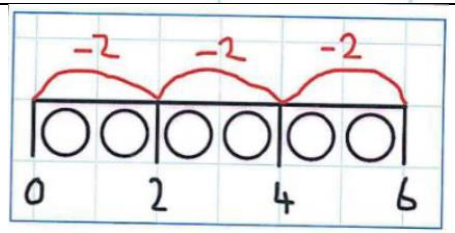
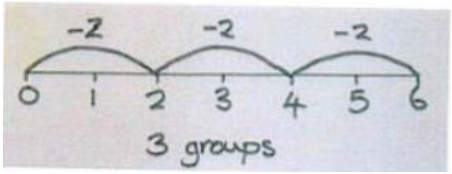
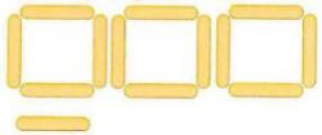
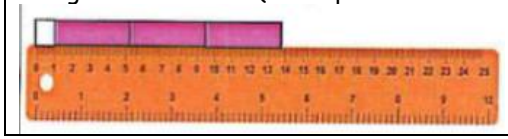
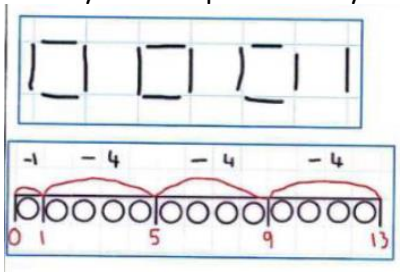
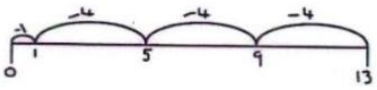
□ = 6 x 23

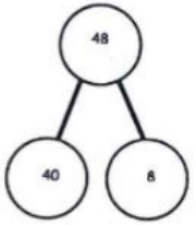
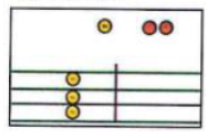
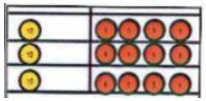
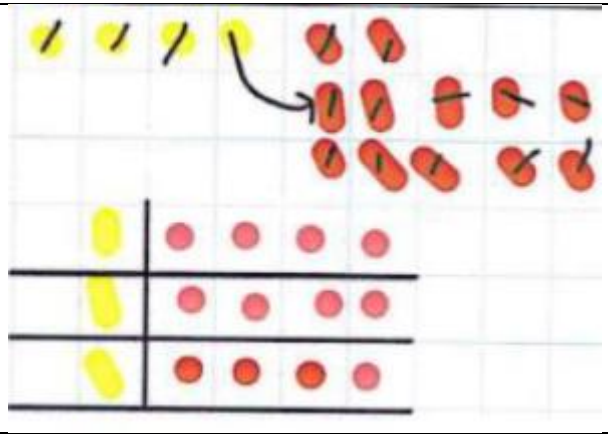
$$\begin{array}{r} 6 \\ \times\ 23 \\ \hline \end{array} \qquad \begin{array}{r} 23 \\ \times\ 6 \\ \hline \end{array}$$

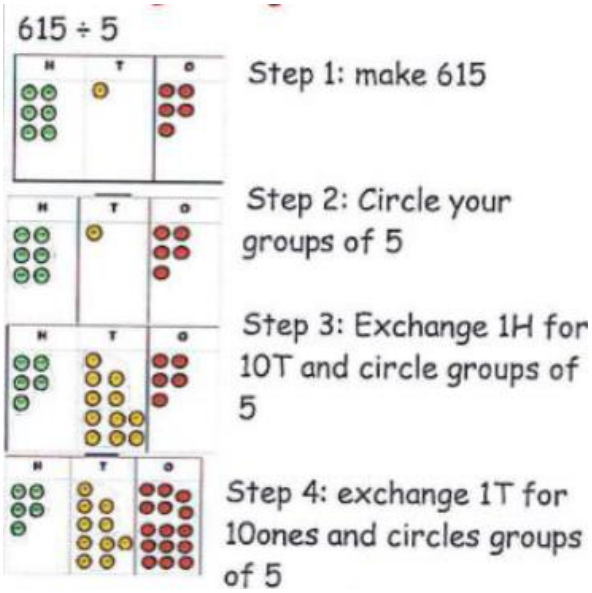
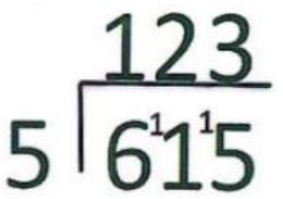
What's the calculation? What's the answer?

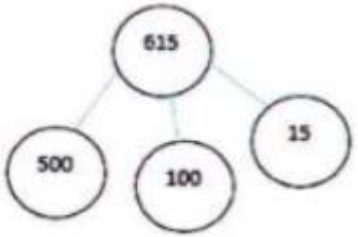


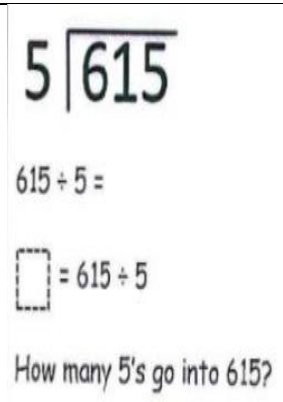
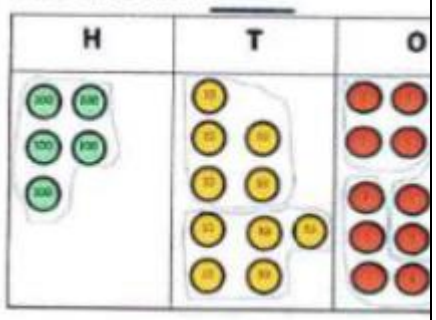
DIVISION - *key language which should be used: share, group, divide, divided by, half, is equal to, is the same as*

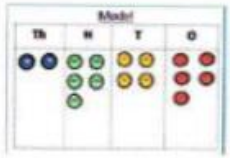
Concrete	Pictorial	Abstract
6 shared between 2 (other concrete objects can also be used eg children and hoops, teddy bears, cakes and plates) 	 This can also be done in a bar so all 4 operations have a similar structure: 	**6 / 2 = 3** **What's the calculation?** 
Understand division as repeated grouping and subtracting 6 / 2 = 3 		Abstract number line 
2d / 1d with remainders 13 / 4 – 3 remainder 1 Use of lollipop sticks to form wholes  Using cuisinaire rods (for repeated subtraction) 	Children to have chance to represent the resources they use in a pictorial way: see below 	13 / 4 – 3 remainder 1 Children to count their times tables facts in their heads 

Concrete	Pictorial	Abstract
2d divided by 1d using base 10 (no remainders) SHARING 48 / 4 = 12  Start with the tens	Children to represent the base 10 and sharing pictorially.	**48 / 4** =  4 tens / 4 = 1 ten 8 ones / 4 = 2 ones 10 + 2 = 12
Sharing place value counters 42 / 3 = 14   Make 42. Share the tens between 3. Can we make an exchange with the extra 10? Exchange the ten for 10 ones and share out the 12 ones.		42 / 3 42 = 30 + 12 30 / 3 = 10 12 / 3 = 4 10 + 4 = 14

Use of the "bus stop method" using grouping and counters. Key language for grouping-how many groups of x can we make with x hundreds. **This can also be done using sharing.** 	**This can be represented pictorially until the children no longer need to do it.** **It can also be done to decimal places if you have a remainder!**	
Fluency variation, different ways to ask children to ask children to solve 165 / 5		

<table>
<tr>
<td>Using the part, whole model below, How can you divide 165 by 5 without using the “bus stop method”?
 
</td>
<td>I have £615 and share it equally between 5 bank accounts. How much will be in each account?

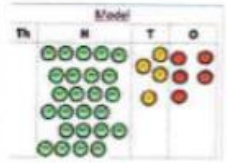
615 pupils need to be put into 5 groups. How many will be put into each group?</td>
<td> 
</td>
<td>What’s the calculation?
What’s the answer?
 
</td>
</tr>
<tr>
<td colspan="4">LONG DIVISION – see below:</td>
</tr>
</table>



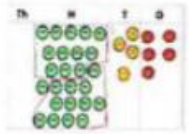
$$\begin{array}{r} 0212 \\ 12\overline{)2544} \\ 24 \\ \hline 14 \\ 12 \\ \hline 24 \\ 24 \\ \hline 0 \end{array}$$

2544 ÷ 12

How many groups of 12 thousands do we have? None



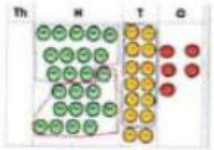
Exchange 2 thousand for 20 hundreds.



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

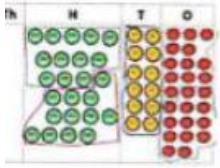
How many groups of 12 are in 25 hundreds? 2 groups. Circle them.

We have grouped 24 hundreds so can take them off and we are left with one.



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

Exchange the one hundred for ten tens so now we have 14 tens. How many groups of 12 are in 14? 1 remainder 2.



Exchange the two tens for twenty ones so now we have 24 ones. How many groups of 12 are in 24? 2

Children to represent with counters pictorially and record the subtractions beneath.

$$\begin{array}{r} 0 \\ 12\overline{)2544} \end{array}$$

Step one- exchange 2 thousand for 20 hundreds so we now have 25 hundreds.

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

Step two- How many groups of 12 can I make with 25 hundreds? The 24 shows the hundreds we have grouped. The one is how many hundreds we have left.

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

Exchange the one hundred for 10 tens. How many groups of 12 can I make with 14 tens?

The 14 shows how many tens I have, the 12 is how many I grouped and the 2 is how many tens I have left.

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

Exchange the 2 tens for 20 ones. The 24 is how many ones I have grouped and the 0 is what I have left.