Brinscall St Johns C.E./

Methodist Primary School

Calculation Policy Document

Date of policy: September 2022
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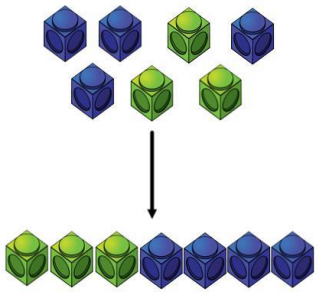
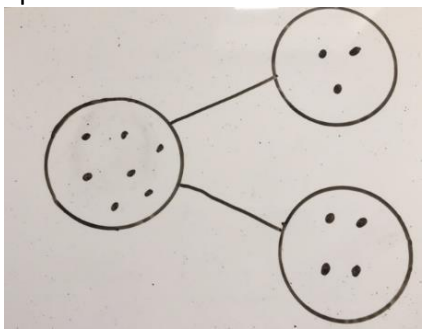
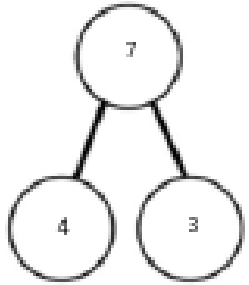
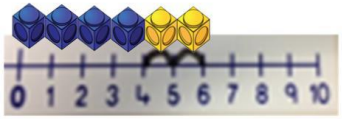
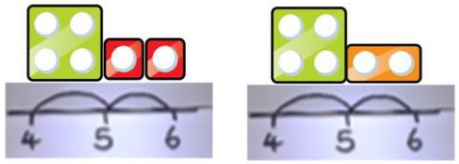
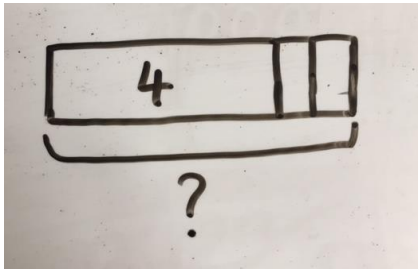
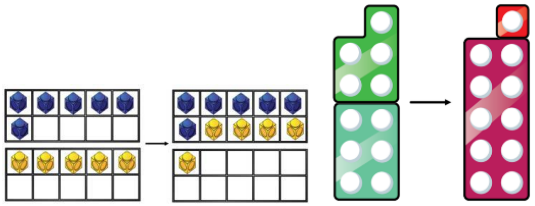
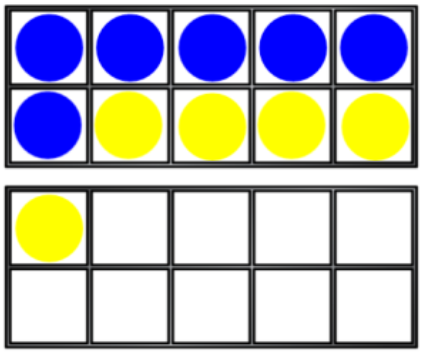
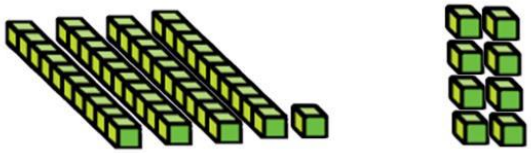
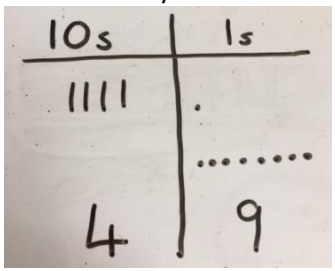
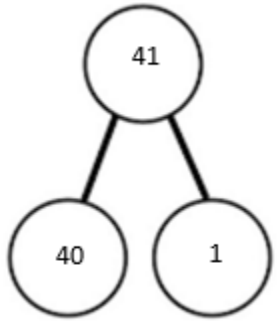
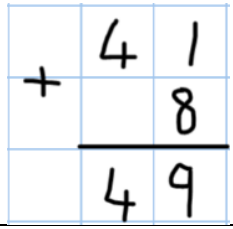
Review date: September 2024

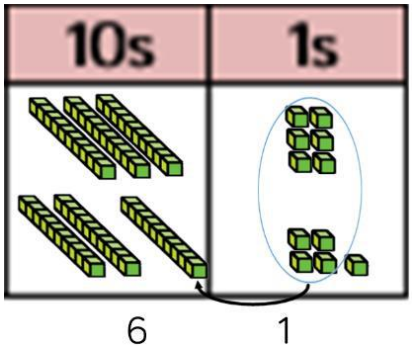
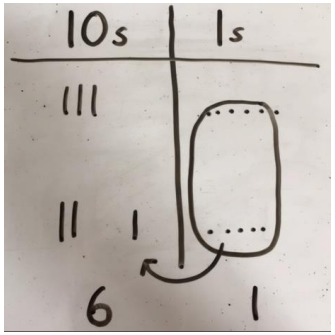
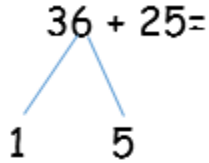
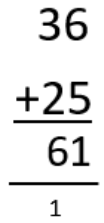
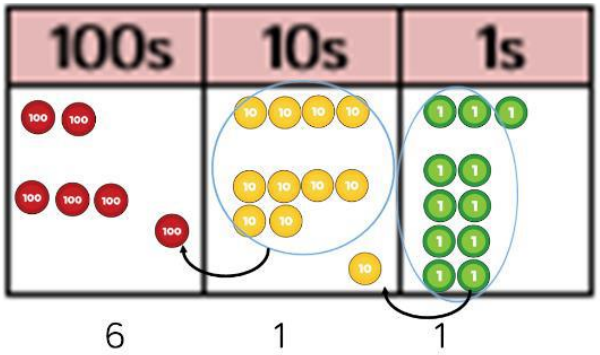
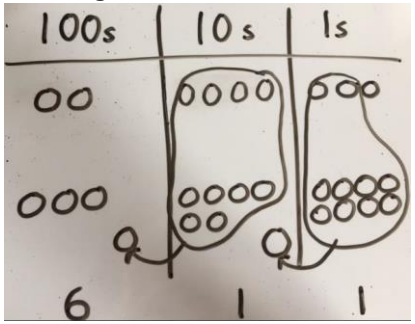
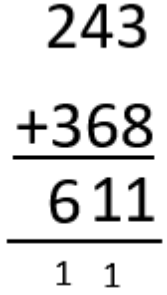
Mathematics at Brinscall St. John's is taught using the mastery approach based around the White Rose scheme of work. This scheme places value on depth and breadth of learning over mechanical repetition and mathematics is taught as a tool with which problems can be solved. The following calculation policy offers an idea of the ways that the four operations of addition, subtraction, multiplication and division will be taught to your child. Whilst there are some methods that will be used more heavily earlier or later in a child's journey through school, emphasis is placed on the flexibility of using different methods to approach a problem, and as such, some of the methods used in the younger year groups will still be revisited throughout school. The 'varied representation' section at the end of each method of operation gives an indication how this may occur.

To help all children to access calculations and to ensure that there is an understanding of the link between the numbers on the page and real-life objects, the progression in learning methods follows a model of concrete, pictorial and abstract representation. The concrete stage is the 'doing' stage, using real-life objects or physical representations to model problems. The pictorial stage is the 'seeing' stage, with visual representations used to model the problems. This is to encourage a mental connection between the physical objects the problem represents and the abstract pictures, diagrams or numbers that form the problem. The abstract stage is the 'symbolic' stage with numbers and symbols used to model problems. The below exemplification shows how the models can be used.

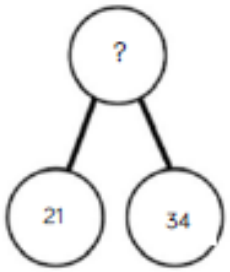
Addition

Year	Concrete	Pictorial	Abstract
EYFS/Y1	Combining two parts to make a whole (use other resources too e.g. eggs, shells, teddy bears, cars). 	Children to represent the cubes using dots or crosses. They could put each part on a part whole model too. 	4 + 3 = 7 Four is a part, 3 is a part and the whole is seven. 
Y1	Counting on using number lines using 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 

Y1/Y2	Regrouping to make 10; 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 + □ = 11 6 + 5 = 5 + □ 6 + 5 = □ + 4
Y2/Y3	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  

Y2/Y3	TO + TO using base 10. Continue to develop understanding of partitioning and place value. 36 + 25 	Children to represent the base 10 in a place value chart 	Looking for ways to make 10. 30 + 20 = 50 5 + 5 = 10 50 + 10 + 1 = 61  Formal method: 
Y3-6	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. 	Children to represent the counters in a place value chart, circling when they make an exchange. 	

The same calculation can be shown in a number of ways and children will be shown this through varied representation. For example, the calculation 21+ 34 could be shown as:



?	
21	34

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

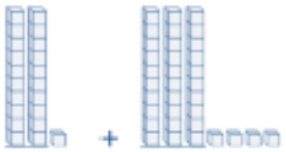
21 + 34 = 55. Prove it

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

21 + 34 =

$\square$ = 21 + 34

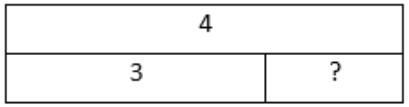
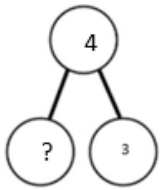
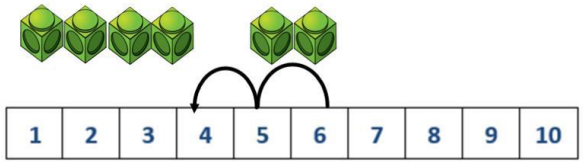
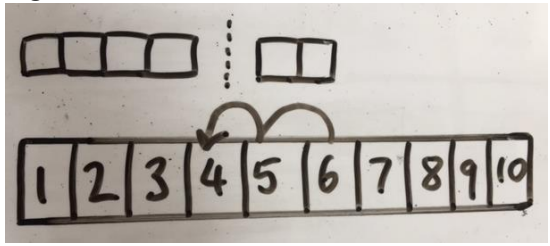
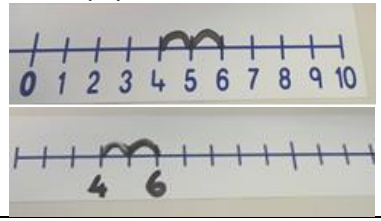
Calculate the sum of twenty-one and thirty-four.

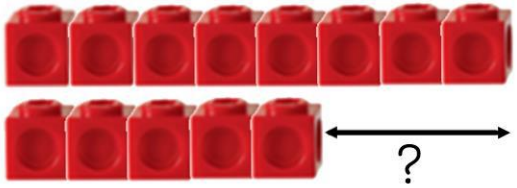
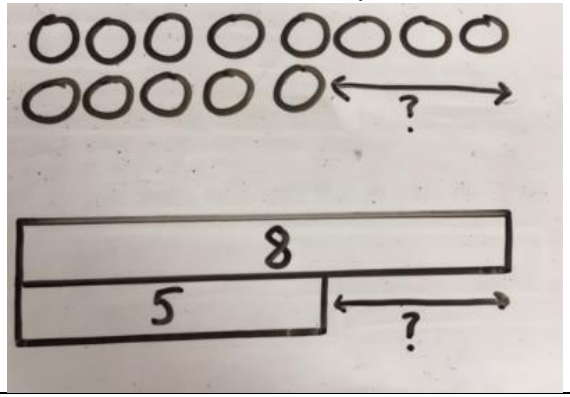
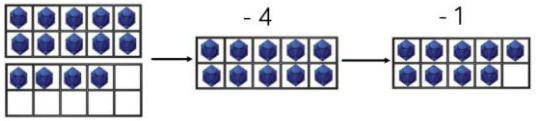
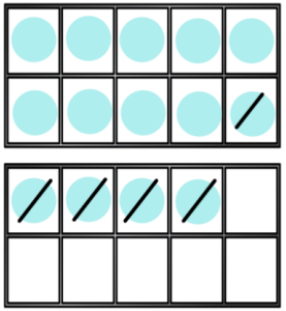
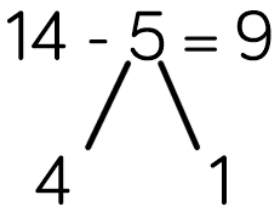


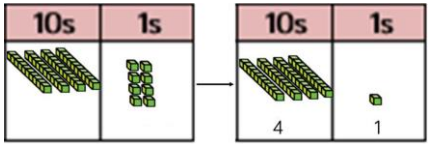
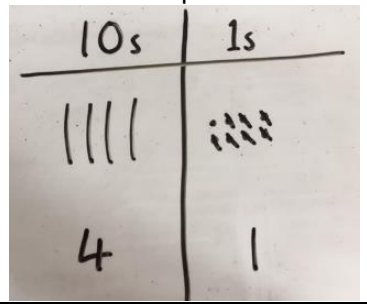
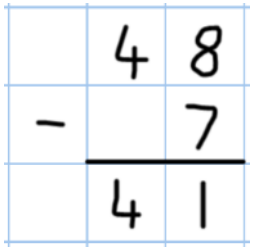
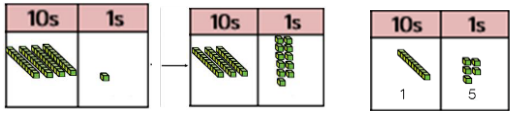
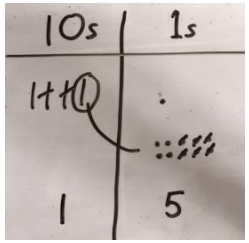
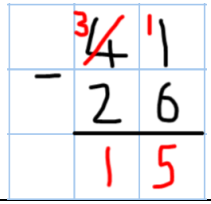
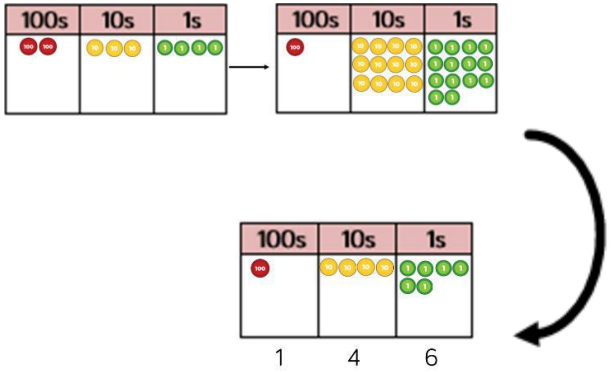
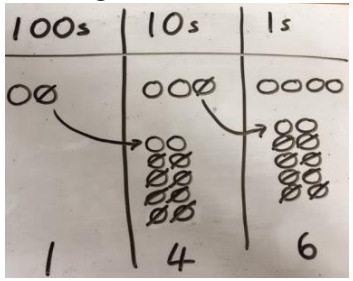
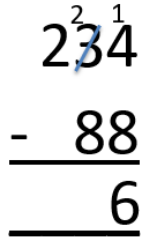
Missing digit problems:

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

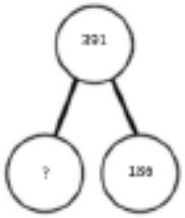
Subtraction

Year	Concrete	Pictorial	Abstract
EYFS/Y1	Physically taking away and removing objects from a whole (ten frames, Numicon, cubes and other items such as beanbags could be used).	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  
Y1	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 

Y1/Y2	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.
Y1/Y2	Making 10 using ten frames. 14 – 5 	Children to present the ten frame pictorially and discuss what they did to make 10. 	Children to show how they can make 10 by partitioning the subtrahend.  14 – 4 = 10 10 – 1 = 9

Y2/Y3	Column method using base 10. 48-7 	Children to represent the base 10 pictorially. 	Column method or children could count back 7. 
Y2-4	Column method 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. 
Y3-6	Column method 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. 

Varied representation will be used to encourage flexibility in methods. For example, 391 – 186 could be shown as:



391	
186	?

Raj spent £391, Timmy spent £186.
How much more did Raj spend?

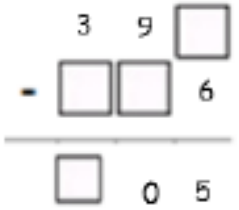
Calculate the difference between 391 and 186.

□ = 391 – 186

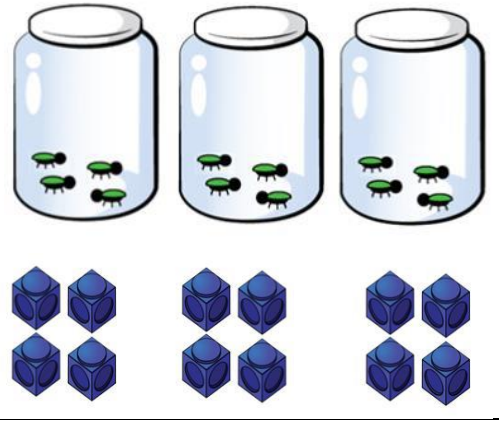
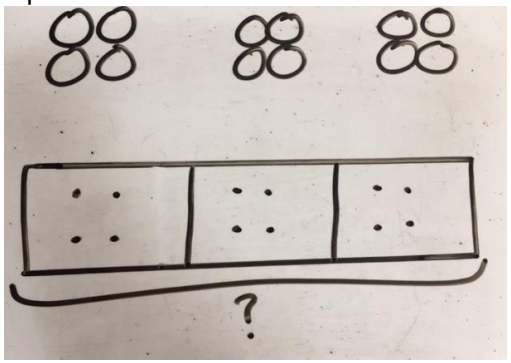
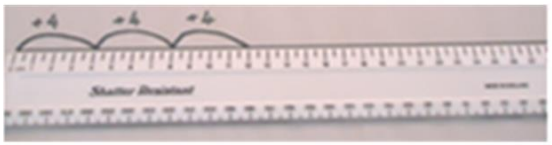
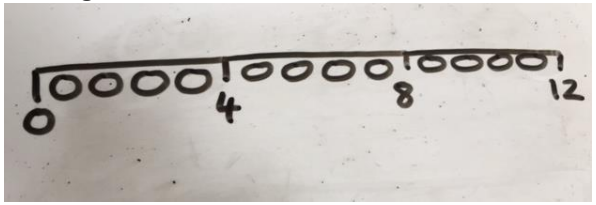
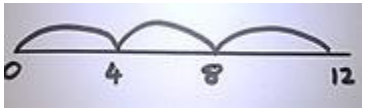
391
-186
___

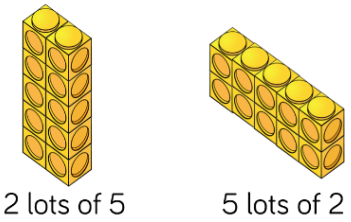
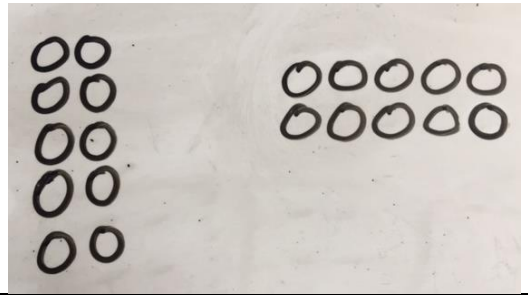
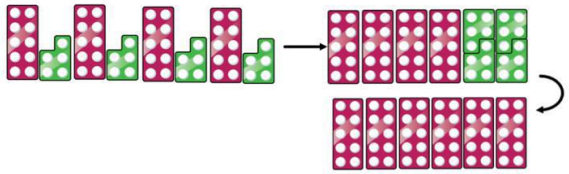
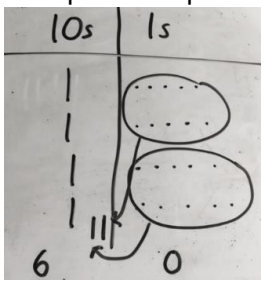
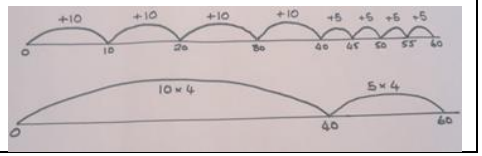
What is 186 less than 391?

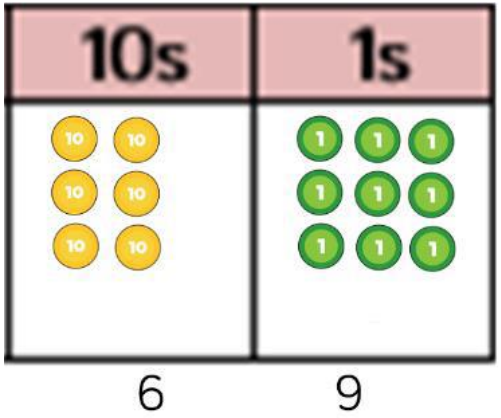
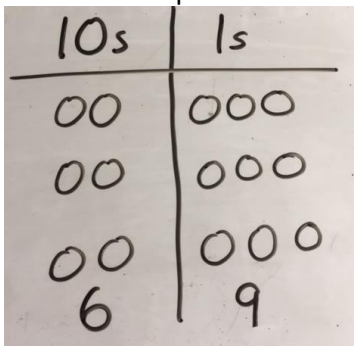
Missing digit calculations

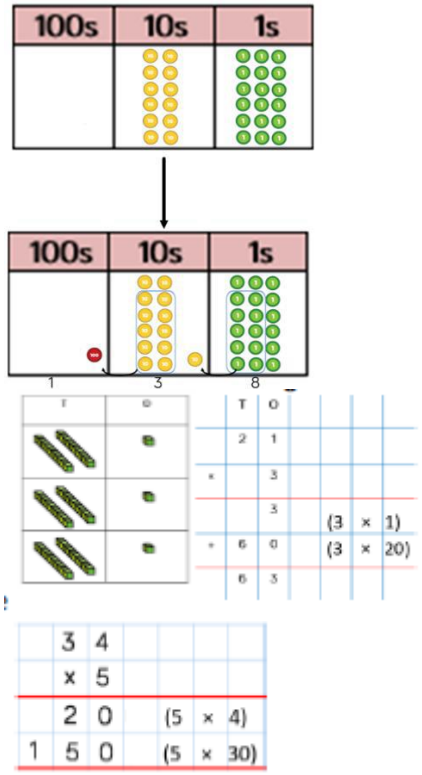
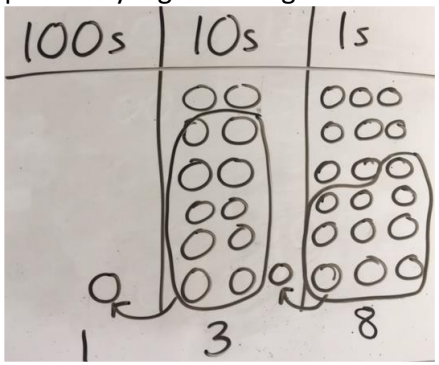


Multiplication

Year	Concrete	Pictorial	Abstract
Y1	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
Y1/Y2	Number lines to show repeated groups- 3 × 4   Cuisenaire rods can be used too.	Represent this pictorially alongside a number line e.g.: 	Abstract number line showing three jumps of four. 3 × 4 = 12 

Y2/Y3	Use arrays to illustrate commutativity counters and other objects can also be used. 2 × 5 = 5 × 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
Y2/Y3	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.  10 x 4 = 40 5 x 4 = 20 40 + 20 = 60 A number line can also be used 

Y3-5	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.

Y3-6	Formal column method with place value counters. 6 x 23  	Children to represent the counters/base 10, pictorially e.g. the image below.  	Formal written method 6 x 23 = 23 × 6 138 1 1

Y5-6	When children start to multiply 3 digits × 3 digits and 4 digits × 2 digits etc., they should be confident with the abstract: To get 744 children have solved 6 × 124. To get 2480 they have solved 20 × 124.	1 2 4 × 2 6 7 4 4 2 4 8 0 3 2 2 4 1 1 Answer: 3224

Varied representation will draw on multiple stages to represent the same problem in differing ways. For example, 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

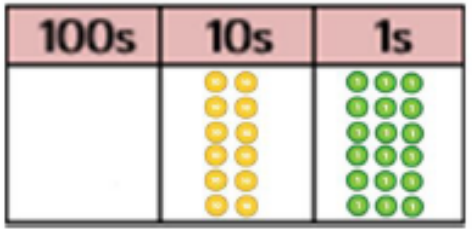
Find the product of 6 and 23

6 × 23 =

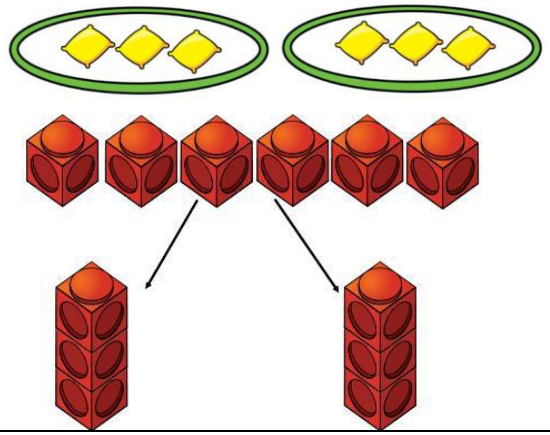
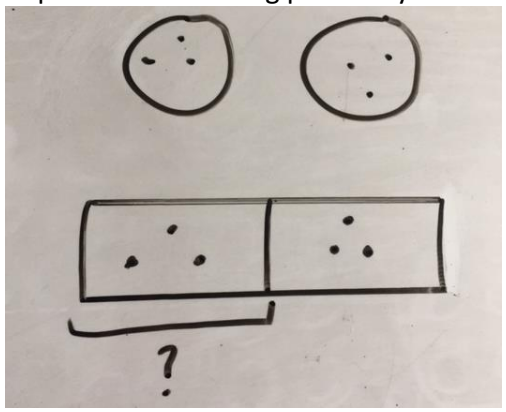
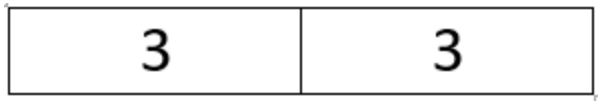
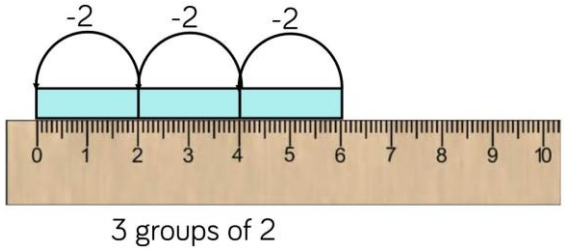
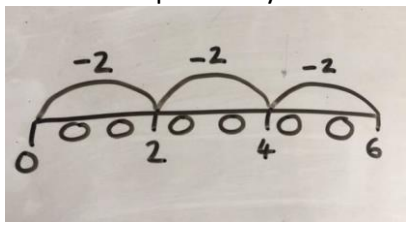
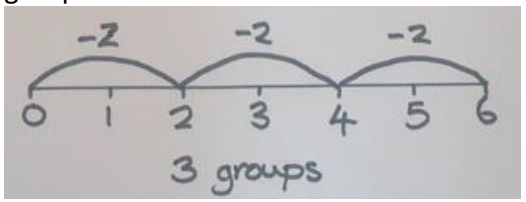
□ = 6 × 23

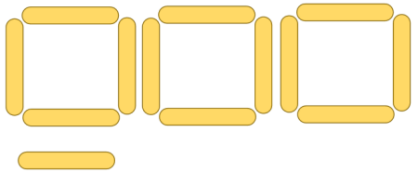
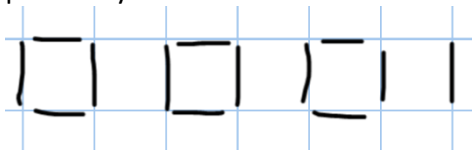
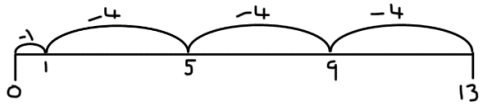
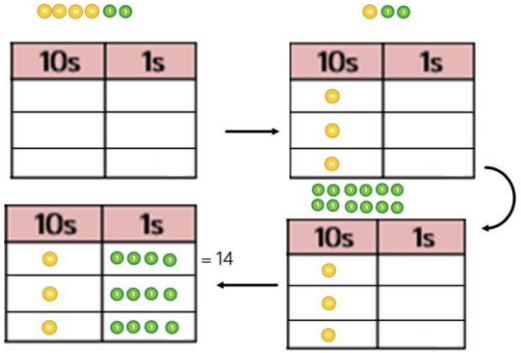
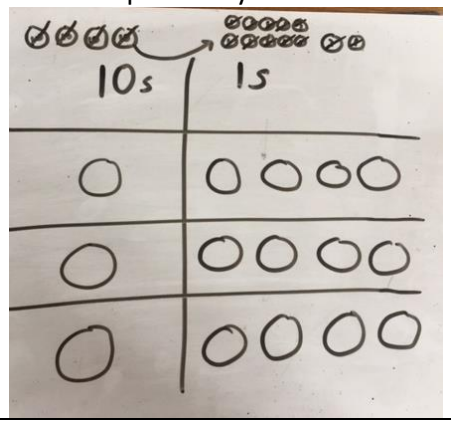
6 × 23 = 23 × 6

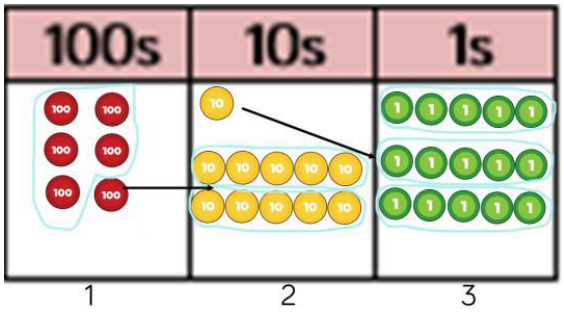
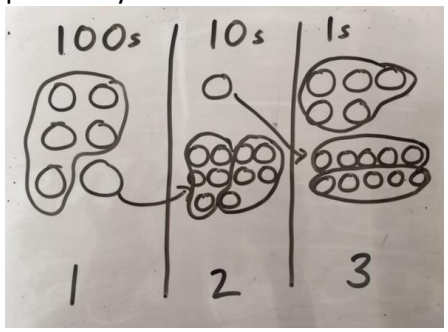
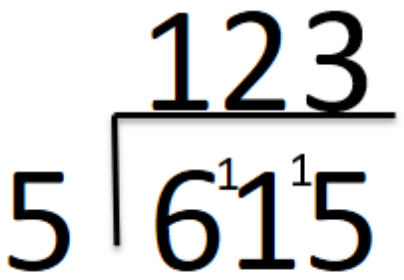
What is the calculation?
What is the product?

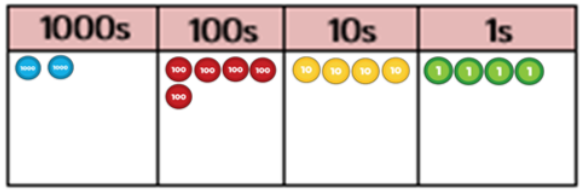
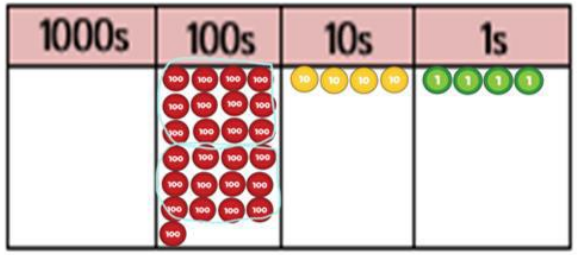
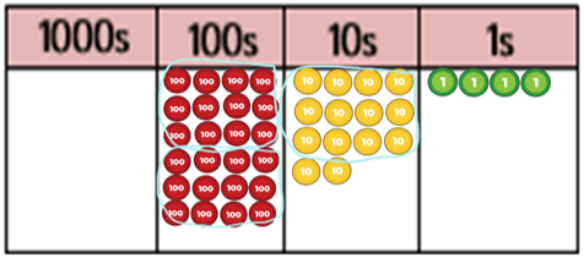
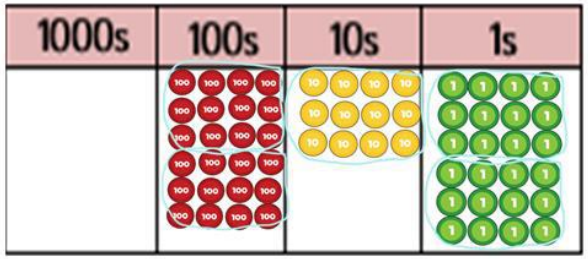


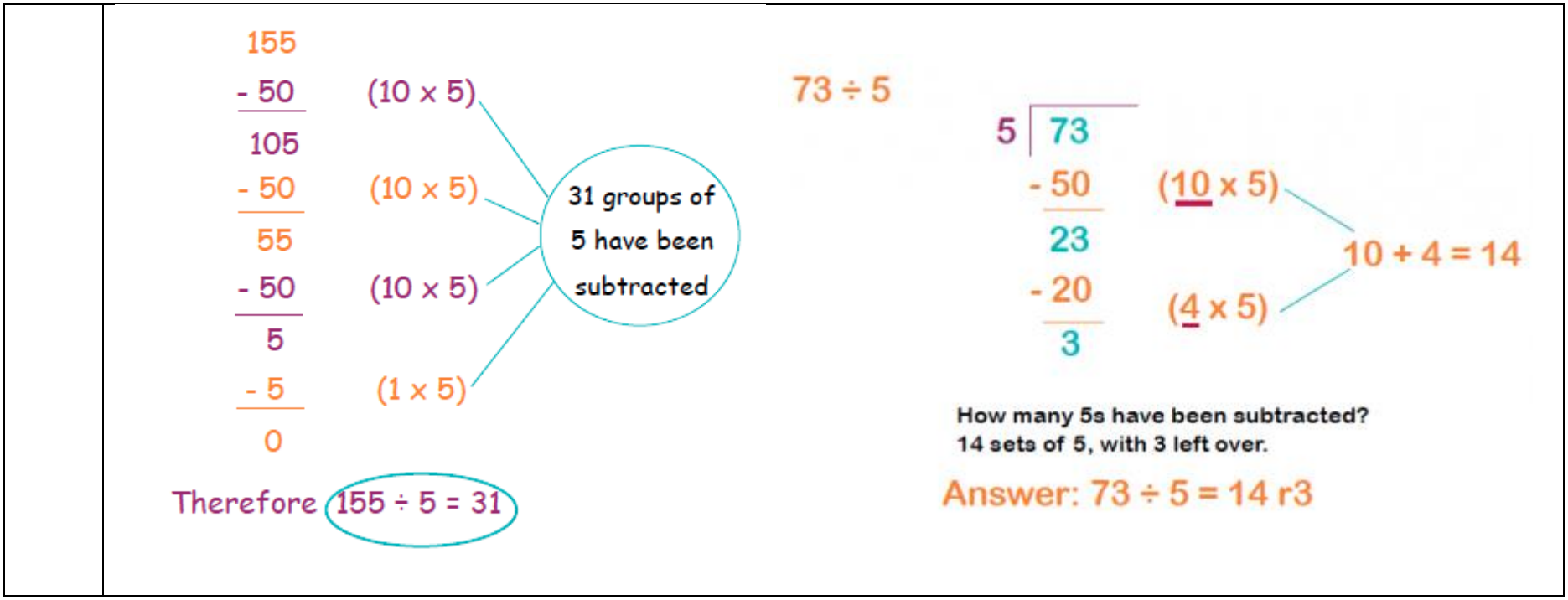
Division

Year	Concrete	Pictorial	Abstract
Y1	Sharing using a range of objects. 6 ÷ 2 	Represent the sharing pictorially. 	6 ÷ 2 = 3  Children should also be encouraged to use their 2 times tables facts.
Y1/Y2	Repeated subtraction using Cuisenaire rods above a ruler. 6 ÷ 2 	Children to represent repeated subtraction pictorially. 	Abstract number line to represent the equal groups that have been subtracted. 

Y2/Y3	2digit ÷ 1digit with remainders using lollipop sticks. Cuisenaire rods, above a ruler can also be used. 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' 
Y2/Y3	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

Y3-5	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. 

Y6	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. $\begin{array}{r} 0212 \\ 12\overline{)2544} \\ 24 \\ \hline 14 \\ 12 \\ \hline 24 \\ 24 \\ \hline 0 \end{array}$ Chunking



Varied representation will draw on multiple stages to represent the same problem in differing ways. For example, 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 | 615

615 ÷ 5 =

☐ = 615 ÷ 5

What is the calculation?
What is the answer?