Etwall Primary School Calculation Policy
(Adapted from White Rose Maths)

This policy supports the White Rose maths (Y1-6) and Power Maths (EYFS) schemes used throughout the school. Progression within each area of calculation is in line with the programme of study in the 2014 National Curriculum. This calculation policy should be used to support children to develop a deep understanding of number and calculation. This policy has been designed to teach children through the use of concrete, pictorial and abstract representations.

Concrete representation— a pupil is first introduced to an idea or skill by acting it out with real objects. This is a 'hands on' component using real objects and is a foundation for conceptual understanding.

Pictorial representation – a pupil has sufficiently understood the 'hands on' experiences performed and can now relate them to representations, such as a diagram or picture of the problem.

Abstract representation—a pupil is now capable of representing problems by using mathematical notation, for example 12 x 2 = 24.

It is important that conceptual understanding, supported by the use of representation, is secure for all procedures. Reinforcement is achieved by going back and forth between these representations.

Our long-term aim is for children to be able to select an efficient method (whether this be mental or written) that is appropriate for a given task. They will do this by always asking themselves:

'Can I do this in my head?'

'Can I do this in my head using drawings or jottings?'

'Do I need to use a pencil and paper procedure?'

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	EYFS/Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Addition	Combining two parts to make a whole: part whole model. Starting at the bigger number and counting on. Regrouping to make 10 using ten frame.	Adding three single digits. Use of base 10 to combine two numbers.	Column method- regrouping. Using place value counters (up to 3 digits).	Column method- regrouping. (up to 4 digits)	Column method- regrouping. Use of place value counters for adding decimals.	Column method- regrouping. Abstract methods. Place value counters to be used for adding decimal numbers.
Subtraction	Taking away ones Counting back Find the difference Part whole model Make 10 using the ten frame	Counting back Find the difference Part whole model Make 10 Use of base 10	Column method with regrouping. (up to 3 digits using place value counters)	Column method with regrouping. (up to 4 digits)	Column method with regrouping. Abstract for whole numbers. Start with place value counters for decimals- with the same amount of decimal places.	Column method with regrouping. Abstract methods. Place value counters for decimals- with different amounts of decimal places.

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	EYFS/Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Multiplication	Recognising and making equal groups. Doubling Counting in multiples Use cubes, Numicon and other objects in the classroom	Arrays- showing commutative multiplication	Arrays 2d × 1d using base 10	Column multiplication- introduced with place value counters. (2 and 3 digit multiplied by 1 digit)	Column multiplication Abstract only but might need a repeat of year 4 first(up to 4 digit numbers multiplied by 1 or 2 digits)	Column multiplication Abstract methods (multi-digit up to 4 digits by a 2 digit number)
Division	Sharing objects into groups Division as grouping e.g. I have 12 sweets and put them in groups of 3, how many groups? Use cubes and draw round 3 cubes at a time.	Division as grouping Division within arrays- linking to multiplication Repeated subtraction	Division with a remainder-using lollipop sticks, times tables facts and repeated subtraction. 2d divided by 1d using base 10 or place value counters	Division with a remainder Short division (up to 3 digits by 1 digit- concrete and pictorial)	Short division (up to 4 digits by a 1 digit number including remainders)	Short division Long division with place value counters (up to 4 digits by a 2 digit number) Children should exchange into the tenths and hundredths column too

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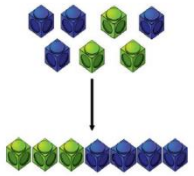
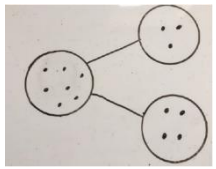
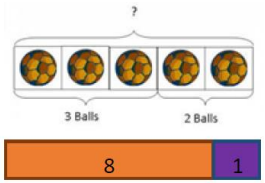
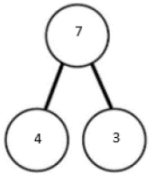
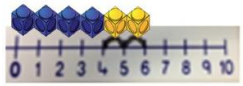
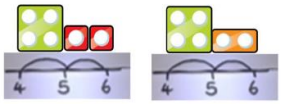
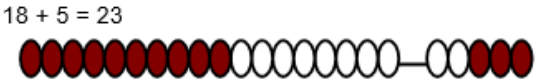
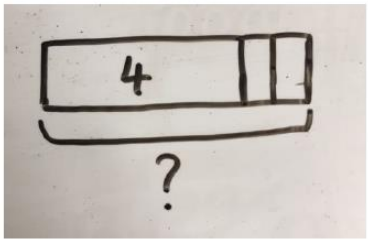
Addition

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

	Concrete	Pictorial	Abstract
Combining two parts to make a whole: Part Whole Model	use other resources too e.g. shells, teddy bears, cars 	Children to represent the cubes using dots or crosses. They could put each part on a part whole model too.   Use pictures to add two numbers together as a group or in a bar.	4 + 3 = 7 Four is a part, 3 is a part and the whole is seven.  Ensure calculations are also done where the answer is in different places. E.g  = 4 + 3
Starting at the bigger number and counting on. Counting on using number lines	Use cubes or numicon.   	A bar model which encourages the children to count on, rather than count all. 	The abstract number line: What is 2 more than 4? What is the sum of 2 and 4? What is the total of 4 and 2? 4 + 2 

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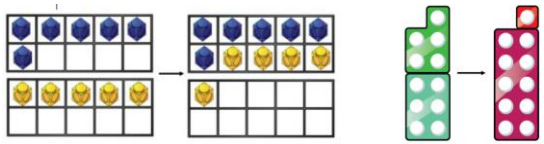
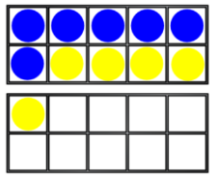
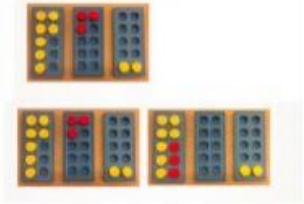
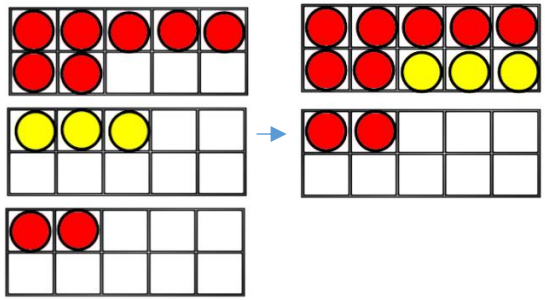
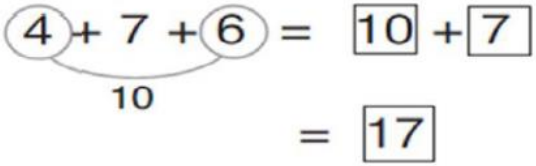
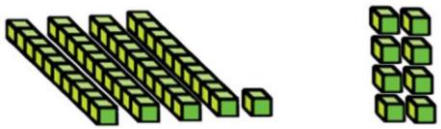
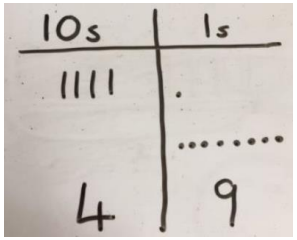
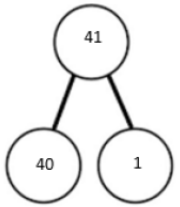
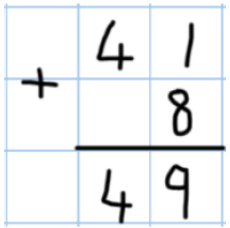
Regrouping to make 10 using ten frame. *This is an essential skill for column addition later.*	Using ten frames and counters/cubes or using Numicon. 6 + 5 	Children to draw the ten frame and counters/cubes. 	Children to develop an understanding of equality e.g. $6 + \square = 11$ $6 + 5 = 5 + \square$ $6 + 5 = \square + 4$
Adding three single digits.	Using ten frames and counters/cubes or using numicon. 7+3+2 = leads to 10 + 2 = 	Children to draw the ten frame and counters/cubes. 7 + 3 + 2 = 12 	Combine the two numbers that make or bridge 10 and then add on the third number. 
Use of base 10 to combine two numbers. TO + O using base 10.	Continue to develop understanding of partitioning and place value. 41 + 8 	Children to represent the base 10 e.g. lines for tens and dot/crosses for ones. 	41 + 8  1 + 8 = 9 40 + 9 = 49 

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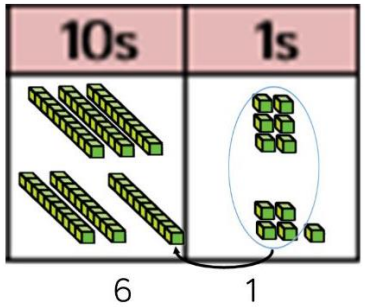
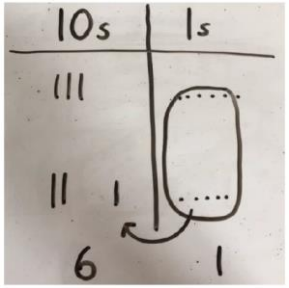
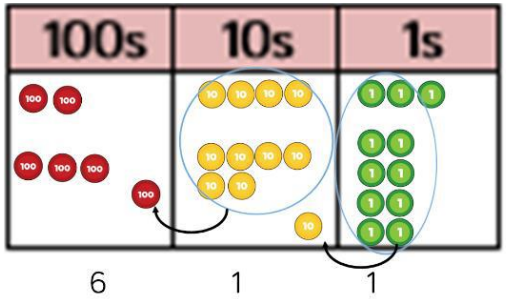
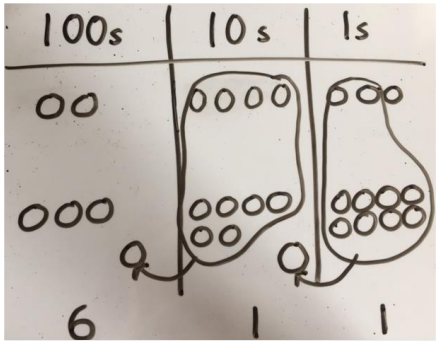
Column method- regrouping. e.g. TO + TO using base 10.	Continue to develop understanding of partitioning and place value using Dienes or Place Value counters. 36 + 25  	Children to represent the base 10 in a place value chart.  	**Partitioning** 36 + 25 = 30 + 6 = 20 + 5 50 + 11 = 61 **Formal Method** 1 3 6 + 2 5 6 1
Column method- regrouping. e.g. Use of place value counters to add HTO + TO, HTO + HTO etc. Use of place value counters for adding decimals.	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. 243 + 368  	Children to represent the counters in a place value chart, circling when they make an exchange.  	**Partitioning if needed** 243 + 368 = 200 + 40 + 3 300 + 60 + 8 500 + 100 + 11 = 611 **Formal Method** 1 1 2 4 3 + 3 6 8 6 1 1

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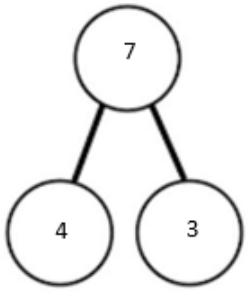
Conceptual variation; different ways to ask children to solve 21 + 34



?	
21	34

Word problems:

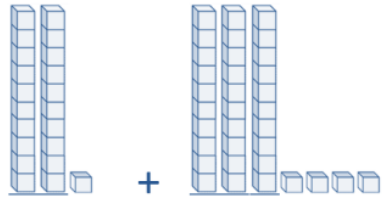
In year 3, there are 21 children and in year 4, there are 34 children.
How many children in total?

21 + 34 = 55. Prove it

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

21 + 34 =

$\square$ = 21 + 34



Missing digit problems:

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

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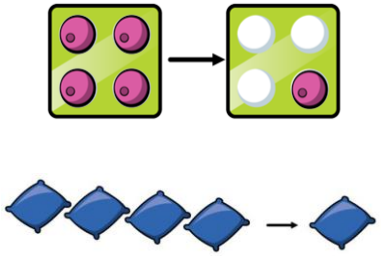
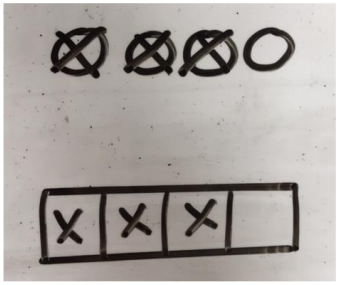
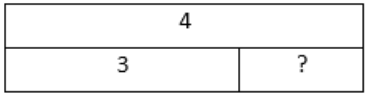
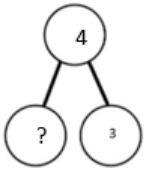
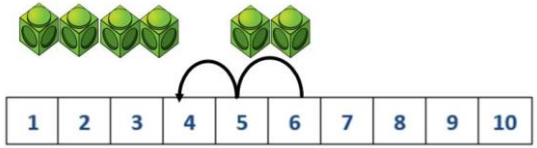
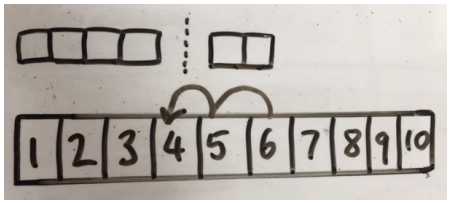
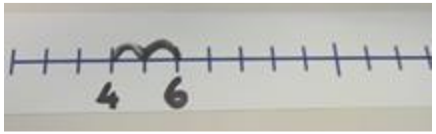
Subtraction

Key language: take away, less than, the difference, subtract, minus, fewer, decrease.

	Concrete	Pictorial	Abstract
Taking away ones Physically taking away and removing objects from a whole	Ten frames, Numicon, cubes and other items such as beanbags could be used. 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 - 1  
Counting back	Using number lines or number tracks Children start with 6 and count back 2. 6 – 2 = 4  	Children to represent what they see pictorially e.g. 	Children to represent the calculation on a number line or number track and show their jumps. Encourage children to use an empty number line  

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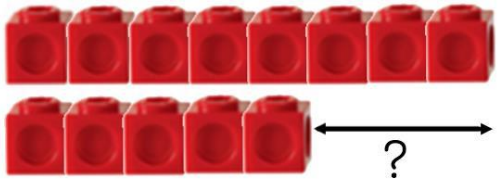
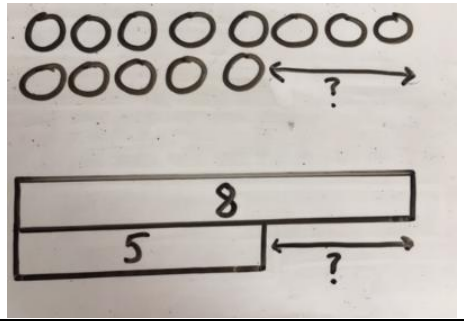
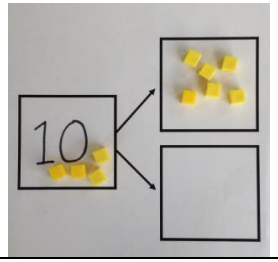
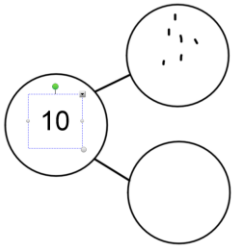
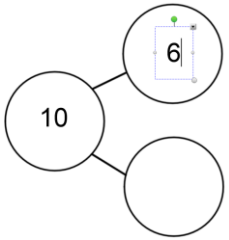
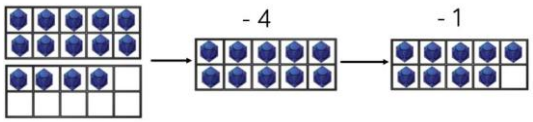
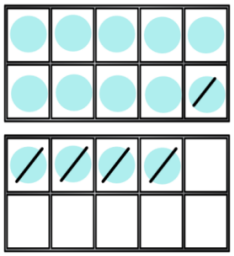
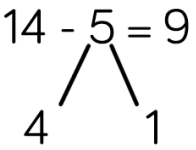
Finding the difference	Using cubes, Numicon or Cuisenaire rods, other objects can also be used. Calculate the difference between 8 and 5. 	Children to draw the cubes/other concrete objects which they have used or use the bar model to illustrate what they need to calculate. 	Find the difference between 8 and 5. 8 – 5, the difference is ☐ Children to explore why 9 - 6 = 8 – 5 = 7 – 4 have the same difference.
Part Whole model	Link to addition. Use PPW model to model the inverse. 	Children to draw the PPW model to illustrate what they need to calculate. 	Move to using numbers within the PPW model. 
Making 10 using the 10 frame	Using ten frames. 14 – 5 	Children to present the ten frame pictorially and discuss what they did to make 10. 14-5 	Children to show how they can make 10 by partitioning the subtraction.  14 – 4 = 10 10 – 1 = 9

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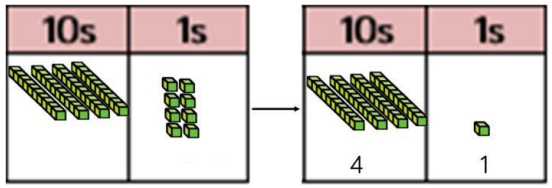
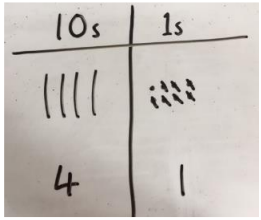
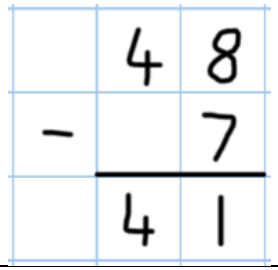
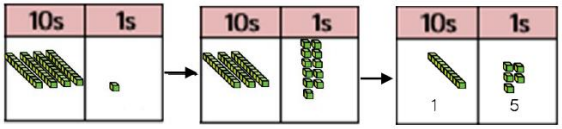
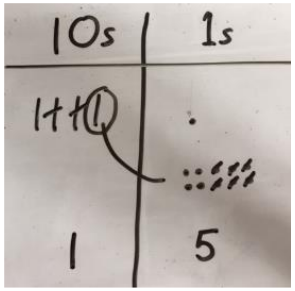
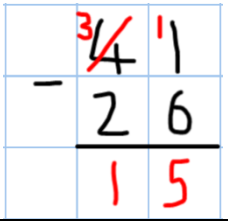
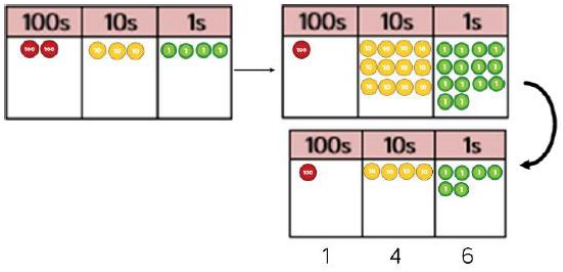
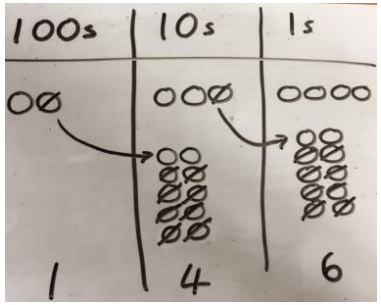
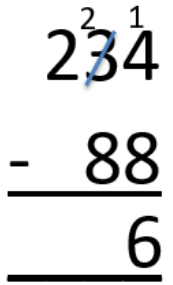
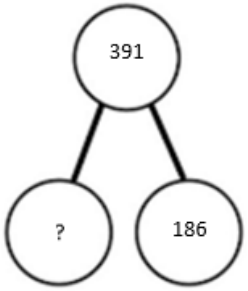
Column method using base 10.	48 – 7 	Children to represent the base 10 pictorially. 	Column method or children could count back 7. 
Column method with regrouping using base 10 and having to exchange.	41 – 26 = 	Represent the base 10 pictorially, remembering to show the exchange. 	**Formal column method.** Children must understand that when they have exchanged the 10 they still have 41 because 41 = 30 + 11. 
Column method with regrouping using place value counters.	234 – 88 	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. 

Etwall Primary School Calculation Policy
(Adapted from White Rose Maths)

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



391	
186	?

Raj spent £391, Timmy spent £186.

How much more did Raj spend?

Calculate the difference between 391 and 186.

□ = 391 – 186

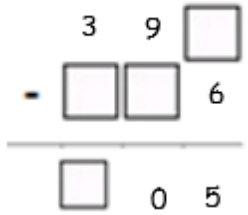
391

-186

———

What is 186 less than 391?

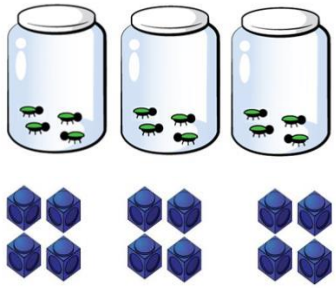
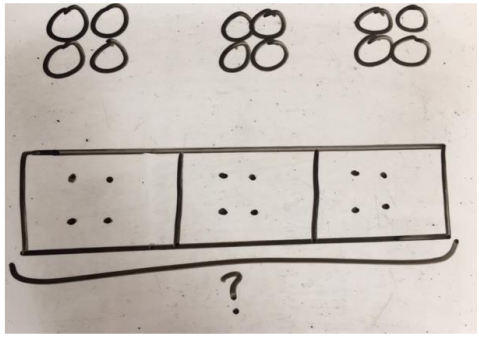
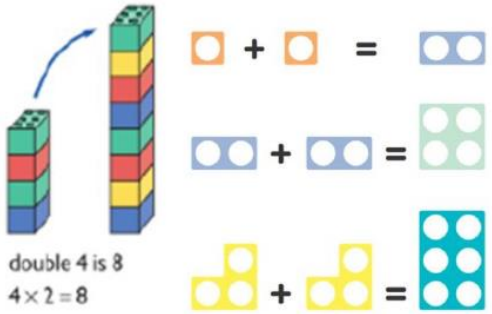
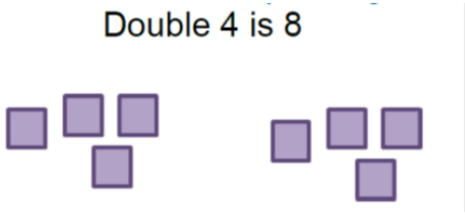
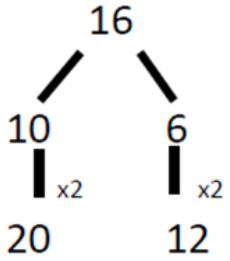
Missing digit calculations



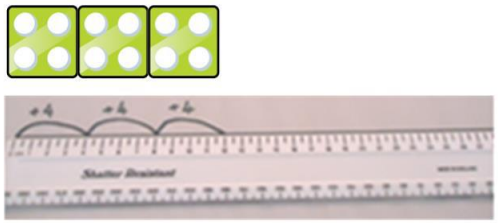
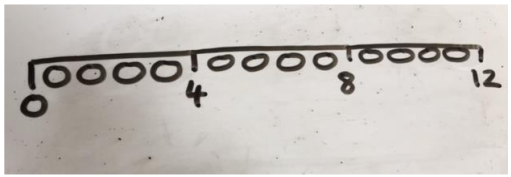
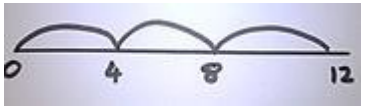
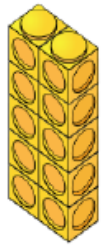
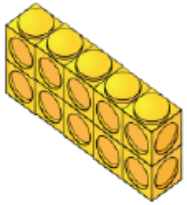
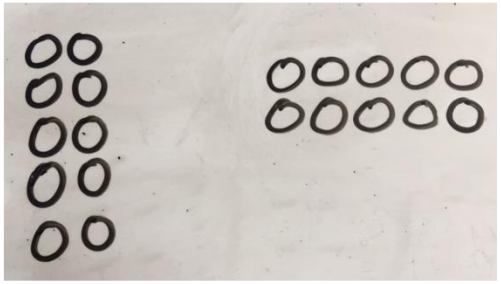
Etwall Primary School Calculation Policy
(Adapted from White Rose Maths)

Multiplication

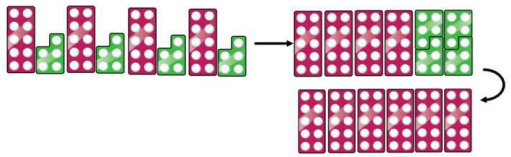
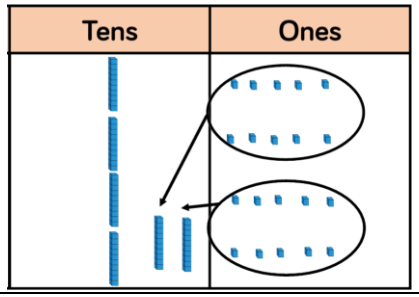
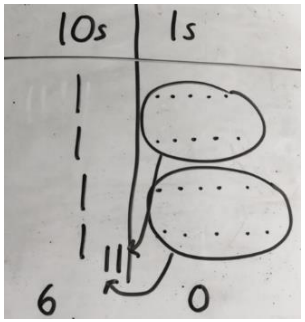
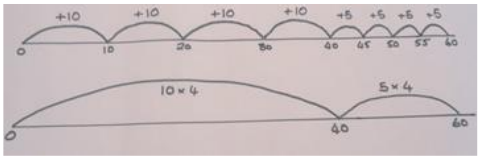
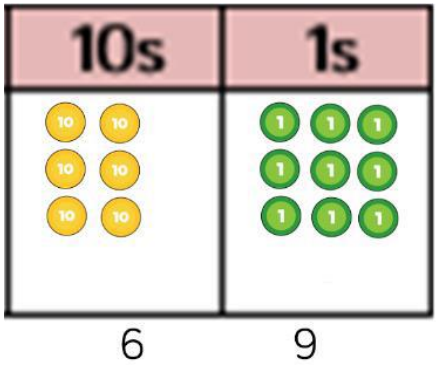
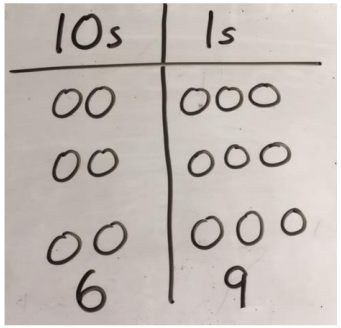
Key language: double, times, multiplied by, the product of, groups of, lots of, equal groups.

	Concrete	Pictorial	Abstract
Recognising and making equal groups Repeated grouping/repeated addition	3 × 4 4 + 4 + 4 There are 3 equal groups, with 4 in each group. 	Children to represent the practical resources in a picture and use a bar model. 	3 × 4 = 12 4 + 4 + 4 = 12
Doubling	Use practical activities using manip-ultives including cubes and Numicon to demonstrate doubling 	Children draw pictures to show how to double numbers 	Partition a number and then double each part before recombining it back together.  = 34

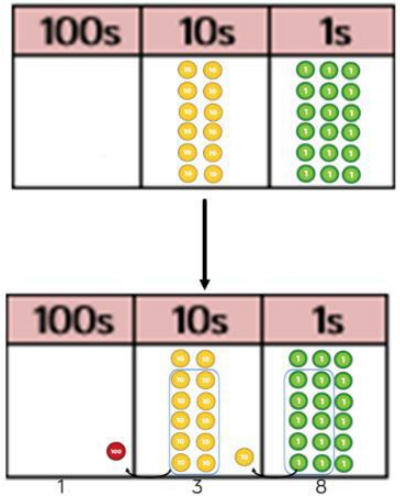
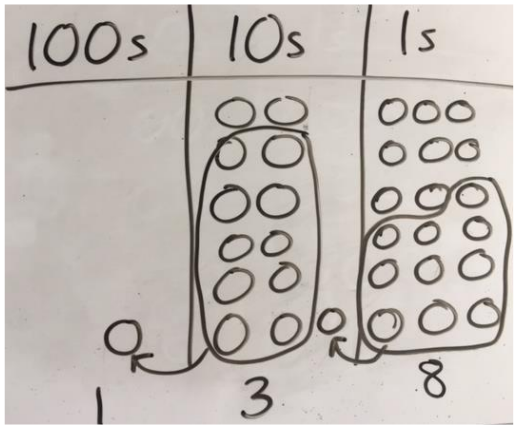
Etwall Primary School Calculation Policy
(Adapted from White Rose Maths)

Counting in multiples. Number lines to show repeated groups-	3 × 4 	Represent this pictorially alongside a number line e.g.: 	Abstract number line showing three jumps of four. 3 × 4 = 12 
Use arrays to illustrate commutativity	Counters and other objects can also be used. 2 × 5 = 5 × 2  2 lots of 5  5 lots of 2	Children to represent the arrays pictorially. 	Children to be able to use an array to write a range of calculations e.g. 10 = 2 × 5 5 × 2 = 10 2 + 2 + 2 + 2 + 2 = 10 10 = 5 + 5

Etwall Primary School Calculation Policy
(Adapted from White Rose Maths)

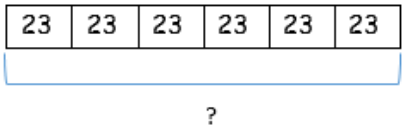
2d × 1d using base 10 Partition to multiply	Using Numicon, base 10 or Cuisenaire rods. 4 × 15  	Children to represent the concrete manipulatives pictorially. 	Children to be encouraged to show the steps they have taken. 4 x 15 10 5 10 x 4 = 40 5 x 4 = 20 40 + 20 = 60 A number line can also be used 
Formal column method	with place value counters (base 10 can also be used.) 3 × 23 	Children to represent the counters pictorially. 	Children to record what it is they are doing to show understanding. **Expanded method** 3 x 23 = 3 x 20 = 60 3 x 3 = 9 60 + 9 = 69 **Formal written method** 23 x 3 69

Etwall Primary School Calculation Policy
(Adapted from White Rose Maths)

<table>
<tr>
<td>Formal column method</td>
<td>With place value counters.
6 x 23
 
</td>
<td>Children to represent the counters/base 10, pictorially e.g. the image below.
 
</td>
<td><u>Formal written method</u>
6 x 23 =
23
× 6
138
1 1</td>
</tr>
<tr>
<td>Formal Column Method</td>
<td colspan="2">When children start to multiply 3d × 3d and 4d × 2d etc., they should be confident with the abstract:
To get 744 children have solved 6 × 124.
To get 2480 they have solved 20 × 124.</td>
<td>1 2 4
× 2 6
7 4 4
1 2
2 4 8 0
3 2 2 4
1 1
Answer: 3224</td>
</tr>
</table>

Etwall Primary School Calculation Policy
(Adapted from White Rose Maths)

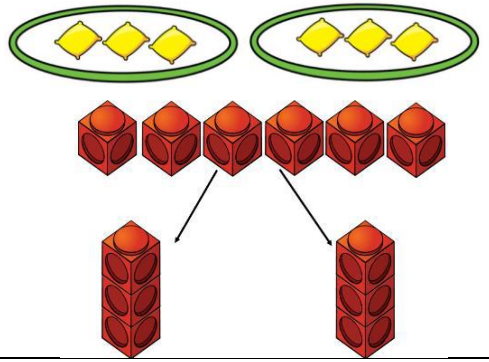
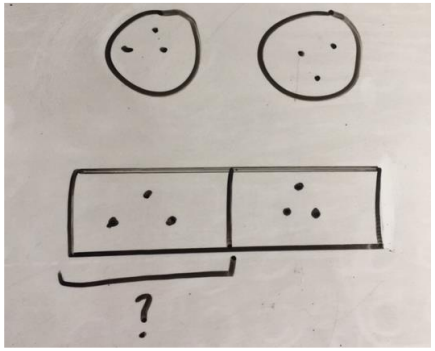
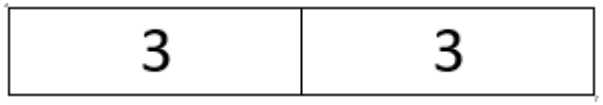
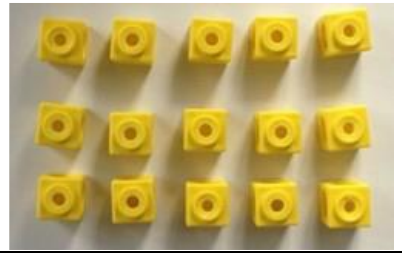
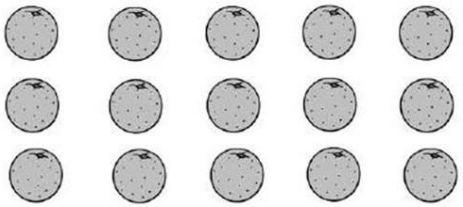
Conceptual variation; different ways to ask children to solve 6 × 23

	Mai had to swim 23 lengths, 6 times a week. How many lengths did she swim in one week? With the counters, prove that 6 x 23 = 138	Find the product of 6 and 23 6 × 23 = ☐ = 6 × 23 6 × 23 = ____ 23 × 6 = ____	What is the calculation? What is the product? 

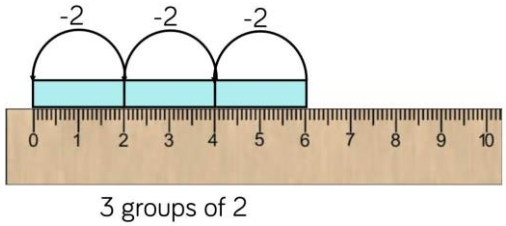
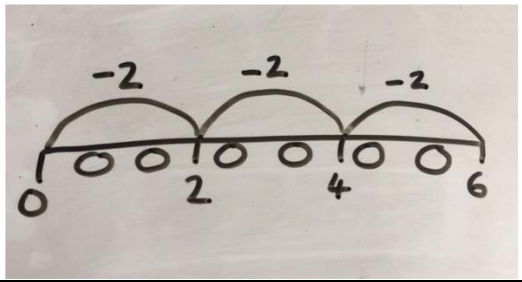
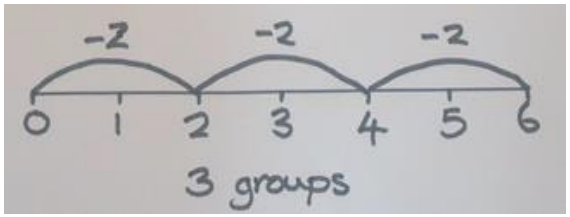
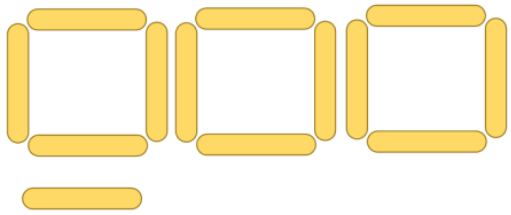
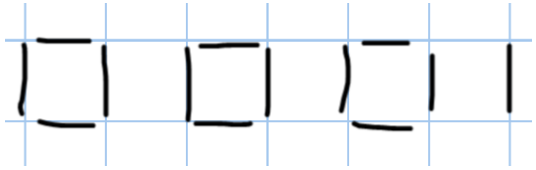
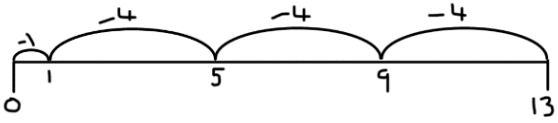
Etwall Primary School Calculation Policy
(Adapted from White Rose Maths)

Division

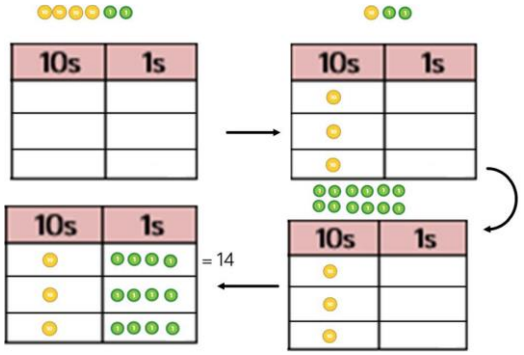
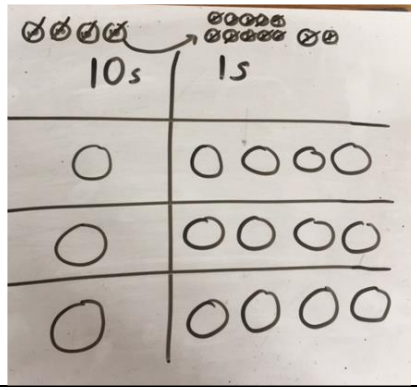
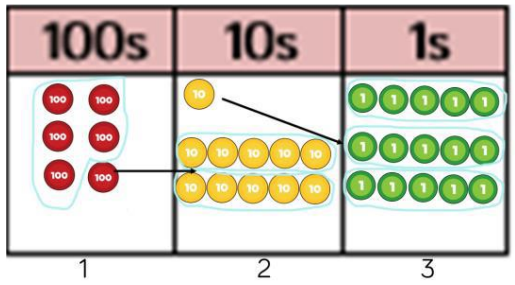
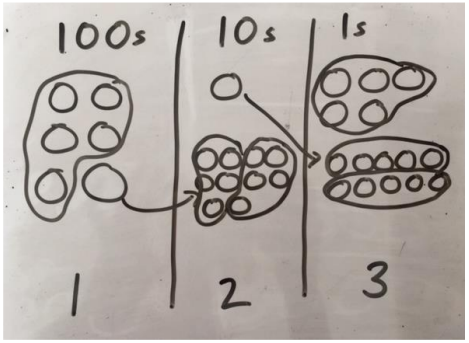
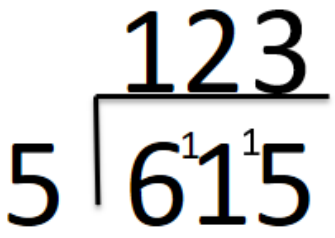
Key language: share, group, divide, divided by, half.

	Concrete	Pictorial	Abstract
Sharing	Using a range of resources. 6 ÷ 2 	Represent the sharing pictorially. 	6 ÷ 2 = 3  Children should also be encouraged to use their 2 times-tables facts.
Division with 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 eight linking number sentences. 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7 28 = 7 x 4 28 = 4 x 7 4 = 28 ÷ 7 7 = 28 ÷ 4

Etwall Primary School Calculation Policy
(Adapted from White Rose Maths)

Repeated subtraction	6 ÷ 2  3 groups of 2	Children to represent repeated subtraction pictorially.  	Abstract number line to represent the equal groups that have been subtracted. 
2d ÷ 1d with remainders	Using lollipop sticks. 13 ÷ 4 Use of lollipop sticks to form wholes- squares are made because we are dividing by 4.  There are 3 whole squares, with 1 left over.	Children to represent the lollipop sticks pictorially.  There are 3 whole squares, with 1 left over.	13 ÷ 4 = 3 remainder 1 Children should be encouraged to use their times table facts; they could also represent repeated addition on a number line. '3 groups of 4, with 1 left over' 

Etwall Primary School Calculation Policy
(Adapted from White Rose Maths)

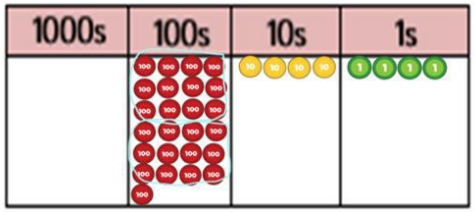
Sharing using place value counters.	42 ÷ 3 = 14 	Children to represent the place value counters pictorially. 	Children to be able to make sense of the place value counters and write calculations to show the process. 42 ÷ 3 42 = 30 + 12 30 ÷ 3 = 10 12 ÷ 3 = 4 10 + 4 = 14
Short division	Using place value counters to group. 615 ÷ 5  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 to the calculation using the short division scaffold. 

Long division

Using place value counters

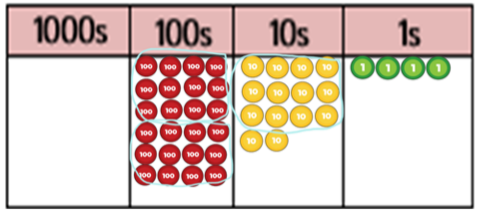
2544 ÷ 12

We can't group 2 thousands into groups of 12 so will exchange them.



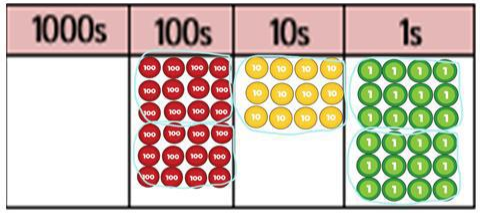
We can group 24 hundreds into groups of 12 which leaves with 1 hundred.

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



After exchanging the hundred, we have 14 tens. We can group 12 tens into a group of 12, which leaves 2 tens.

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



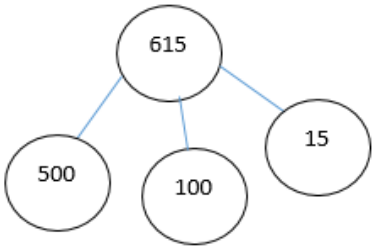
After exchanging the 2 tens, we have 24 ones. We can group 24 ones into 2 group of 12, which leaves no remainder.

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

Etwall Primary School Calculation Policy
(Adapted from White Rose Maths)

Conceptual variation; different ways to ask children to solve 615 ÷ 5

Using the part whole model below, how can you divide 615 by 5 without using short division?



I have £615 and share it equally between 5 bank accounts. How much will be in each account?

615 pupils need to be put into 5 groups. How many will be in each group?

$5\overline{)615}$

615 ÷ 5 =

☐ = 615 ÷ 5

What is the calculation?
What is the answer?