CHRIST CHURCH
CHURCH OF ENGLAND
PRIMARY SCHOOL

Christ Church C of E Primary

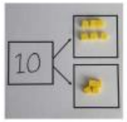
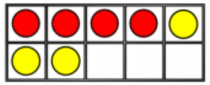
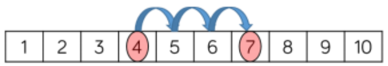
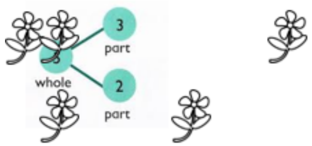
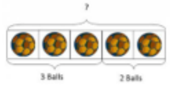
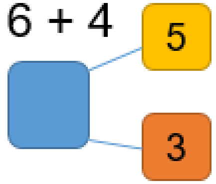
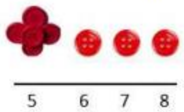
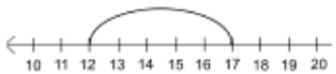
Written Calculation Policy February 2021

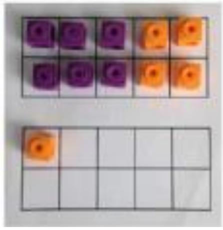
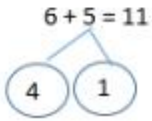
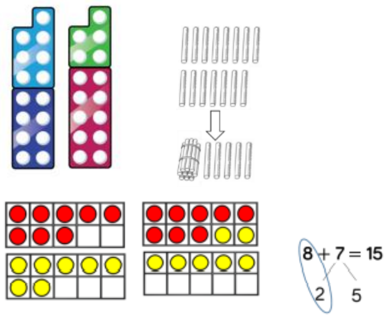
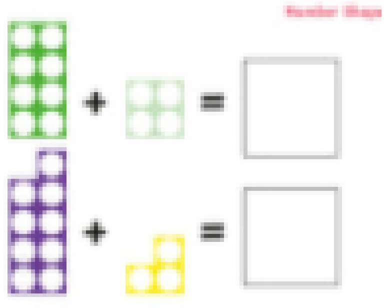
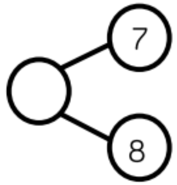
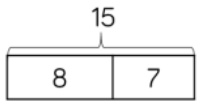
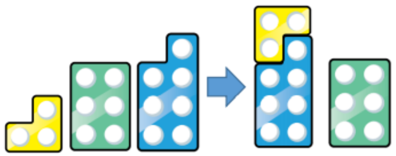
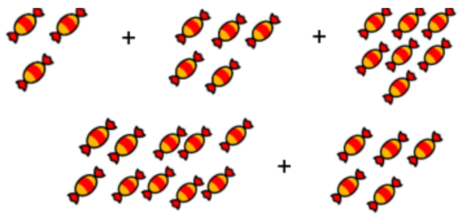
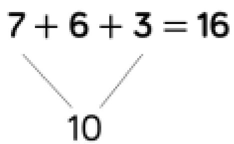
This policy has been devised to show the progression in calculation (addition, subtraction, multiplication and division) throughout school. It is our aim that all children can use written methods efficiently, accurately and with confidence.   We have adapted the White Rose Maths Hub calculation policy with further material added. It is a working document and revised and amended when needed.

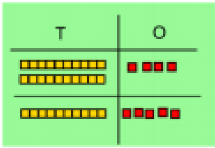
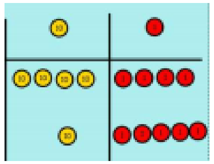
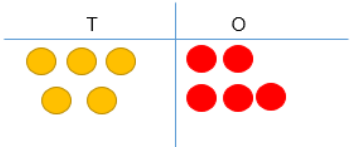
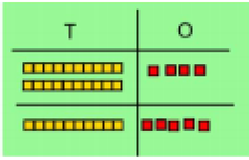
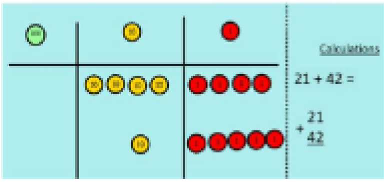
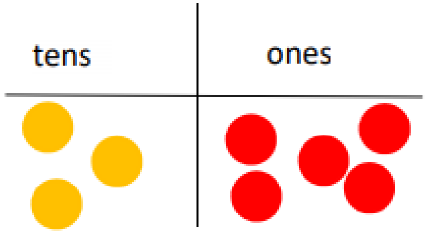
Children acquire secure understanding of objectives by using the concrete, pictorial, abstract approach (CPA). This is a highly effective approach which ensures deep understanding of maths.

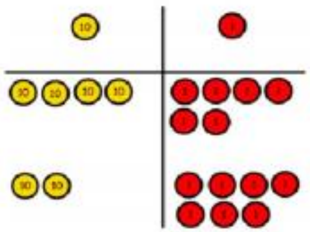
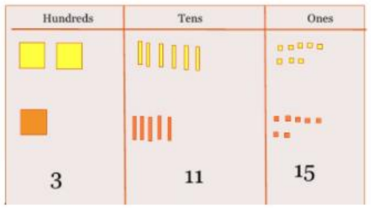
- Concrete – this is the 'doing' stage. Pupils use concrete objects to model problems. This may be real life objects, such as fruit or buttons, which then progresses onto mathematical resources such as counters and cubes to represent the fruit.
- Pictorial – this is the 'seeing' stage. Visual representations are used to model problems. Children are also encouraged to draw their own diagrams and models to represent objects in the problem.
- Abstract – this is the symbolic stage. When children have demonstrated a solid understanding of the concrete and pictorial stages, they can move onto the introduction of abstract concepts at a symbolic level – namely numbers and mathematical symbols.

1. Addition

	Objective	Concrete	Pictorial	Abstract
Year 1	Adding 1 digit numbers within 10	  Use cubes to add two numbers together as a group or in a bar.     	  Use pictures to add two numbers together as a group or in a bar.  	$4 + 3 = 7$ $10 = 6 + 4$  Use the part-part whole diagram as shown above to move into the abstract.
	Starting with the bigger number and counting on	 Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer.  	12 + 5 = 17  Start at the larger number on the number line and count on in ones or in one jump to find the answer.	$5 + 12 = 17$ Put the largest number in your head and count on the smaller number until you find the answer

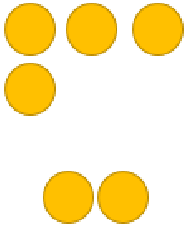
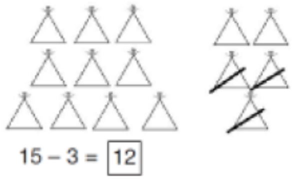
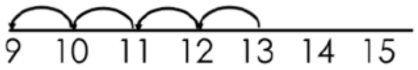
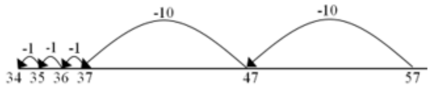
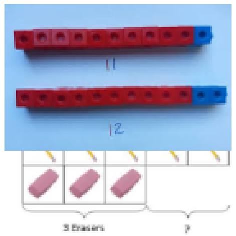
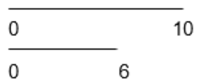
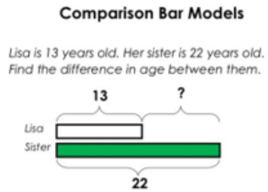
	Regrouping to make 10	  6 + 5 = 11 Start with the bigger number and use the smaller number to make 10.	 	6 + 5 = 6 + 4 = 10 10 + 1 = 11
Year 1/2	Add 1 and 2 digit numbers to 20			 Part whole models and bar models can also be used.
Year 2	Adding three single digits		 Add together three groups of objects. Draw a picture to recombine the groups to make 10.	$\boxed{7 + 6 + 3 = 16}$  Children are encouraged to look for pairs of numbers which make 10.

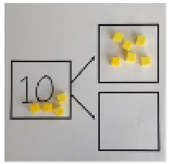
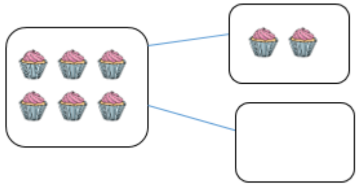
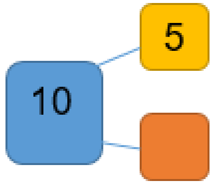
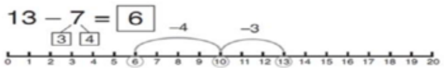
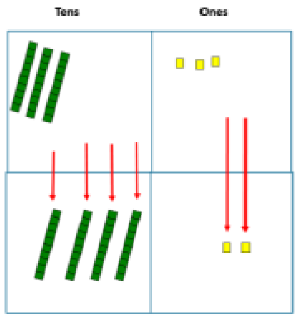
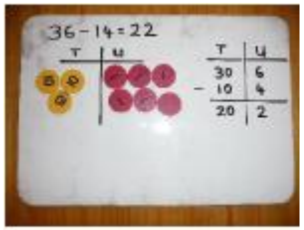
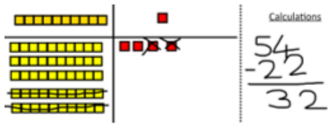
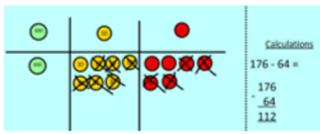
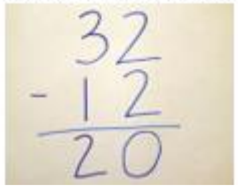
	Column method without regrouping	Add together the ones first, then add the tens. Use the Base 10 blocks first before moving onto place value counters. 24 + 15 =  44 + 15 = 	After practically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions.  	<u>Calculations</u> 21 + 42 = 21 + <u>42</u>
Year 3	Column method without regrouping (up to 3 digits)	 Dienes or numicon Add together the ones first, then the tens.  love to using place value counters	Children move to drawing the counters using a tens and one frame.  	2 2 3 + 1 1 4 3 3 7 Add the ones first, then the tens, then the hundreds.

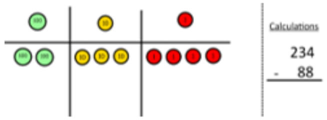
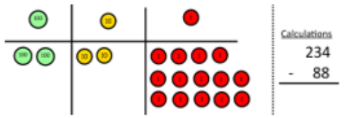
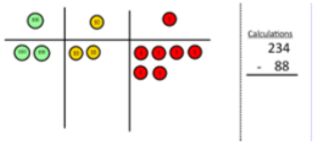
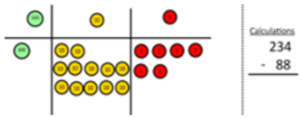
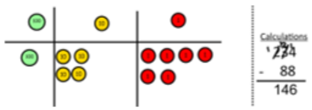
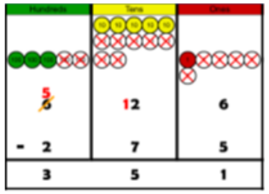
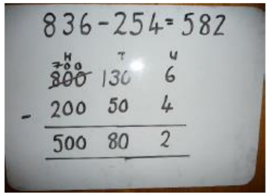
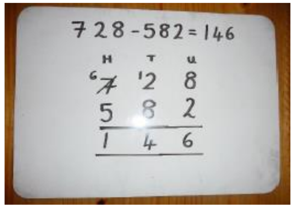
Years 3, 4, 5 and 6	Column method with regrouping Y3 – up to 3 digits Y4 – up to 4 digits Y5 – numbers with more than 4 digits and decimals Y6 – all of the above; numbers with different decimal places	 46 + 27 = 73 268 + 157 Now, we need to count up each column to see how many hundreds, tens, and ones there are  	Children often draw pictorial representations of base 10 and pv counters to support their learning.	$\begin{array}{rcrl} 20 & + & 5 & \\ 40 & + & 8 & \\ \hline 60 & + & 13 & = 73 \end{array}$ Start by partitioning the numbers before formal column to show the exchange. $\begin{array}{r} 536 \\ +\ 85 \\ \hline 621 \\ \hline \end{array}$ At Christ Church Primary, when regrouping we place the digit 'on the doorstep': $\begin{array}{rrrl} 5 & 6 & 7 & + \\ {}_1 1 & {}_1 9 & 9 & \\ \hline 7 & 6 & 6 & \end{array}$ Line up the decimal points $\begin{array}{r} 22.3 \\ +\ 34.1 \\ \hline 56.4 \end{array}$ Line up the decimal points $\begin{array}{l} \ \ 1.234 \\ +\ 4.1 \\ \hline \ \ 5.334 \end{array}$ Children are encouraged to put the place holder in:

				$\begin{array}{r} 5.90 \\ +\ 3.14 \\ \hline 9.04 \\ \hline \end{array}$

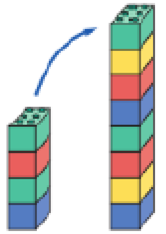
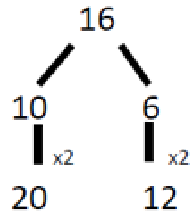
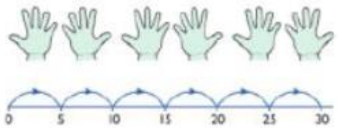
2. Subtraction

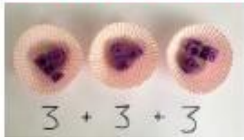
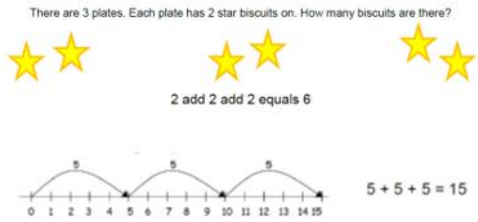
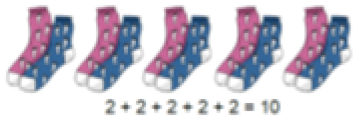
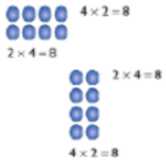
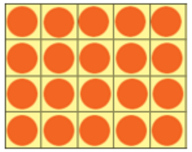
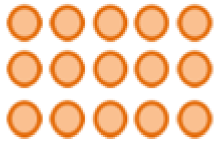
	Objective	Concrete	Pictorial	Abstract
Year 1	Subtraction of ones	Use physical objects, counters, cubes etc. to show how objects can be taken away.  6 – 2 = 4 	Cross out drawn objects to show what has been taken away. 	Written calculations 12 – 4 = 8 13 – 5 = 8
Year 1/2	Counting back	Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones. 13 – 4 	Count back on a number line or number track  Start at the bigger number and count back the smaller number showing the jumps on the number line. 	Put 13 in your head and count back 4. You may use your fingers to help you.
	Find the difference	Compare amounts and objects to find the difference.  Use cubes to build towers or make bars to find the difference Use basic bar models with items to find the difference	Use 2 number lines to illustrate finding the difference e.g. 10 – 6:  Draw bars to find the difference between 2 numbers. 	Peter has 18 sweets. Jemma has 23. Find the difference between the number of sweets.

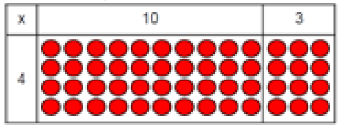
	Part whole model	 Link to addition- use the part whole model to help explain the inverse between addition and subtraction. If 10 is the whole and 6 is one of the parts. What is the other part? 10 - 6 =	Use a pictorial representation of objects (or resources to represent the objects) to show the part whole model. 	 Move to using numbers within the part whole model.
	Make 10	14 – 9 =  Make 14 on the ten frame. Take away the four first to make 10 then takeaway one more so you have taken away 5. You are left with the answer of 9.	 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.	16 – 8= How many do we take off to reach the next 10? How many do we have left to take off?
Year 2/3	Column method no regrouping	Use base 10 to make the bigger number then subtract the smaller number.  	 Draw the Base 10 or place value counters alongside the written calculation to help to show working. 	47 – 24 = 23 40 + 7 – 20 + 4 20 + 3 This will lead to a clear written column subtraction. 

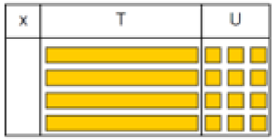
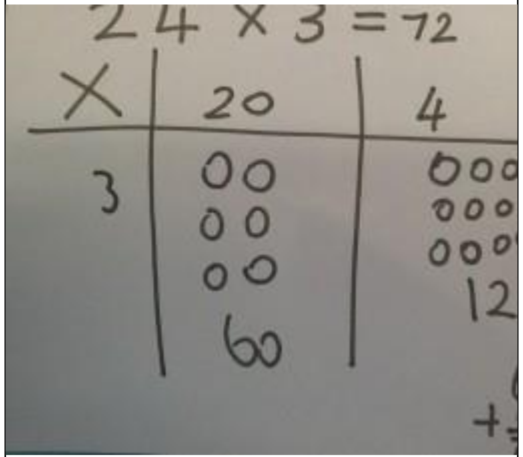
Years 3/4/5/6	Column method with regrouping Year 3 – up to 3 digit number Year 4- up to 4 digit numbers Year 5 – numbers with more than 4 digits and decimals Year 6 – all of the above and numbers with different decimal places	Base 10. Start with one exchange before moving onto subtractions with two exchanges.  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.  Now look at the tens, can I take away 8 tens easily? I need to exchange one hundred for ten tens.  Now I can take away eight tens and complete my subtraction 	 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.	Model to children the expanded method first:   Extend to the compact method: Children will then have a secure $\begin{array}{rcccc} & & {}^{5} & {}^{12} & & {}^{1} \\ & 2 & \cancel{6} & \cancel{3} & . & \mathbf{0} \\ - & & 2 & 6 & . & 5 \\ \hline & 2 & 3 & 6 & . & 5 \end{array}$ understanding of subtracting any number including decimals.	3.

3. Multiplication

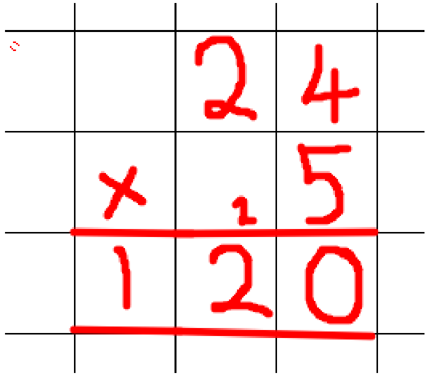
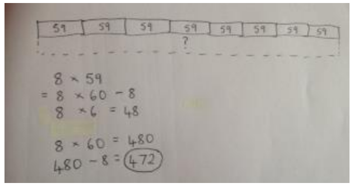
	Objective	Concrete	Pictorial	Abstract
Years 1/2	Doubling/halving	Cubes/numicon to show how to double a number  double 4 is 8 4 × 2 = 8	Double 4 is 8  Pictures to show how to double a number.	 Partition a number and then double each part before recombining it back together.
Years 1/2/3	Counting in multiples	  Count in multiples supported by concrete objects in equal groups. Numicon and cuisinaire can also support with this.	 Use a number line or pictures to continue support in counting in multiples.	Count in multiples aloud. Write number sequences

Years 2/3	Repeated addition	   Use different objects to add equal groups.	 	Write addition sentences to describe objects and pictures. 
	Arrays	Create arrays using counters/cubes and other practical resources to show multiplication sentences  	Draw arrays in different rotations to find **commutative** multiplication sentences.   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 x 3 = 15 3 x 5 = 15

<table>
<tr>
<td>Year 3</td>
<td>Grid multiplication</td>
<td>Show the link with arrays to first introduce the grid method.

4 rows of 10
4 rows of 3

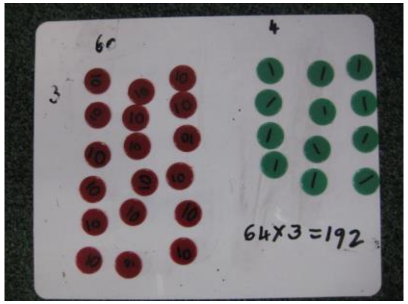
Move on to using Base 10 to move towards a more compact method.

4 rows of 13</td>
<td></td>
<td>Start with multiplying by one digit numbers and showing the clear addition alongside the grid.

<table><tr><td>×</td><td>30</td><td>5</td></tr><tr><td>7</td><td>210</td><td>35</td></tr></table>
210 + 35 = 245

If children are ready, they can be shown the column method:

We carry on the doorstep at CCPS.</td>
</tr>
<tr>
<td>Years 4/5/6</td>
<td>Column multiplication Y4 – 2 and 3 digit numbers by 1 digit</td>
<td>Children can continue to be supported by pv counters to demonstrate column multiplication</td>
<td>Bar models are useful in supporting

learners</td>
<td>Short multiplication in year 4.

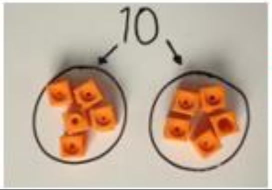
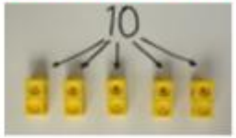
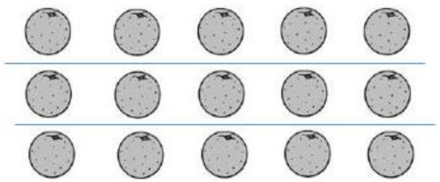
Long multiplication in y5/6.</td>
</tr>
</table>

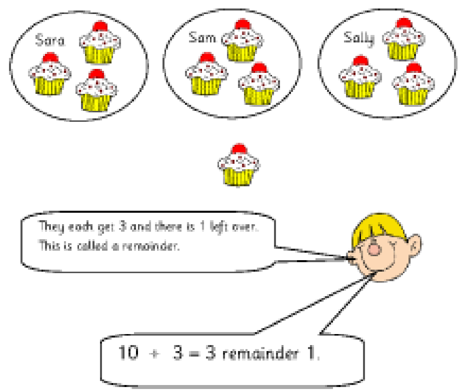
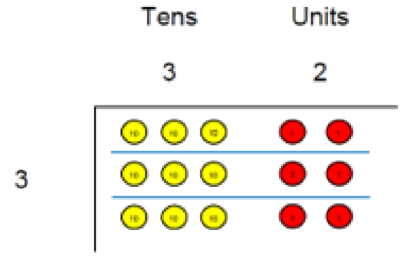
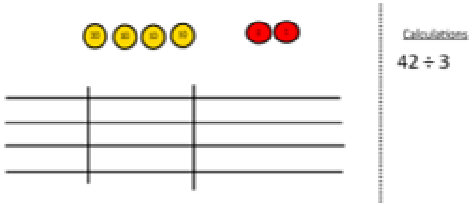
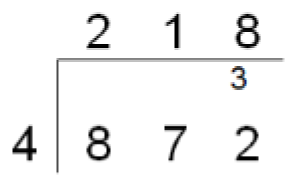
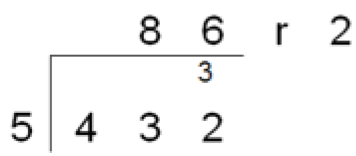
<table>
<tr>
<td></td>
<td>Y5 – numbers with up to 4 digits multiplied by 1 or 2 digits

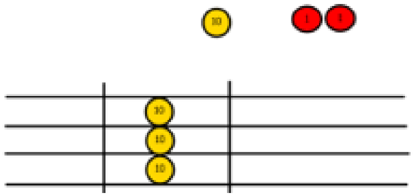
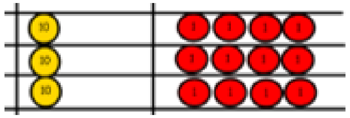
Y6 – numbers with up to 4 digits multiplied by a 2 digit number</td>
<td>
</td>
<td>understand that multiplication is repeated addition.</td>
<td>$$\begin{array}{r} 74 \\ \times\ 63 \\ \hline 12 \\ 210 \\ 240 \\ +\ 4200 \\ \hline 4662 \end{array}$$

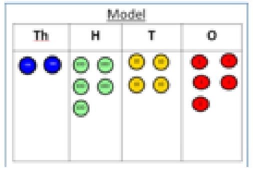
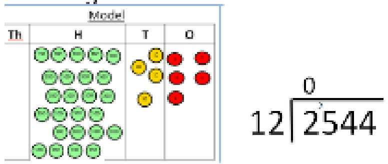
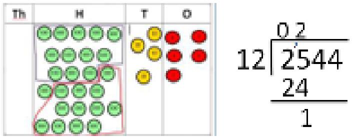
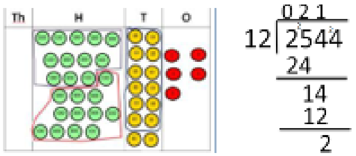
$$\begin{array}{rrrrl} & H & T & O & \\ & 1 & 3 & 2 & \\ \times & & 1 & 4 & \\ \hline & 5 & 2 & 8 & \text{(ones)} \\ \hline 1 & 3 & 2 & 0 & \text{(tens)} \\ \hline 1 & 8 & 4 & 8 & \\ \hline \end{array}$$</td>
</tr>
</table>

4. Division

	Objective	Concrete	Pictorial	Abstract
Years 1/2	Sharing	 I have 10 cubes, can you share them equally in 2 groups?  **This picture illustrates 10 ÷ 2 as <u>sharing.</u>**	 8 ÷ 2 = 4	Share 9 cakes between 3 people. 9 ÷ 3 = 3
	Grouping	Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding. **This picture illustrates 10 ÷ 2 as <u>grouping.</u>**  		28 ÷ 7 = 4 Divide 28 into 7 different groups. How many are in each group?
Years 2/3/4	Arrays	 Link division to multiplication by creating an array and thinking about the number sentences that can be created. Eg 15 ÷ 3 = 5 5 x 3 = 15 15 ÷ 5 = 3 3 x 5 = 15	 Draw an array and use lines to split the array into groups to make multiplication and division sentences.	Find the inverse of multiplication and division sentences by creating four linking number sentences (fact families). 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7

Years 3/4	Division with a remainder		Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder.  This model could also be represented using arrays. Draw dots and group them to divide an amount and clearly show a remainder. 	Complete written divisions and show the remainder using r. 
Years 3/4/5/6	Short division Y3 – 2 digits by 1 digit – taught through concrete and pictorial representations Y4 – up to 3 digit divided by 1 digit Y5 – up to 4 digit numbers divided by a 1 digit number,	 Use place value counters to divide using the bus stop method alongside  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.	Children may want to draw their own representations.	Begin with divisions that divide equally with no remainder.  Move onto divisions with a remainder. 

	interpreting the remainder as an approximate for the context of the problem Y6 – interpreting remainders as whole numbers/fractions/decimals	 We exchange this ten for ten ones and then share the ones equally among the groups.  We look how much in 1 group so the answer is 14.		

Year 6	Long division	 2544 ÷ 12 How many groups of 12 thousands do we have? None Exchange 2 thousand for 20 hundreds.  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.  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