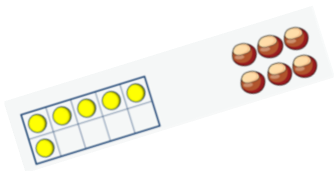
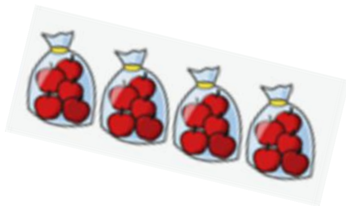
Menston Primary School

Calculations Policy





Introduction

This calculation policy sets out the preferred methods of calculation used across our school. It illustrates how a range of models and structures support children in developing a secure understanding of mathematical concepts through concrete, pictorial and abstract representations. Our aim is to ensure that these approaches are applied consistently for all pupils, providing a strong foundation for deep and meaningful mathematical understanding.

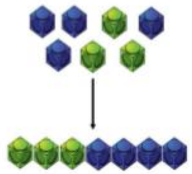
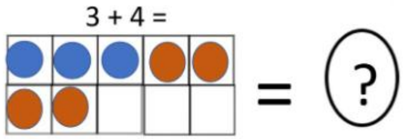
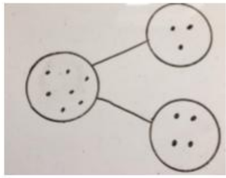
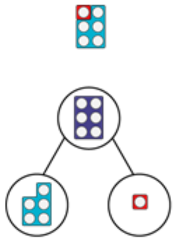
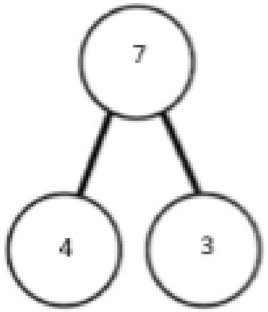
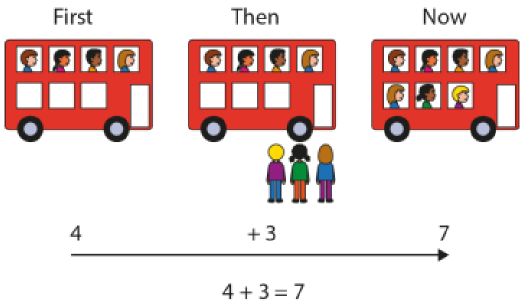
A consistent and progressive approach to calculation is essential to support pupils' mathematical development throughout their time in school. This policy provides teachers with a clear progression of methods, enabling them to identify each child's stage of learning and confidently support the next steps in their development.

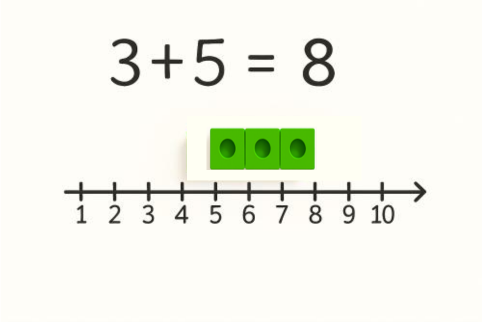
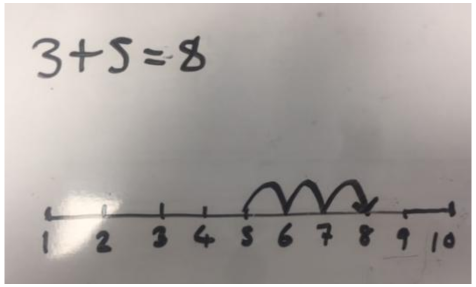
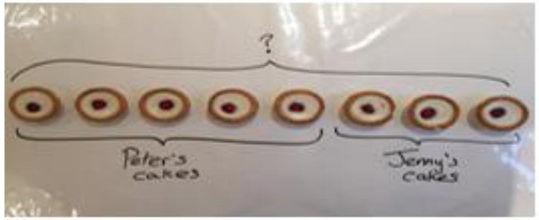
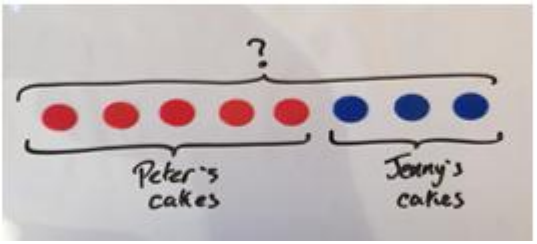
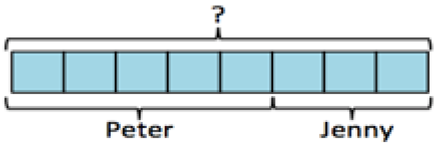
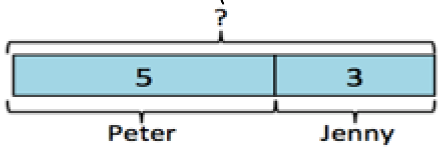
Although the policy is organised broadly from Reception to Year 6, specific year groups are not assigned to individual methods. This reflects our belief that children progress at different rates and should only move on when they have a secure grasp of a concept. To support this, calculation methods progress from using concrete resources to pictorial representations, including ten frames, number lines, part - whole models and bar models, to abstract calculations. Concrete resources continue to be used at all stages to deepen and strengthen pupils' conceptual understanding.

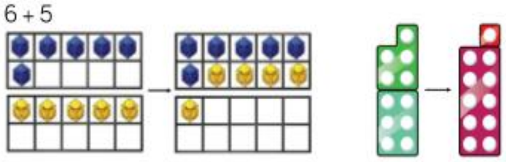
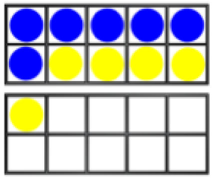
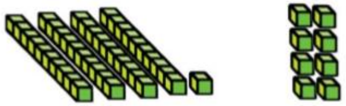
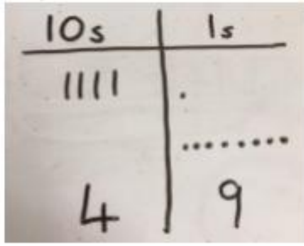
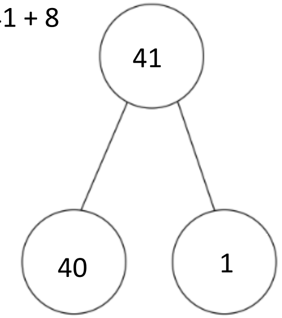
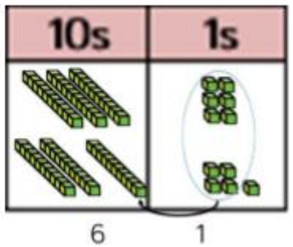
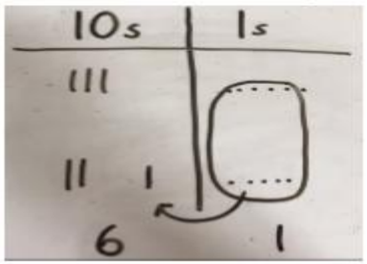
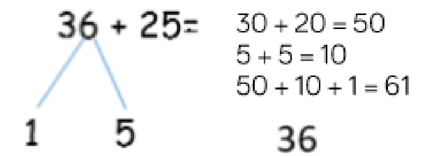
Children develop mathematical understanding through the Concrete ➡ Pictorial ➡ Abstract (CPA) approach: beginning with practical, hands-on resources to explore concepts, moving to visual representations that model and clarify their thinking and progressing to abstract symbols and formal methods once understanding is secure. This structured progression ensures that pupils build deep, flexible knowledge and make clear connections between each stage of learning.

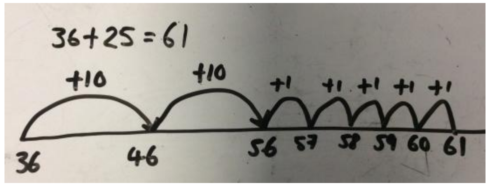
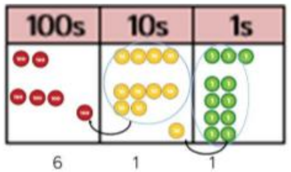
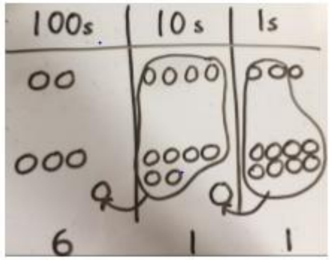
Stem sentences (highlighted in red below) support mathematical reasoning by giving pupils precise language structures that help them articulate their thinking, make connections between concepts. This helps children to explain their methods with clarity and accuracy.

We use Mastery principles to teach mathematics and our curriculum framework is based on the White Rose Maths structured, progressive scheme of learning to ensure complete coverage of all national curriculum objectives. We have produced separate documents which give more detail about how we teach number and calculations in Reception and Key Stage 1, including information about the Mastering Number programme.

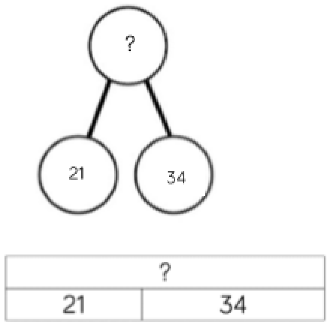
Addition	Concrete →	Pictorial →	Abstract
Combining two parts to make a whole: part whole model Stem sentences: ***This is a whole… because I have all of it.*** ***This is not a whole… because I don't have all of it.*** ***… is a part*** ***… is a part*** ***The whole is…***	Combining two parts to make a whole **using objects and resources.**   	Represent the concrete resources using dots/ circles. This could be shown using ten frames.  This could also be shown using part whole models.  	4 + 3 = 7 Four is a part, 3 is a part and the whole is seven. 
Addition stories Stem sentence: ***First…then…now***	Chairs can be placed in rows of 2 to represent seats on a bus. Children can role play getting on the bus. They should practise using the language 'First.. then…now' to explain the addition story. 	This can then be represented pictorially alongside the addition calculation. 	This can then be represented as the calculation alone, including missing number problems. 4 + 3 = 7 3 + _ = 7 7 = 3 + 4 7 = 4 + _ First there are four children on the bus. Then three more get on. Now there are seven children on the bus altogether.

Adding by counting forwards on a number line	Using number lines or number tracks, children start with the larger number (5) and count on (3), This should be done using concrete objects such as cubes first. 	Children draw the steps onto the number line. Children see that the total of 3 + 5 is the same as 5 + 3 by counting on from both numbers. Children see that it is more efficient to count on from the larger number. 	These additions using single digit numbers can then be represented as the calculations, including missing number problems. $3 + 5 = ?$ $5 + 3 = ?$ $8 = 3 + ?$ $8 = ? + 5$ I have 3 sweets. I am given 5 more. How many do I have altogether?
Combining parts to make a whole: bar model Stem sentences: ***… is a part*** ***… is a part*** ***… is the whole***	Creating bar models using objects as part of a story.  	Children to represent the problem using a drawn bar model with each section representing one.  Once confident, children can represent each number as one bar (accurate scale is **essential**). 	Children to complete an abstract calculation. $5 + 3 = 8$ $3 + 5 = 8$ $? = 5 + 3$ Peter has five cakes and Jenny has three cakes. How many cakes do they have altogether?

Regrouping to make 10.	Regrouping to make 10: using ten frames and counters/ cubes or using Numicon. 	Children draw dots/ circles on images of the ten frames to represent the counters/cubes. 	Children use knowledge of complements to ten to add numbers which cross the tens boundary. 6 + 5 is the same as 6 + 4 + 1 is the same as 10 + 1
TO + 0 using base ten and other concrete apparatus	Children develop understanding of partitioning and place value. TO + O using base ten, counters (moving onto place value counters when ready to in KS2). e.g. 41 + 8 	Children represent the base 10 e.g. lines for tens and dots/crosses for ones 	41 + 8  1 + 8 = 9 40 + 9 = 49
TO + TO using base ten, Numicon and other equipment.	TO + TO using base 10 Continue to develop understanding of partitioning and place value. 36 + 25 	Children represent the base 10 in a place value chart. 	Partitioning methods used to add. This does not always need to be recorded but can be used as a mental method. 36 = 30 + 6 25 = 20 + 5 50 + 11 = 61 Children should extend this by looking for ways to make 10. 

		Jottings to be made alongside using the concrete apparatus. 3 6 + 2 5 50 + 11 50 + 11 = 61	Children can then use a number line. They should begin with the larger number. The smaller should then be **partitioned** and added on in steps. 
Column method – exchanging. Sentence stem: *If the column sum is equal to 10 or more, we must exchange.*	Use of place value counters to add HTO + TO, HTO + HTO etc. When there are 10 ones in the 1s column – we exchange for 1 ten. When there are 10 tens in the 10s column, we exchange for 1 hundred.  This can also be done with Base 10 (dienes) to help children clearly see that 10 ones equal 1 ten and that 10 tens equal 100.	Children to represent the counters in a place value chart when they make an exchange. 	Once children have a secure understanding of exchanging, they can move onto formal methods of addition. They can begin by partitioning the numbers. 20 + 5 40 + 8 60 + 13 = 73 Children should then move on to showing the exchange below the calculation. Children should cross out the exchanged digit as they add it, to ensure that they do not forget.

<table>
<tr><td></td><td></td><td></td><td>243
+368
611
1 1

This will later be developed to adding decimals using column addition.</td></tr>
<tr><td colspan="4">Conceptual variation e.g. different ways to ask children to solve 21 + 34</td></tr>
<tr><td>
</td><td>21
+34
____

21 + 34 =

☐ = 21 + 34

Calculate the sum of twenty-one and thirty-four.</td><td>

Missing digit problems:

</td><td>Raj spent £34. Timmy spent £55.
How much more did Raj spend?

Calculate the difference between 34 and 55.</td></tr>
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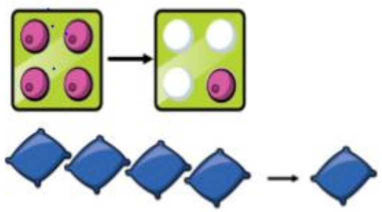
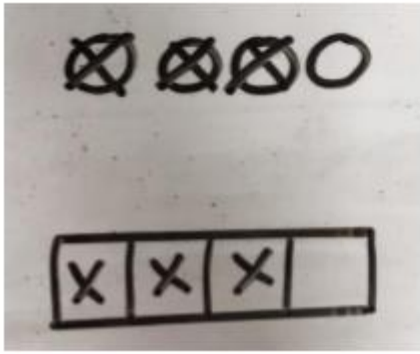
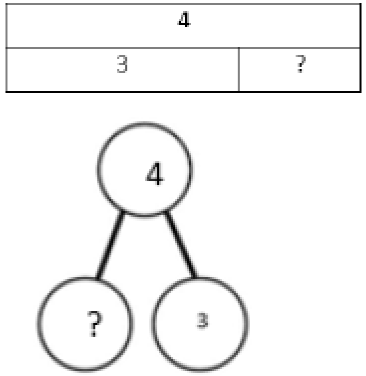
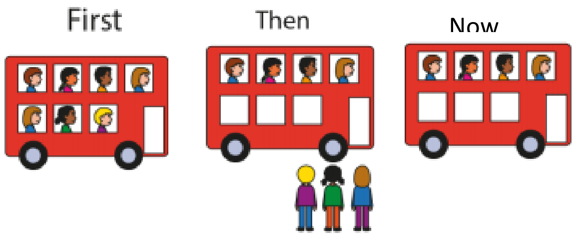
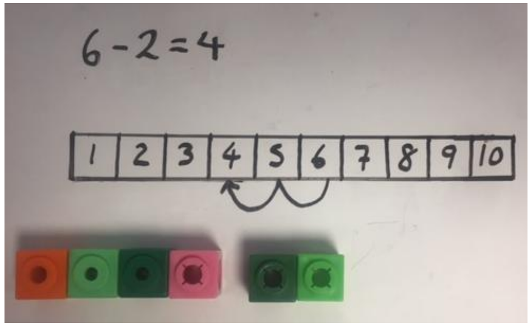
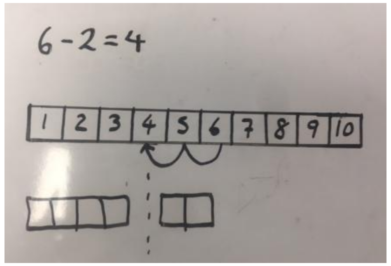
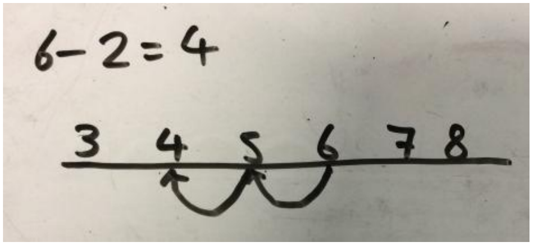
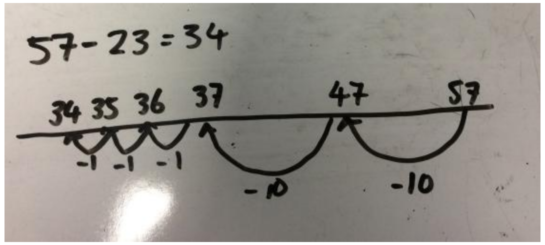
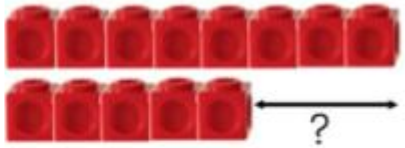
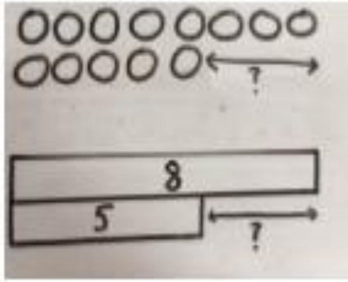
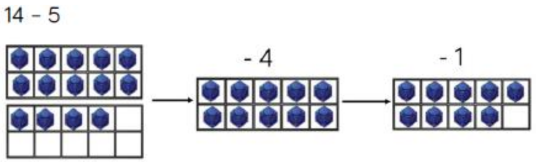
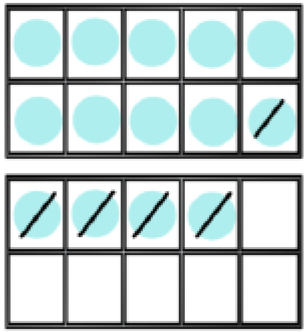
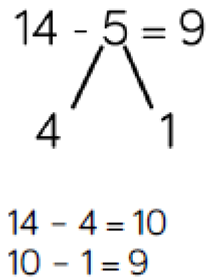
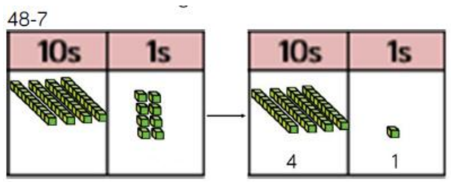
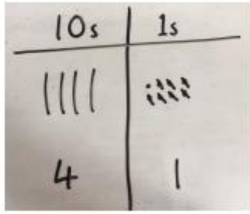
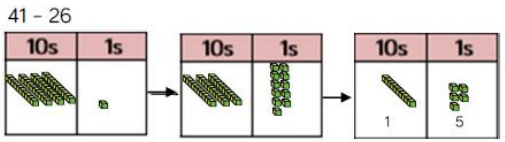
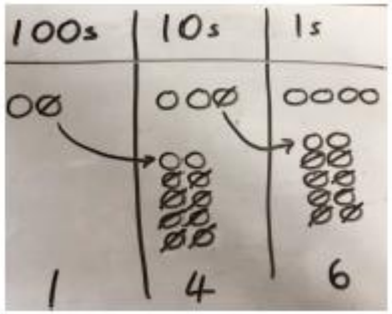
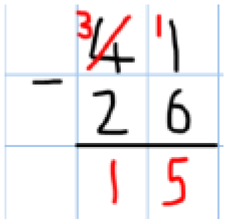
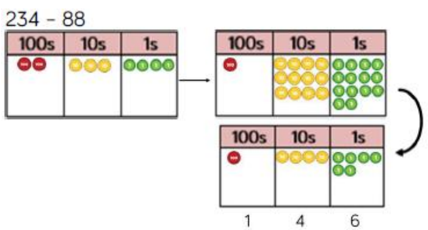
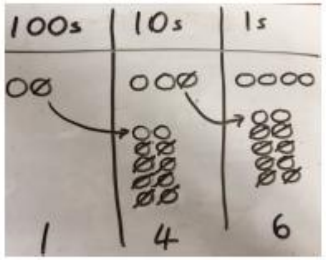
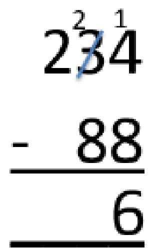
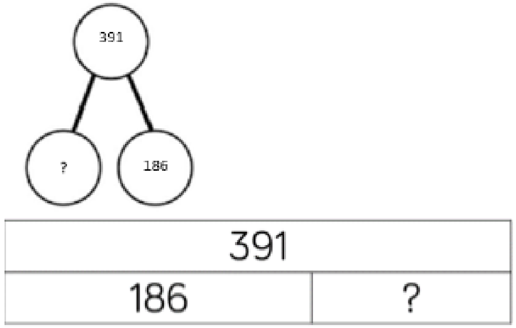
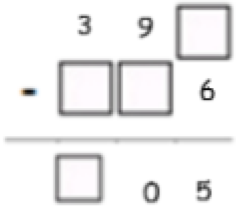
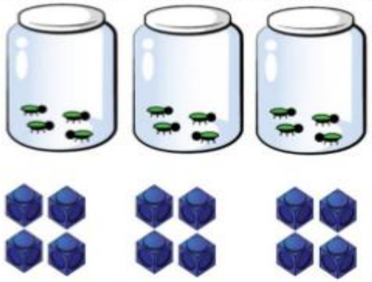
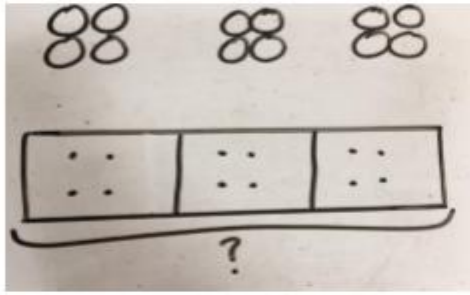
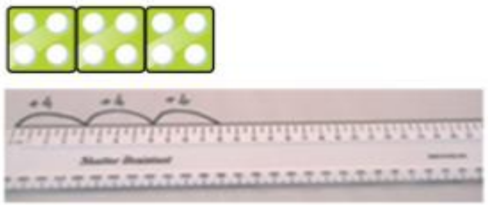
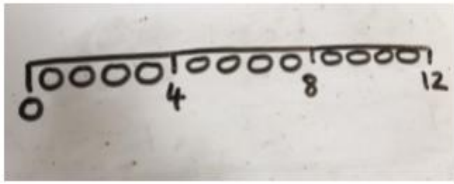
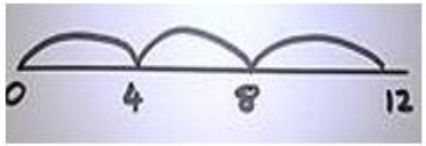
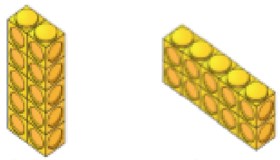
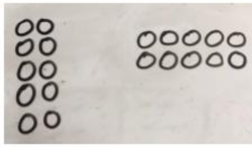
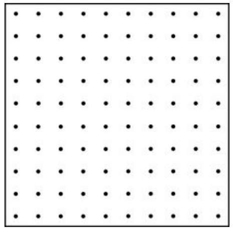
Subtraction	Concrete →	Pictorial →	Abstract
Physically taking away and removing objects from a whole. Stem sentence: *When we subtract… our number gets… smaller.*	4 - 3 = 1 	Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also be used. 	4- 3 = □ = 4 - 3 
Subtraction stories Stem sentence: *First…then…now*	Chairs can be placed in rows of 2 to represent seats on a bus. Children can act out children getting off the bus. They should practise using the language ‘First.. then…now’ to explain the subtraction story. 	This can then be represented pictorially alongside the subtraction calculation.  7 ⟶ -3 ⟶ = 4	This can then be represented as the calculation alone, including missing number problems 7 – 3 = 4 4 = 7 – 3 3 = 7 - _

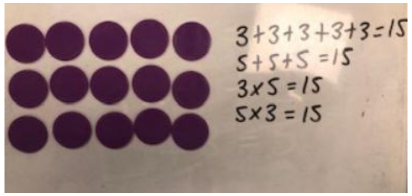
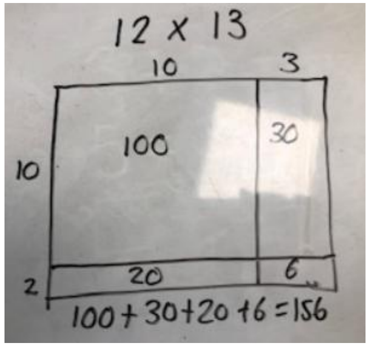
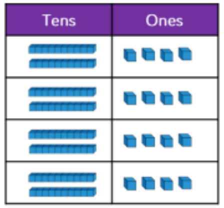
Counting back	Using number lines or number tracks, children start with 6 and count back 2. This should be done using concrete objects such as cubes.  	Childen to represent what they see pictorially.  Children to count back on a number line (arrows below the line for subtraction).  This should then progress to counting back using 2 digit numbers which have been partitioned into tens and ones.  	Put 13 in your head and count back 4. What number are you at?

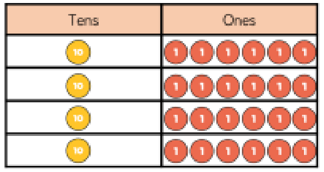
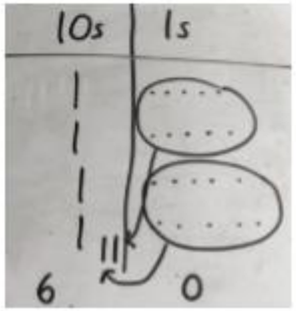
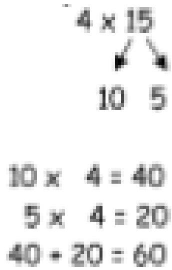
Finding the difference	Use cubes, Numicon or other objects (of uniform size) to calculate difference. Calculate the difference between 8 and 5. 	Children draw the cubes/other concrete objects which they have used or use the bar model to illustrate what they need to calculate. **Accurate scale is essential, so squared paper is best for this.** Finding the difference between 8 and 5. 	Find the difference between 8 and 5. Children to explore why: 9 - 6 8 - 5 7 - 4 have the same difference.
Making 10 using ten frames.	Partitioning to 10 and another number using ten frames e.g. 14 – 5 	Children to represent the ten frame pictorially and discuss what they did to make ten. 	Children to show how they can make 10 by partitioning the number which is being subtracted. 

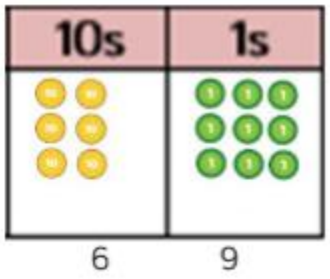
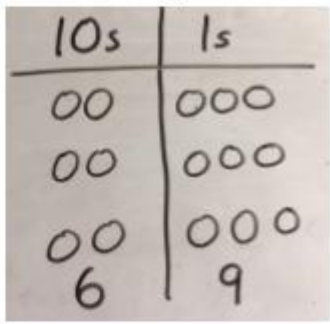
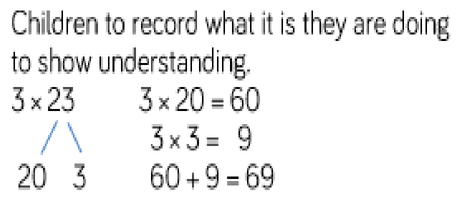
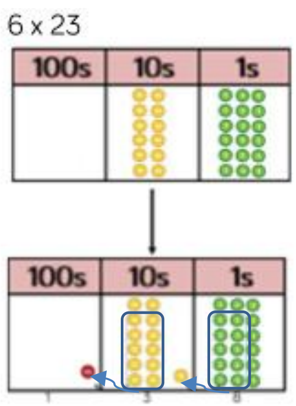
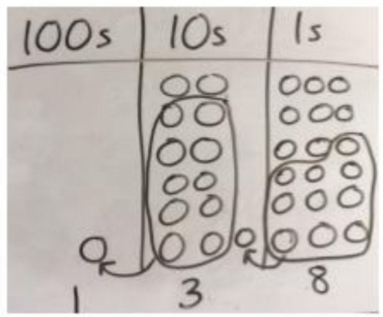
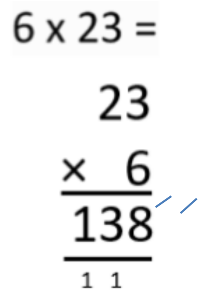
TO – O and TO – TO without exchanging Stem sentences: *The ones column represents..one(s) minus ..one(s) is equal to … ones.* *The tens column represents…ten(s) minus…ten(s) is equal to … tens.*	Children represent TO-O using base 10. Children can move onto using place value counters. e.g. 48 - 7 	Children show the base 10 pictorially. 	Children complete calculations mentally (no exchange). 46 – 13 = 39 – 5 =
Subtraction with exchanging Stem sentence: *We must exchange …ten for…ones.*	Children use base 10 to show subtraction calculations where exchanging needed. e.g. 41 – 26 	Represent the base 10 pictorially- remember to show the exchange. 	Formal column method. Children must understand that when they have exchanged the 10 they still have 41 because 41 = 30 + 11 
Column method	Children use place value counters to show what happens when subtracting using the column method. 	Represent the place value counters pictorially remembering to show what has been exchanged. 	Formal column method. Children must understand what has happened when they have crossed out digits. 

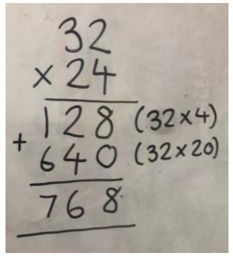
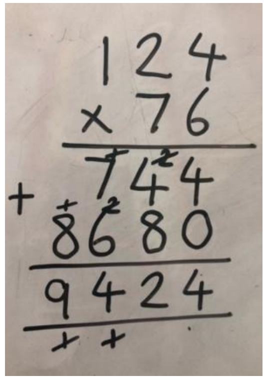
Conceptual variation e.g. different ways to ask children to solve 391-186			
	☐ = 391 - 186 391 -186 ____ What is 186 less than 391?	Missing digit calculations 	Raj spent £391, Timmy spent £186. How much more did Raj spend? Calculate the difference between 391 and 186.

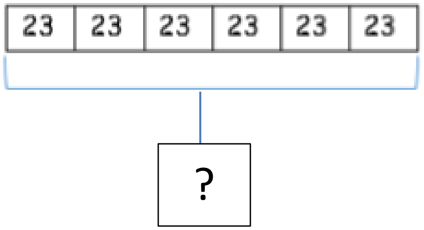
Multiplication	**Concrete** →	**Pictorial** →	**Abstract**
Repeated grouping/ repeated addition	Using objects to show repeated grouping and addition. 3 × 4 4 + 4 + 4 There are 3 equal groups, with 4 in each group. 	Children represent the practical resources in a picture and a bar model. 	3 x 4 = 12 4 + 4 + 4 = 12
Number lines	Children use objects on a number line to show repeated groups. e.g. Numicon on a number line e.g. 3 x 4 (is the same as 4 + 4 + 4) 3 × 4 	Represent this pictorially alongside a number line. 	Abstract number line showing three jumps of four. 3 x 4 = 12 
Use arrays to show commutativity Stem sentences: *There are… rows of ….; altogether there are…* *We have… groups of…*	Children to use counters and other objects to show arrays. 2 x 5 = 5 x 2  2 lots of 5 5 lots of 2	Children to represent the arrays pictorially or using dot paper.  	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

<table>
<tr>
<td>There are…columns of…; altogether there are…</td>
<td>
</td>
<td>Children to use blank arrays to show more complex multiplications. This supports mental methods of multiplication.

</td>
<td></td>
</tr>
<tr>
<td>Partition to multiply using base 10 or place value counters.</td>
<td>Partition to multiply using base 10 or place value counters.
e.g. 24 x 4


16 x 4

</td>
<td>Children to represent the concrete manipulatives pictorially.

</td>
<td>Children to be encouraged to show the steps they have taken.

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

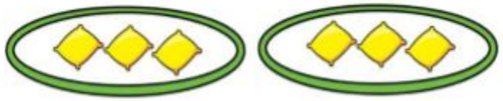
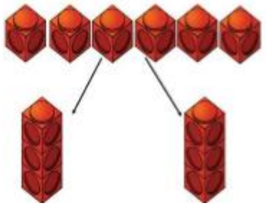
Multiplying TO X O Stem sentences: *The factors are … and …* *The product is…*	Representing the multiplication using place value counters (base 10 can also be used). e.g. 3 x 23  	Children represent the counters pictorially.  	 Children should **begin** to look at this as a formal method but should be aware that mental methods should be used when possible. 23 x 3 69
Formal column method Stem sentences: *The factors are … and …* *The product is…*	Children to represent a formal column method with place value counters.  	Children to represent the counters/ base 10 pictorially.  	Formal written method. Exchanged digits should be written beneath the calculation. These should be crossed out when they are added so they are not forgotten. 

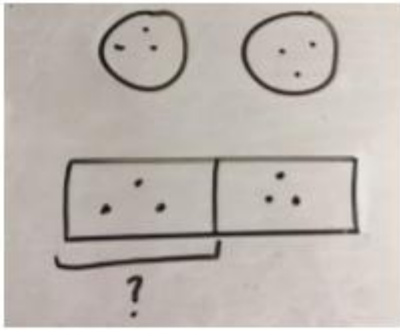
			Children then begin to learn long multiplication. First with notations alongside.  Once they are secure with this, they can multiply without writing the partitioned calculation alongside. Exchanged digits should be added to each row of the calculation as shown below. Exchanged digits should be crossed out once they have been added. 

Conceptual variation e.g. different ways to ask children to solve 6 x 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 $\begin{array}{r} 6 \\ \times\ 23 \\ \hline \\ \hline \end{array}$ $\quad$ $\begin{array}{r} 23 \\ \times\ 6 \\ \hline \\ \hline \end{array}$	What is the calculation? What is the product? 

<table>
<tr><th>Division</th><th>Concrete →</th><th>Pictorial →</th><th>Abstract</th></tr>
<tr>
<td>Sharing objects into groups.
6 ÷ 2

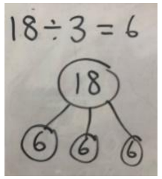
Sentence stem:
divided into groups of…</td>
<td>Sharing equally using a range of objects.
6 ÷ 2


</td>
<td>Represent the equal sharing pictorially.


</td>
<td>6 ÷ 2
| 3 | 3 |

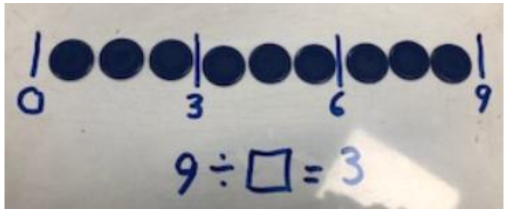
Children should also be encouraged to use their 2 times table facts.

Part whole models are also used to show division as sharing.

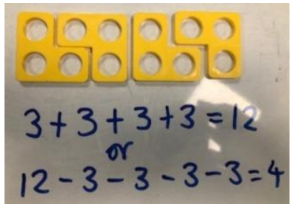

</td>
</tr>
<tr>
<td>Division as grouping.

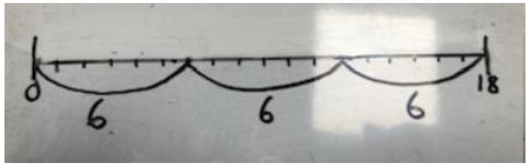
Sentence stems: …is divided into groups of…There are … groups.</td>
<td>Repeated addition or subtraction

e.g. counting up or down in groups of 3, to find how many 3s in 9.

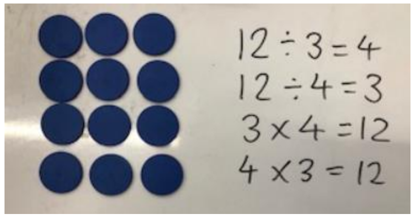
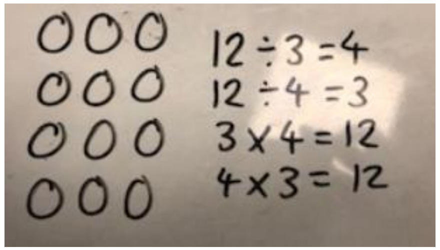
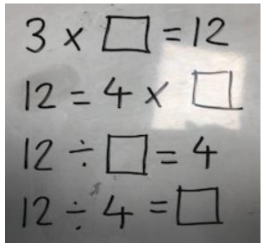


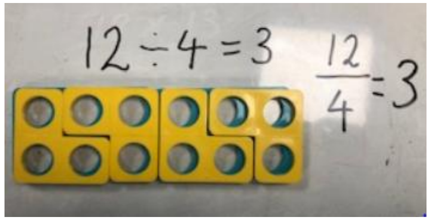
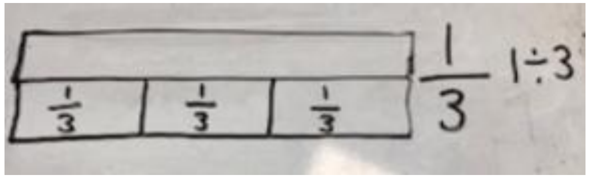
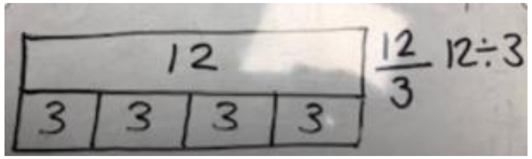
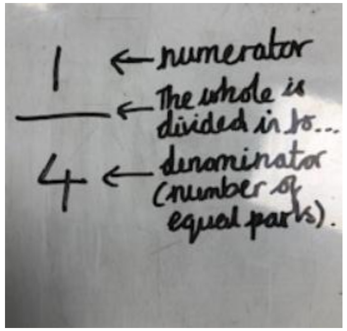
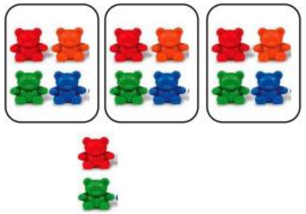
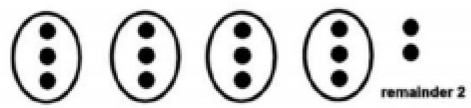
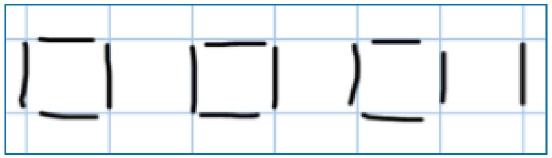
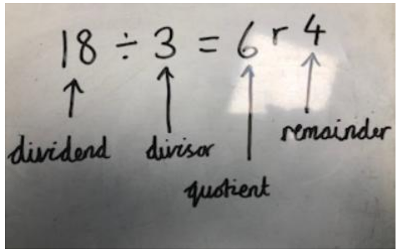
Using Numicon, to see division as repeated addition/subtraction.

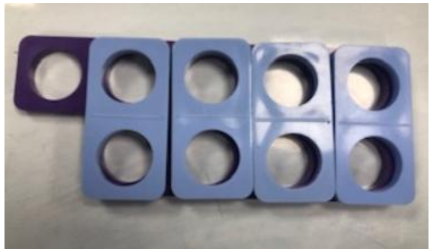
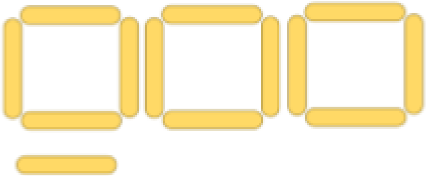
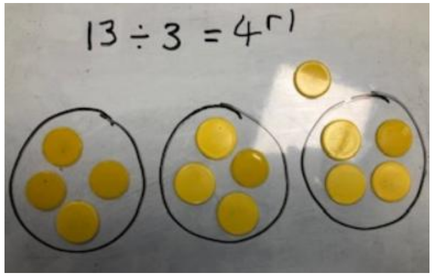
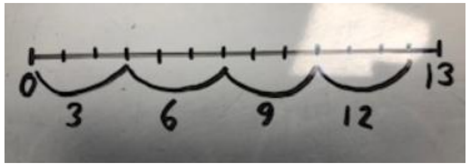

</td>
<td>Using a number line to work out the number of groups of 6 in 18.

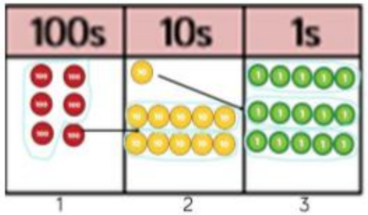
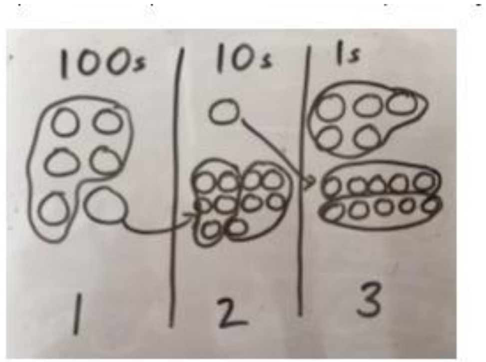
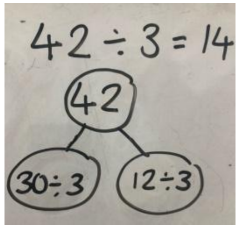
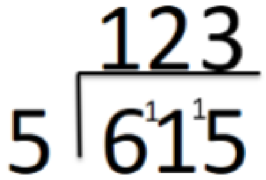
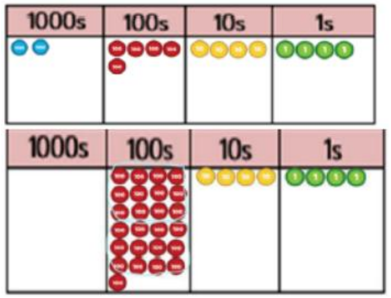
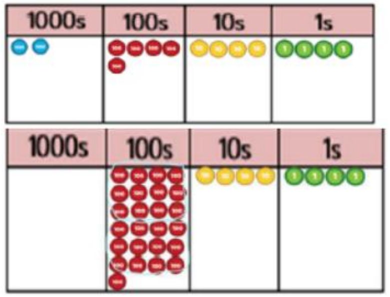
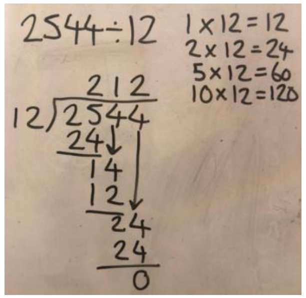

</td>
<td>Application of grouping to word problems:

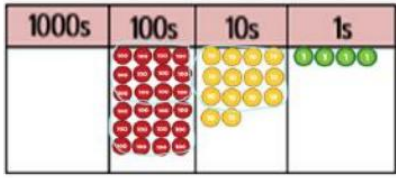
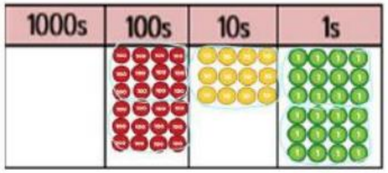
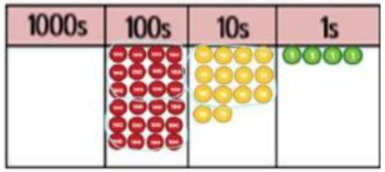
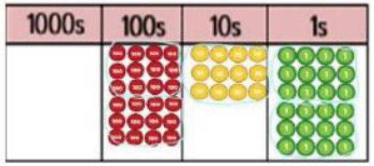
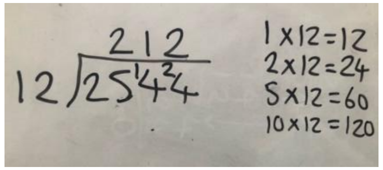
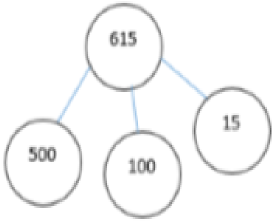
A teacher needs 28 pens for a writing activity. Pens come in packs of 7. How many packs does she need to get?</td>
</tr>
</table>

	Using Cuisenaire rods alongside a ruler to show how many groups of 3 in 15.  Using Cuisenaire rods to show how many groups of 4 there are in 20. 		
Division as arrays. Sentence stem: *… put into …rows, makes … columns.*	Using arrays to show a link between multiplication and division. 	Drawing arrays to show the connection between multiplication and division. 	Create linked multiplication and division statements using the inverse method. 

Division linked to fractions. Stem sentence: *The whole has been divided into…equal parts and we have…of them.*	Using concrete resources to show that a whole divided into 2 equal parts is $\frac{1}{2}$  Our whole is 12. It has been divided into 4 equal groups. Each of these groups is a quarter. 	Using bar models to highlight the connection between division and fractions. The whole has been divided into 3 equal parts. Each part is a third.  The whole is 12. It has been divided into 4 equal parts. Each of these groups is a quarter. 	Children can confidently discuss the connection between division and fractions. 
Division with a remainder. Sentence stems: *…is divided into groups of…. There are … groups and a remainder of…* *The dividend is…* *The divisor is…* *The quotient is…* *The remainder is…*	Dividing objects between different groups and see how much is left over. 14 ÷ 3 = 4 r 2 	This can then be represented pictorially by grouping the dots and showing the remainder.  	

	Dividing with remainders using Numicon.  Lollipop sticks can also be used to show remainders.  There are 3 whole squares, with 1 left over. Dividing using counters.  	This can also be shown using a number line.  	

Short division Sentence stems: *The dividend is…* *The divisor is…* *The quotient is…* *The remainder is…*	Children use place value counters alongside a bus stop method so the children can compare the formal method to the concrete manipulations.  1) Make 615 with place value counters. 2) How many groups of 5 hundreds can you make with 6 hundred counters? 3) Exchange 1 hundred for 10 tens. 4) How many groups of 5 tens can you make with 11 ten counters? 5) Exchange 1 ten for 10 ones. 6) How many groups of 5 ones can you make with 15 ones?	Represent the place value counters pictorially.  	Children can use partitioning to divide mentally.  Before moving onto a written method of short division. 
Long division *The dividend is…* *The divisor is…* *The quotient is…* *The remainder is…*	A teacher may demonstrate this process using place value counters to show long division. e.g. 2544 ÷ 12  	The counters can be represented pictorially.  	When secure with short division, children can move onto long division. They should write out a list of key multiples before completing the division. 

	 	 	Some children may prefer to use the method shown below. 
Conceptual variation e.g. 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?