Barnfields Primary School

Calculation Progression Policy

Rationale

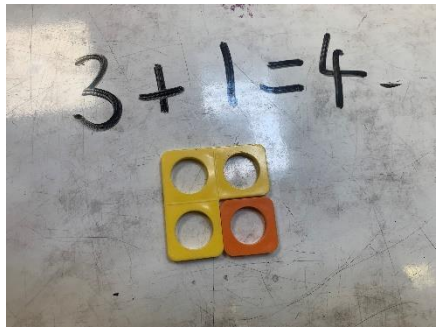
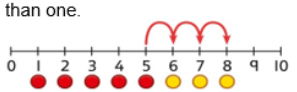
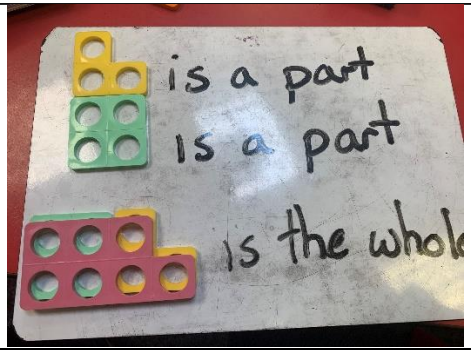
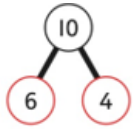
At Barnfields Primary School, we believe in equipping all of our children to become fluent and proficient Mathematicians. The aim of this Calculation Progression Policy is to ensure all of our children are able to use a range of mental calculation strategies effectively, efficiently and flexibly. In partnership with this, it is imperative that children can also use a range of written methods accurately and appropriately. When children are able to employ both of these strategies effectively, they can then solve problems and reason mathematically efficiently. Underpinning all this, is the belief that all children can acquire a competent and confident understanding of numbers and the number system combined with an instant recall of a set of age-appropriate number facts. This knowledge and skillset combined with the automaticity of known facts will ensure our children are able to explore Maths in depth and with success using appropriate vocabulary and skills in order to do so effectively.

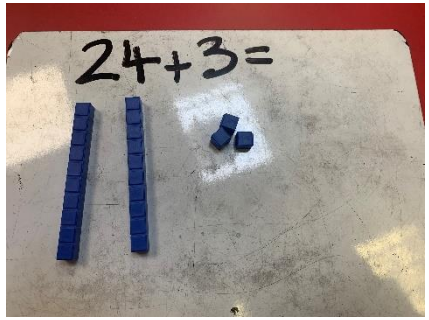
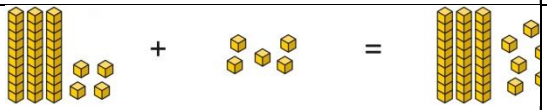
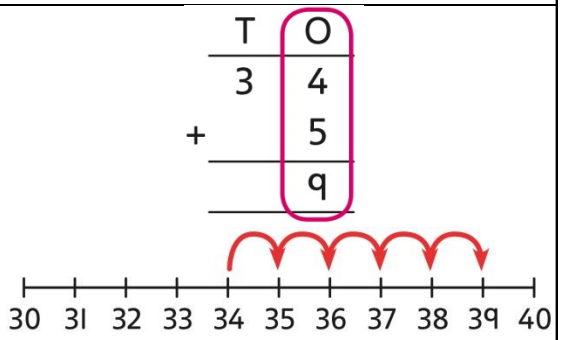
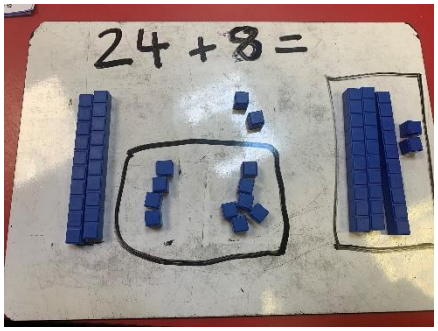
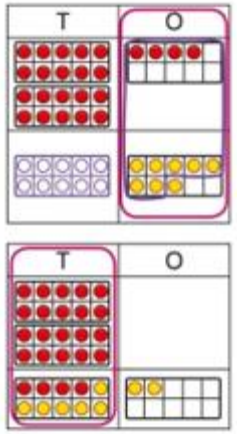
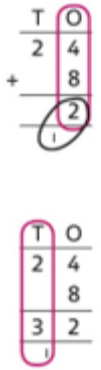
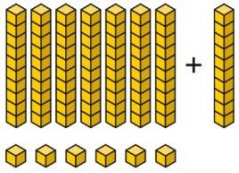
Concrete, Pictorial, Abstract approach

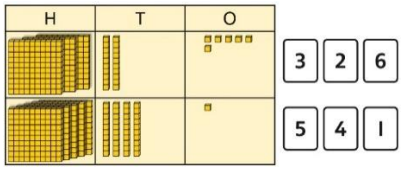
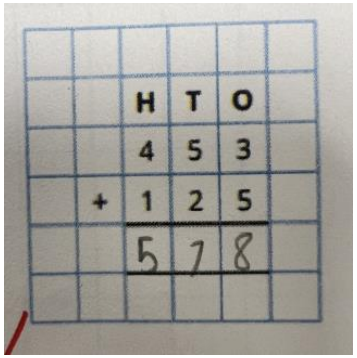
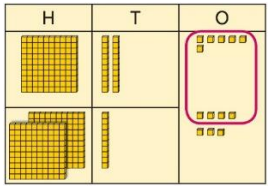
The Concrete, Pictorial, Abstract approach (CPA) is a highly effective approach to teaching that develops a deep and sustainable understanding of maths in pupils.
It is an essential technique within the Singapore method of teaching maths for mastery which is now used to teach Maths in the majority of schools across the UK and employed at Barnfields Primary School. Children can find Maths difficult because it is abstract. The CPA approach builds on children's existing knowledge by introducing abstract concepts in a concrete and tangible way. It involves moving from concrete materials, to pictorial representations, to abstract symbols and problems. Concrete is the "doing" stage. During this stage, students use concrete objects to model problems. Unlike traditional maths teaching methods where teachers demonstrate how to solve a problem, the CPA approach brings concepts to life by allowing children to experience and handle physical (concrete) objects. With the CPA framework, every abstract concept is first introduced using physical, interactive concrete materials.

- Concrete is the "doing" stage. During this stage, children use concrete objects to model problems. Unlike traditional maths teaching methods where teachers demonstrate how to solve a problem, the CPA approach brings concepts to life by allowing children to experience and handle physical (concrete) objects.
- Pictorial is the "seeing" stage. Here, visual representations of concrete objects are used to model problems. This stage encourages children to make a mental connection between the physical object they just handled and the abstract pictures, diagrams or models that represent the objects from the problem. Building or drawing a model makes it easier for children to grasp difficult abstract concepts (for example, fractions). Simply put, it helps students visualise abstract problems and make them more accessible.
- Abstract is the "symbolic" stage, where children use abstract symbols to model problems. Students will not progress to this stage until they have demonstrated that they have a solid understanding of the concrete and pictorial stages of the problem. The abstract stage involves the teacher introducing abstract concepts (for example, mathematical symbols). Children are introduced to the concept at a symbolic level, using only numbers, notation, and mathematical symbols (for example, +, –, x, ÷) to indicate addition, multiplication or division.

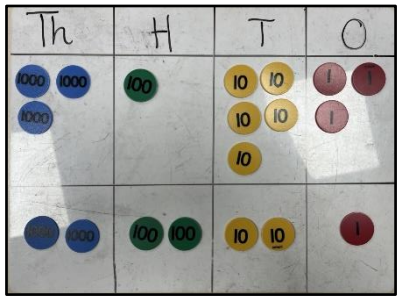
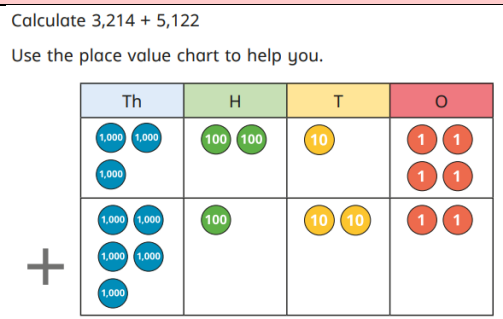
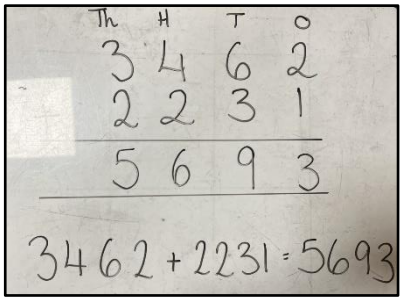
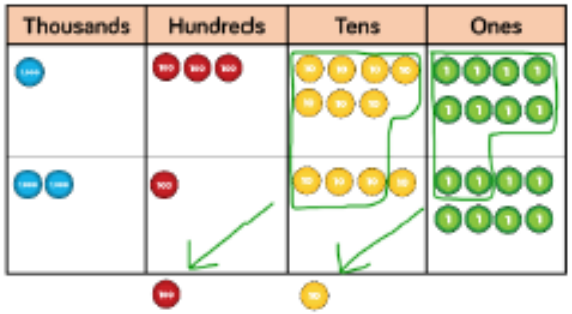
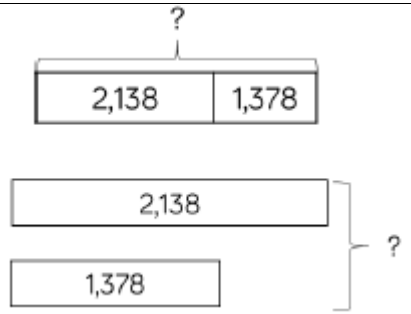
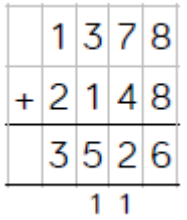
It is important to note this is not a linear approach and teachers will move back and forth between the CPA stages as required.

Year 1 addition			
Concept	Concrete	Pictorial	Abstract
Counting and adding more		Children add one more cube or counter to a group to represent one more  *One more than 4 is 5.*	Use a number line to understand how to link counting on with finding one more.  *One more than 6 is 7.* *7 is one more than 6.* Learn to link counting on with adding more than one.  *5 + 3 = 8*
Understanding part-part-whole relationship		Here are some frogs. ▸ Can you see two groups of frogs? ▸ How many frogs are in each group? ▸ Complete the sentences. ____ is a part. ____ is a part. The whole is ____ 	 6 + 4 = 10

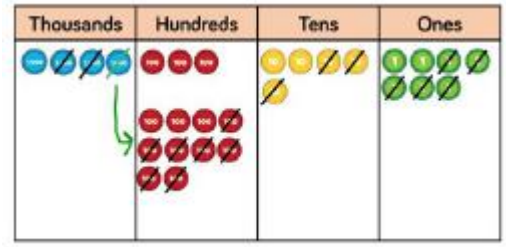
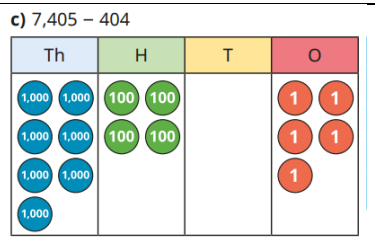
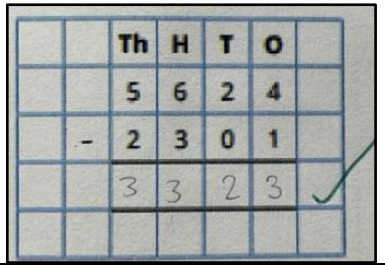
Year 2			
Addition			
Concept	Concrete	Pictorial	Abstract
Adding a 1-digit number to a 2-digit number not bridging a 10		 *34 is 3 tens and 4 ones.* *4 ones and 5 ones are 9 ones.* *The total is 3 tens and 9 ones.*	
Adding a 1-digit number to a 2-digit number with an exchange		Exchange 10 ones for 1 ten. 	Exchange 10 ones for 1 ten. 
Adding a multiple of 10 to a 2 digit number	Add the 10s and then recombine.  *27 is 2 tens and 7 ones.* *50 is 5 tens.*	Add the 10s and then recombine. 	Add the 10s and then recombine. *37 + 20 =* *30 + 20 = 50*

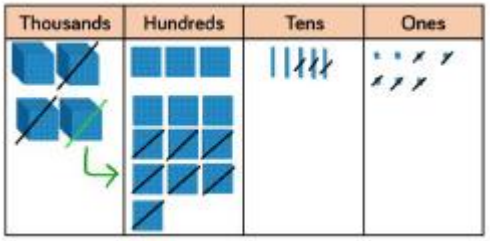
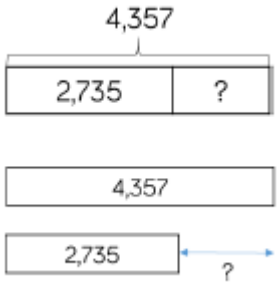
Y3 Addition			
Concept	Concrete	Pictorial	Abstract
Add numbers with up to three digits using the formal written method of column addition- no regrouping	Use place value equipment to make a representation of a calculation. This may or may not be structured in a place value grid. *326 + 541 is represented as:* 	Represent the place value grid with equipment to model the stages of column addition.	Use a column method to solve efficiently, using known bonds. Children must understand how this relates to place value at every stage of the calculation. 
Add numbers with up to three digits using the formal written method of column addition- with regrouping	Use place value equipment to enact the exchange required.  *There are 13 ones.* *I will exchange 10 ones for 1 ten.*	Model the stages of column addition using place value equipment on a place value grid.	Use column addition, ensuring understanding of place value at every stage of the calculation.

Year 4 Addition

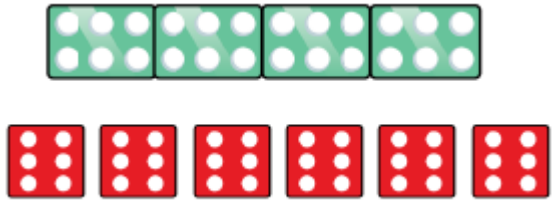
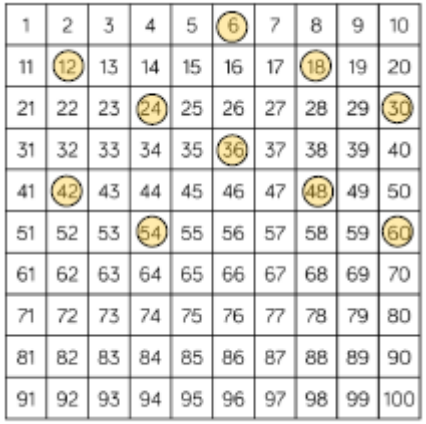
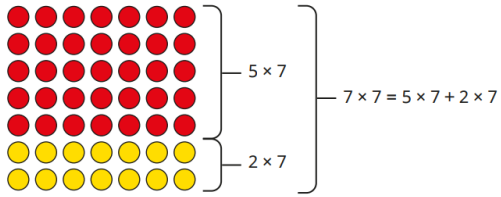
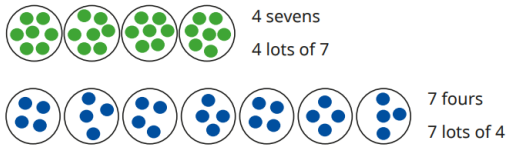
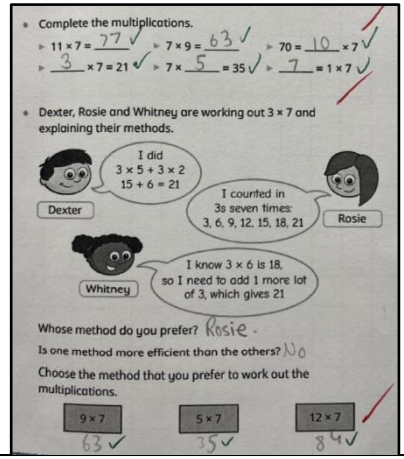
Concept	Concrete	Pictorial	Abstract
Add up to two 4 digit numbers with no exchange.			
Add two 4 digit numbers- with exchanges.			

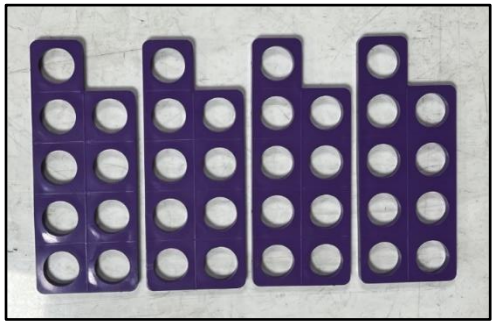
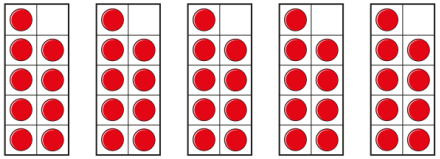
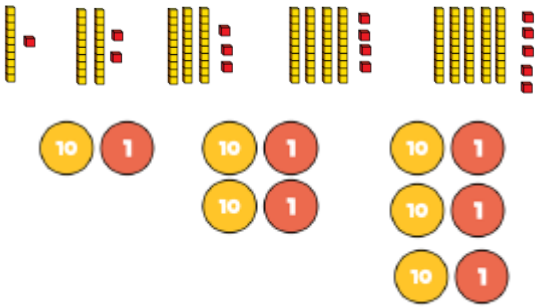
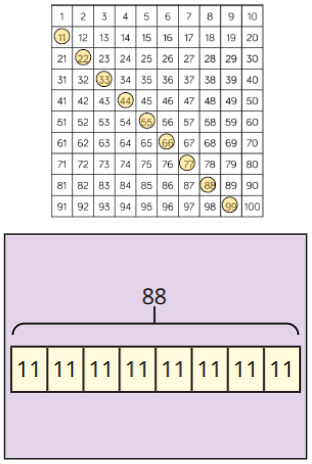
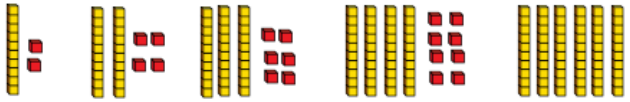
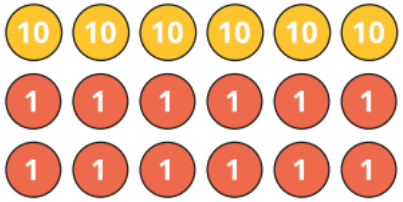
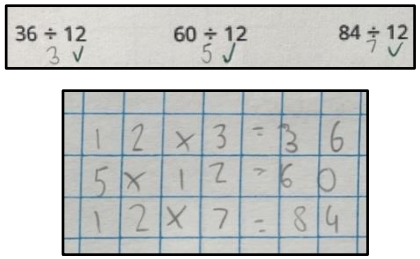
Year 4 Subtraction

Concept	Concrete	Pictorial	Abstract
Subtract two 4 digit numbers- no exchange			

Subtract two 4 digit numbers- with exchanges			3 1 4357 – 2735 1622

Year 4 Multiplication

Concept	Concrete	Pictorial	Abstract
Recall and apply multiplication and division facts for 6 times tables			3 x 6 = 18 6 x 3 = 18 18 divided by 3 = 6 18 divided by 6 = 3
Recall and apply multiplication and division facts for 7 times tables			

Recall and apply multiplication and division facts for 9 times tables			7 × 9 = 63 3 × 9 = 27 9 × 9 = 81 12 × 9 = 108
Recall and apply multiplication and division facts for 11 times tables			99 ÷ 11 55 ÷ 11 22 ÷ 11
Recall and apply multiplication and division facts for 12 times tables			

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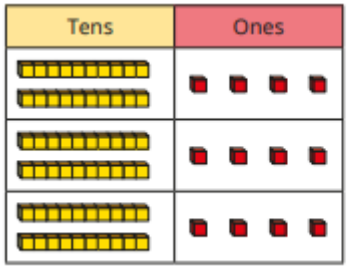
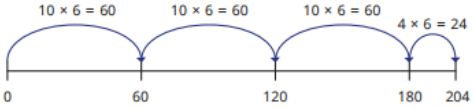
<td>Use informal written methods for multiplicatio n</td>
<td> 

24 × 3 = 12 + 60 = 72</td>
<td>34 x 6 = 204
 
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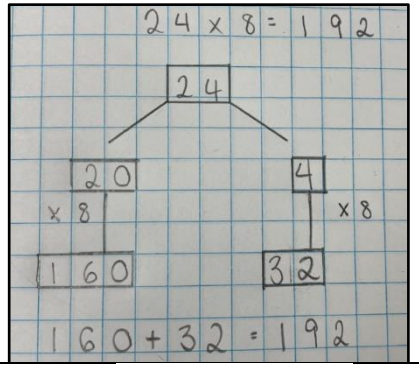
<td> 
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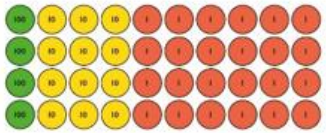
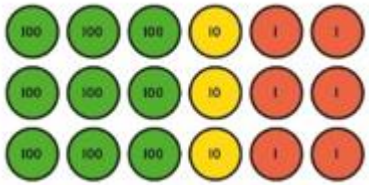
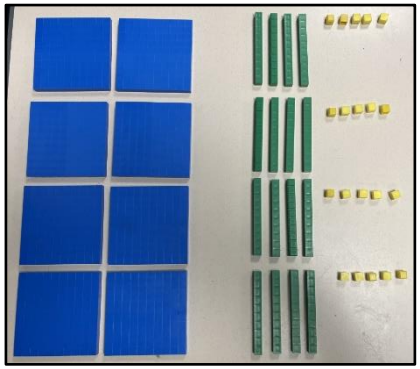
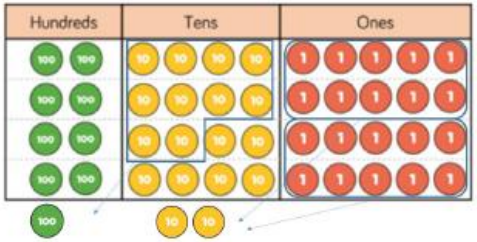
<tr>
<td>Multiply up to 3 digit number by a 1 digit number- no exchange</td>
<td>Use place value equipment to make multiplications.

Make 4 × 136 using equipment.
  </td>
<td>  </td>
<td>3 1 2
× 3
9 3 6</td>
</tr>
<tr>
<td>Multiply a 3 digit number by a 1 digit number with exchanges</td>
<td>  </td>
<td>245 x 4 =</td>
<td> 
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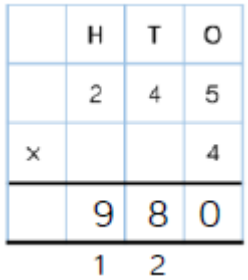
<td> 
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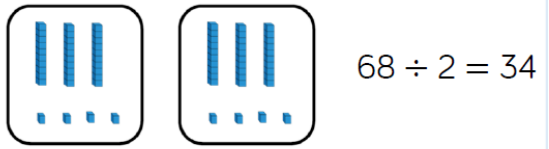
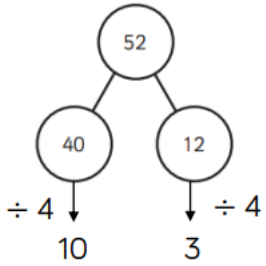
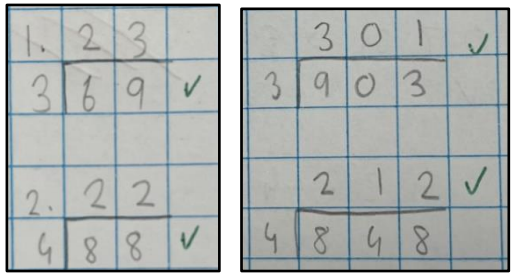
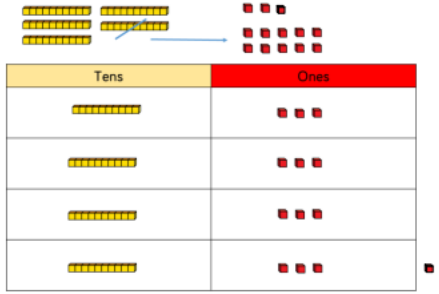
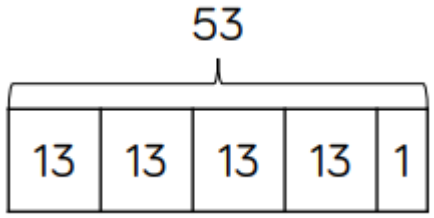
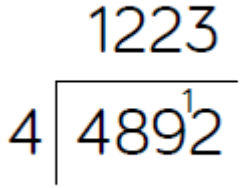
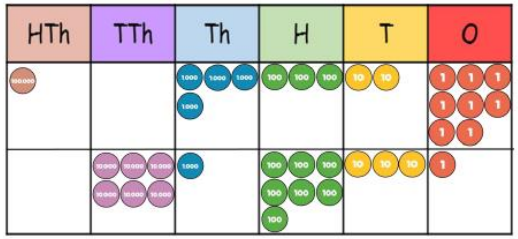
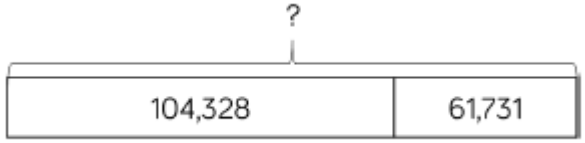
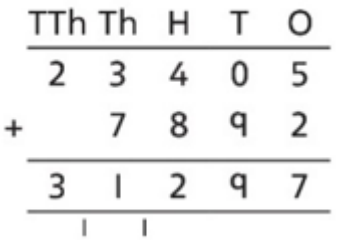
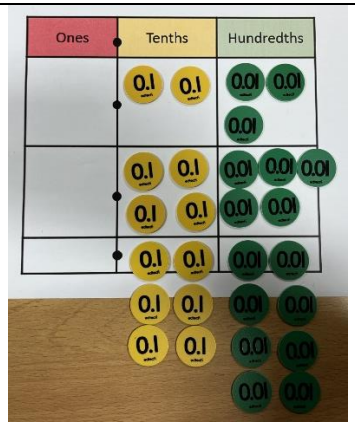
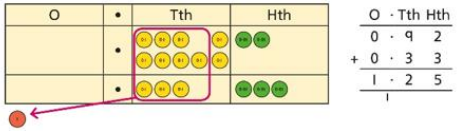
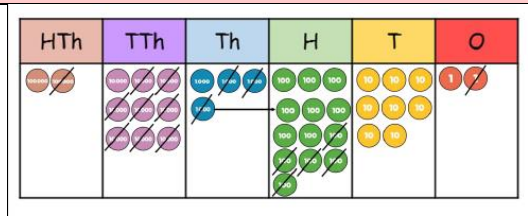
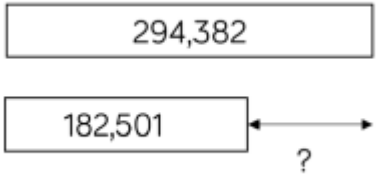
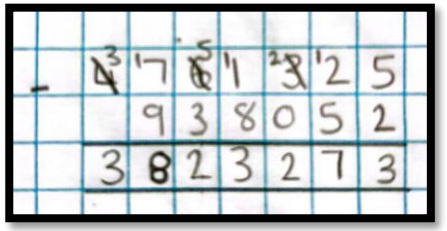
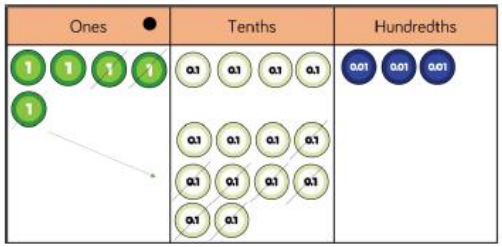
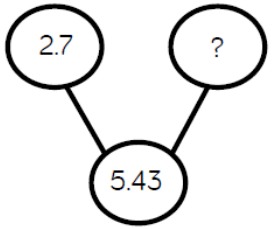
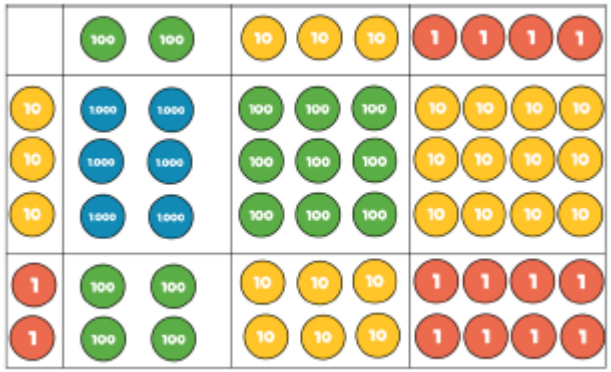
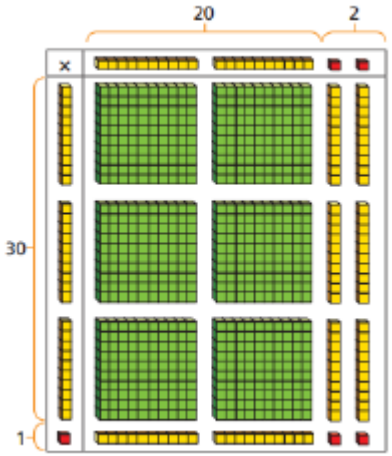
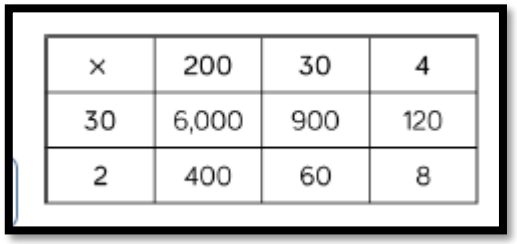
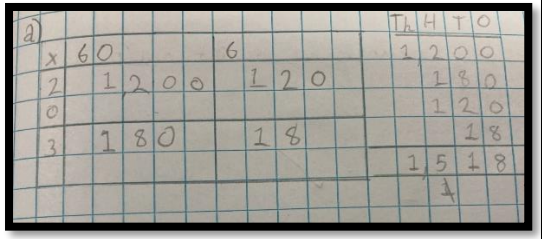
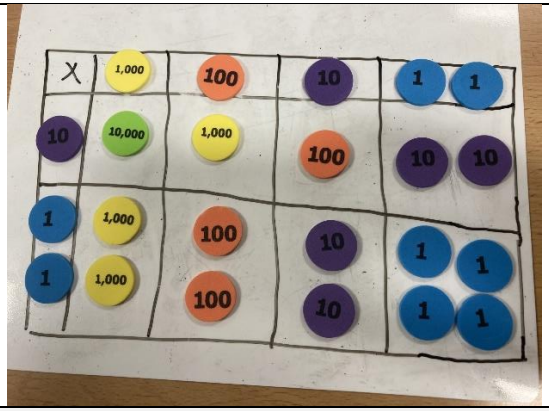
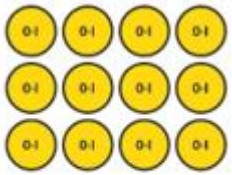
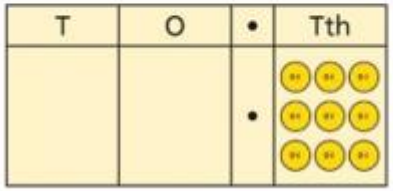
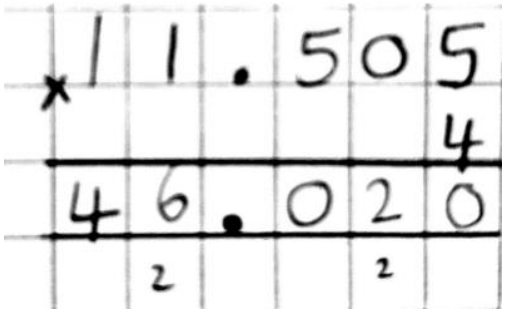
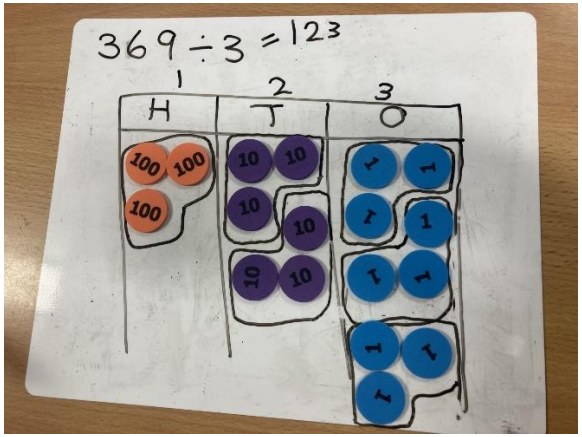
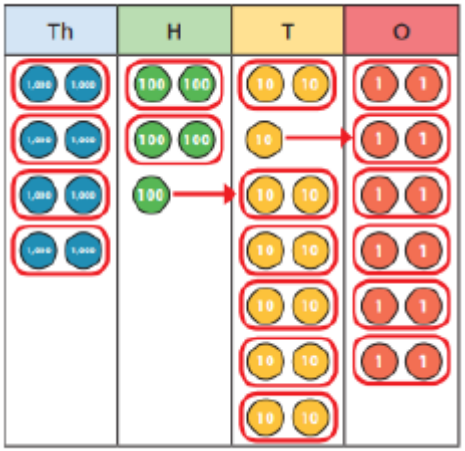
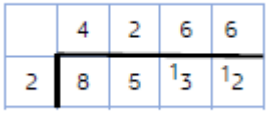
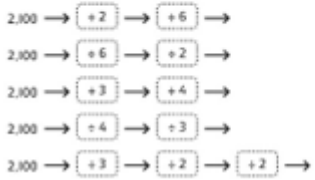
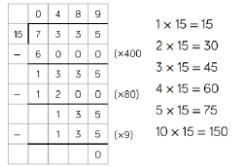
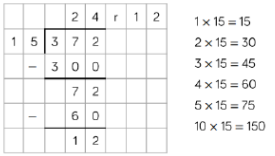
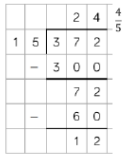
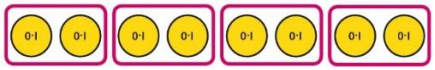
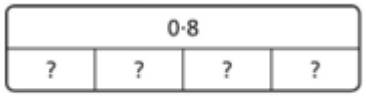
Year 4 Division			
Concept	Concrete	Pictorial	Abstract
Divide 2 and 3 digit numbers using formal written method of short division			
Divide 2 and 3 digit numbers using formal written method of short division- with remainders			

UKS2 Addition			
Concept	Concrete	Pictorial	Abstract
Add whole numbers with more than 4 digits using formal written methods			

Add numbers with up to 3 decimal places using formal written methods			O · Tth Hth 0 · 9 2 + 0 · 3 3 1 · 2 5 1
UKS2 Subtraction			
Concept	Concrete	Pictorial	Abstract
Subtract whole numbers with more than 4 digits using formal written methods			
Subtract numbers with up to 3 decimal places			4 1 5.43 – 2.7 2.73
UKS2 Multiplication			
Concept	Concrete	Pictorial	Abstract

Multiply numbers with up to 4 digits by a 2 digit number using an expanded formal written method (Year 5)			 
Multiply numbers with up to 4 digits by a 2 digit number using a compact formal written method (Year 5)			1 2 3 5 × 2 1 1 2 3 5 1 × 1,235 2 4 7 0 0 20 × 1,235 2 5 9 3 5 21 × 1,235
Multiply multi-digit numbers up to 4 digits by a 2 digit whole number using the formal written method of long			TTh Th H T O 2 7 3 9 × 2 8 2 2 1 5 9 3 1 7 2 5 1 4 7 1 8 0 7 6 6 9 2 1

multiplication (Y6)			
Multiplying decimals (Year 6)	 *3 groups of 4 tenths is 12 tenths.* *4 groups of 3 tenths is 12 tenths.*	Represent calculations on a place value grid. 3 × 3 = 9 3 × 0·3 = 0·9 	
UKS2 Division			
Concept	Concrete	Pictorial	Abstract
Divide up to 4 digit numbers by a 1 digit number using the formal written method of short division and interpret remainders according to context.			

Dividing by a 2 digit number using factors (Y6)	Understand that division by factors can be used when dividing by a number that is not prime.	Use factors and repeated division. *1,260 ÷ 14 = ?*  *1,260 ÷ 2 = 630* *630 ÷ 7 = 90* *1,260 ÷ 14 = 90*	Use factors and repeated division where appropriate. *2,100 ÷ 12 = ?* 
Dividing by a 2 digit number using long division (Y6)			**7,335 ÷ 15 = 489** 
Dividing by a 2 digit number using long division with remainders (Y6)			**372 ÷ 15 = 24 r12**   **372 ÷ 15 = $24\frac{4}{5}$**
Dividing decimals (Y6)	 Use place value equipment to divide decimals into equal groups. *8 tenths divided into 4 groups. 2 tenths in each group.*	 4 × 2 = 8 8 ÷ 4 = 2 So, 4 × 0·2 = 0·8 0·8 ÷ 4 = 0·2