Manor Primary School

Calculation Policy

(Adapted from White Rose)

2023

About our Calculation Policy

This policy has been designed in accordance with the National Curriculum 2014 and helps to develop the three main aims of **Fluency, Reasoning and Problem Solving.** It is designed to give pupils a consistent and smooth progression of learning when using the four main operations.
Please note that the early learning teaching in number and calculations in Reception follows the EYFS document.
The calculation policy is organised according to age stage expectations as set out in the National Curriculum 2014. However, it is vital that pupils are taught according to the stage that they are currently working at, moving on when secure.
It is important that any type of calculation is given a real life context or problem solving approach to help build children's understanding of the purpose of the calculation and to help them recognise when to use certain operations and methods when faced with problems. This must be priority in Numeracy lessons.

Aims of the written calculation policy

- To support greater consistency in the teaching of written calculations across the school.
- To strengthen continuity and progression in children's understanding of the development of written calculations.
- To form a core set of methods which every child will experience and build upon.
- To build on models and images introduced to promote conceptual understanding.
- To provide reference and guidance on the teaching of calculation skills for teaching staff, teaching assistants and parents.

Good practice in calculation

- Establish mental methods based on good understanding of place value in numbers and table facts.
- Show children how to set out written calculations vertically, initially using expanded layouts (starting with adjustments of 'carrying' and introducing this adjustment slowly and systematically).
- Link practical, mental and written methods.
- Make strong links between inverse operations of addition/subtraction and multiplication/division.
- Make sure children always look out for special cases that can still be done entirely mentally.
- Gradually refine the written record into a more compact standard method.
- Extend to larger numbers and decimals.
- Ensure that the understanding of remainders and what to do with them in context, is taught. (E.g. whole numbers, fractions or decimals)
- Once written methods are introduced, continue developing mental skills by applying them to appropriate examples. (Encourage children to try mental methods first.)
- Encourage children to identify the best method and make choices.
- Encourage children to use tools to support their learning e.g. number lines, 100 squares etc. until they are secure.
- Encourage the use of estimation to check the reasonableness of answers.
- Encourage children to use the inverse to check answers.

- **Problem Solving**

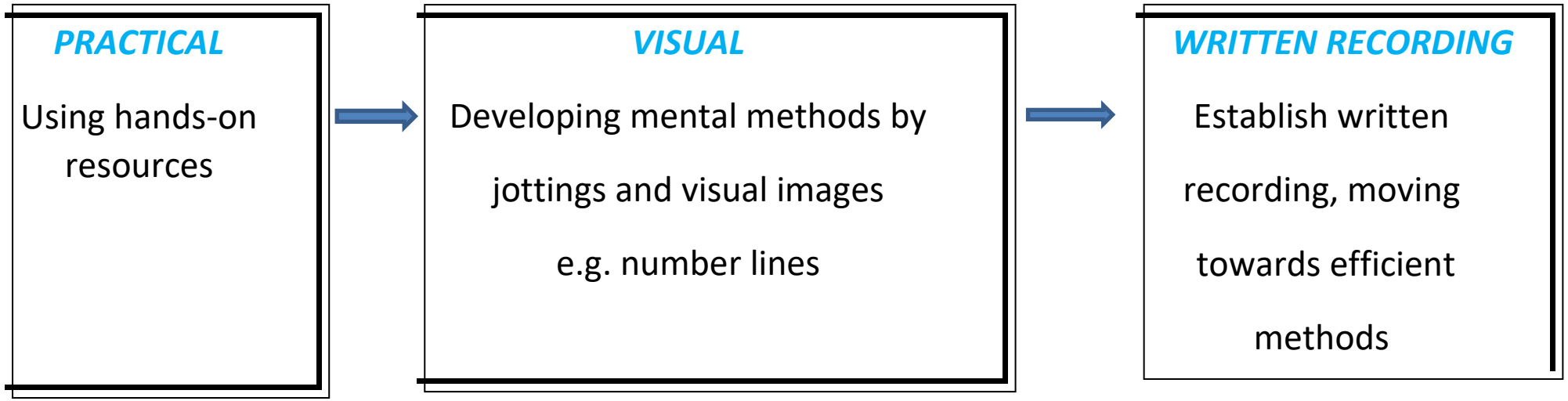
Through problem-solving lessons and activities, children are encouraged to use their mathematical skills and understanding to solve problems unfamiliar to them.

- **Reasoning**

Maths reasoning tasks get children thinking about number problems logically so they can reach conclusions, find solutions and decide which methods to use and why.

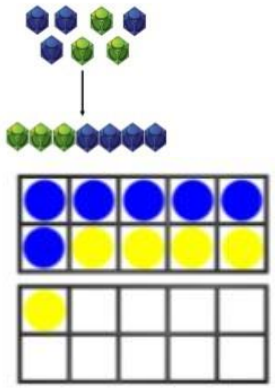
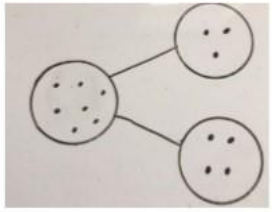
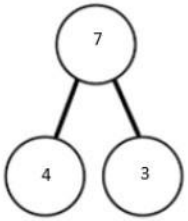
- **Fluency**

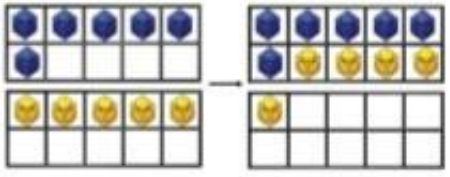
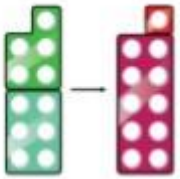
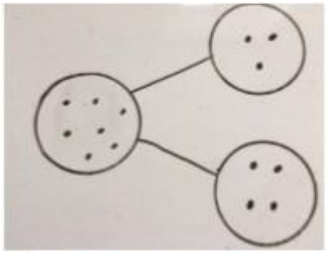
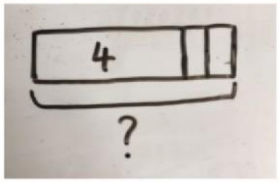
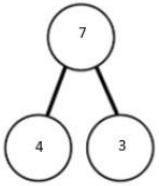
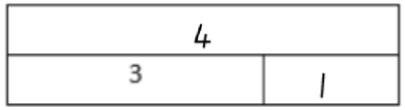
Fluency tasks help children strengthen their foundational knowledge. They practise applying their skills and understanding to different number problems with varying contexts and levels of complexity, while independently choosing the method they use to tackle number problems successfully. Fluency brings together problem-solving and reasoning.

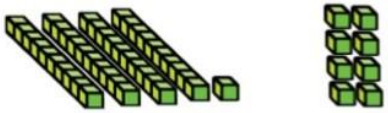
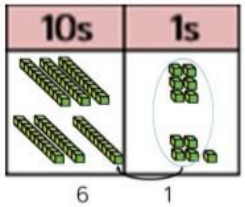
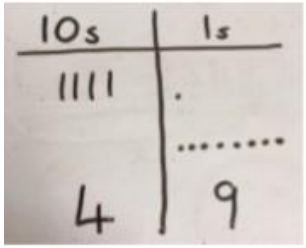
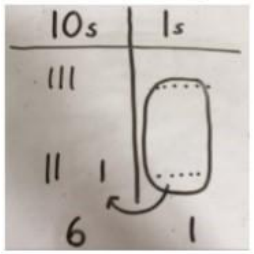
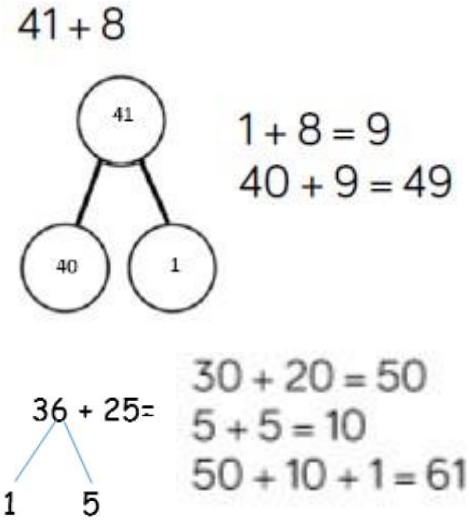


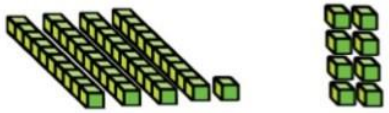
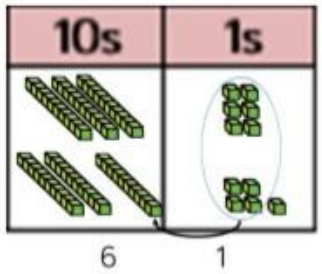
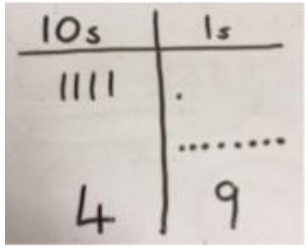
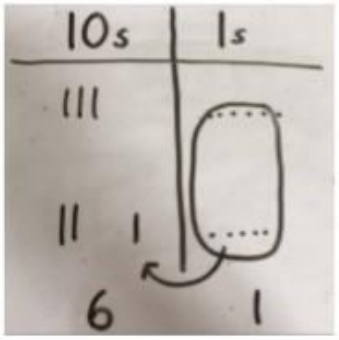
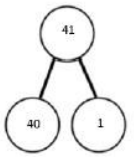
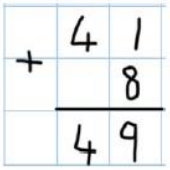
Addition

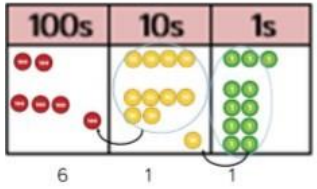
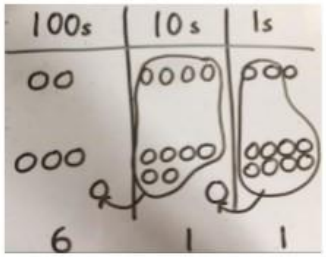
Key language: sum, total, parts and whole, plus, add, altogether, more, is equal to, is the same as.

Objectives	Concrete	Pictorial	Abstract
EYFS – Numbers Automatically recalls number bonds for numbers 0-5 and some to 10. Is able to subitise.	**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. 

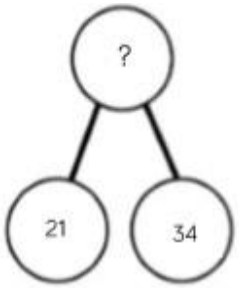
Year 1 Read and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs. Write mathematical statements involving addition (+), subtraction (-) and equals (=) signs. Represent and use number bonds within 20. Add one-digit and two-digit numbers to 20, including zero.	Use tens frames, counters and numicon.  	Part whole models and bar models.  	Part whole models 4 + 3 = 7 Four is a part, 3 is a part and the whole is seven.  Bar models 3 + 1 = 4 

Year 2 I can solve problems with addition and subtraction including those involving numbers, quantities and measures by using objects or pictures. I can answer simple addition and subtraction questions in my head as well as by writing them down. I can add and subtract 2 two digit numbers mentally and when using objects, number lines and pictures.	Use base 10  	Draw tens and ones - lines and dots.  	Part whole models and partitioning 

Year 3 I can add numbers with up to three digits using formal column methods I can solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction **Year 4** I can add numbers with up to four digits using formal column methods I can solve two step addition and subtraction problems using different methods and explain why I used them	Use base 10  	Draw tens and ones—lines and dots  	Column method 41 + 8  1 + 8 = 9 40 + 9 = 49  Looking for ways to make 10. 36 + 25= 1 5 30 + 20 = 50 5 + 5 = 10 50 + 10 + 1 = 61 36 Formal method: +25 61 1

Year 5 I can add and subtract numbers with more than 4 digits using written methods. I can solve addition and subtraction problems needing more than one step and can work out which operation and method is the most suitable. **Year 6** I can mentally calculate using a mix of the four operations.	**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. 	Chidren to represent the counters in a place value chart, circling when they make an exchange. 	243 +368 611 1 1

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



?	
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

21
+34
___

21 + 34 =

☐ = 21 + 34

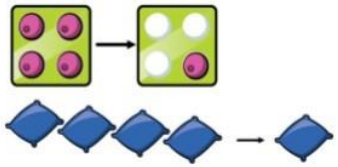
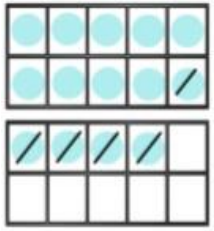
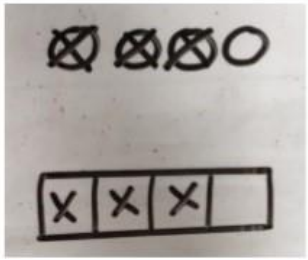
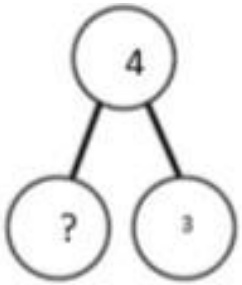
Calculate the sum of twenty-one and thirty-four.

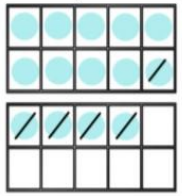
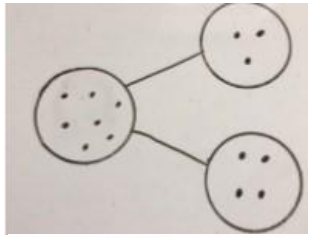
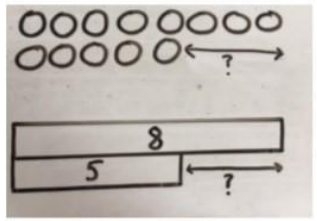
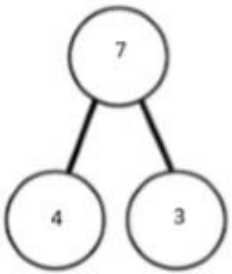
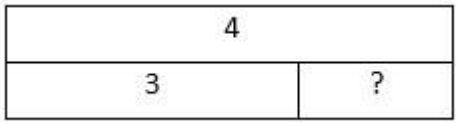
Missing digit problems:

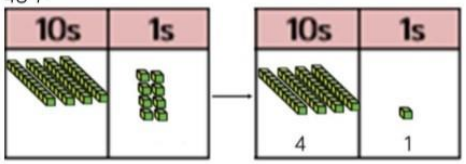
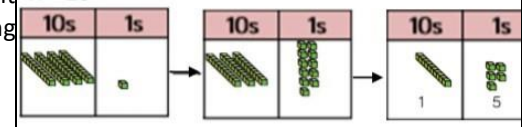
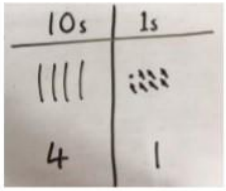
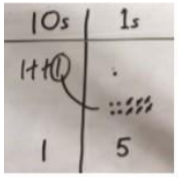
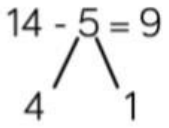
10s	1s
	?
?	5

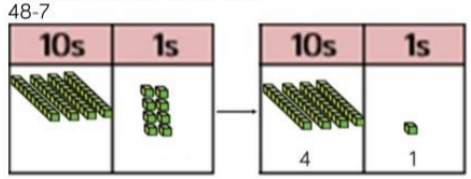
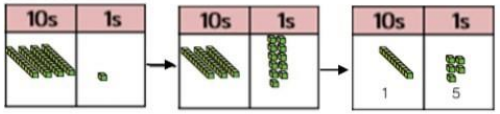
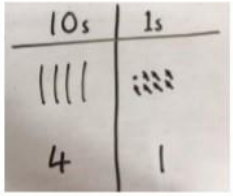
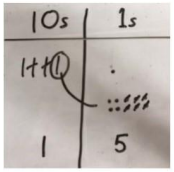
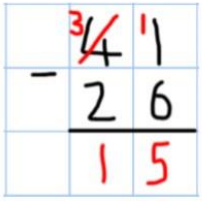
Subtraction

Key language: Takeaway, less than, the difference, subtract, minus, fewer and decrease.

Objectives	Concrete	Pictorial	Abstract
EYFS (Numbers) Understands one more than/one less than relationship between consecutive numbers.	Physically take away objects. 4 - 3 = 1  Use tens frames and counters 	Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also be used. 	Part whole models 

Year 1 Read and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs. Write mathematical statements involving addition (+), subtraction (-) and equals (=) signs. I can use subtraction facts up to 20 I can subtract one digit and two digit numbers to 20.	Use tens frames and counters. Children to present the ten frame pictorially and discuss what they did to make 10. 	Part whole models 7—3 = 4  	Part whole models and bar models 7—3 = 4  

Year 2 I can solve problems with addition and subtraction including those involving numbers, quantities and measures by using objects or pictures. I can answer simple addition and subtraction questions in my head as well as by writing them down. I can add and subtract 2 two digit numbers mentally and when using objects, number lines and pictures.	Use base 10 **Column method** using base 10. 48-7  **Column method** using base 10 and having to exchange. 41 - 26 	Draw tens and ones - lines and dots. Children to represent the base 10 pictorially.  Represent the base 10 pictorially, remembering to show the exchange. 	Part whole models and partitioning Children to show how they can make 10 by partitioning the subtrahend.  14 - 4 = 10 10 - 1 = 9

Year 3 I can add numbers with up to three digits using formal column methods. I can solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction. **Year 4** I can add numbers with up to four digits using formal column methods. I can solve two step addition and subtraction problems using different methods and explain why I used them.	Use base 10 **Column method** using base 10. 48-7  **Column method** using base 10 and having to exchange. 41 – 26  	Draw tens and ones—lines and dots Children to represent the base 10 pictorially.  Represent the base 10 pictorially, remembering to show the exchange.  	Column method Formal column method. Children must understand that when they have exchanged the 10 they still have 41 because 41 = 30 + 11. 

Year 5

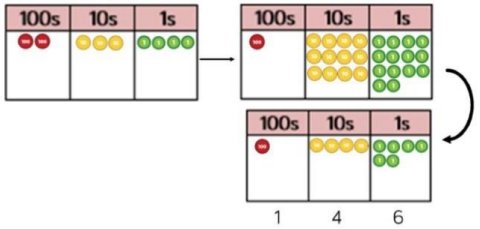
I can add and subtract numbers with more than 4 digits using written methods.

I can solve addition and subtraction problems needing more than one step and can work out which operation and method is the most suitable.

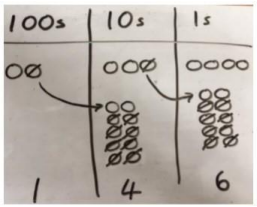
Year 6

I can mentally calculate using a mix of the four operations.

Column method using place value counters.
234 – 88



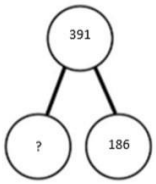
Represent the place value counters pictorially; remembering to show what has been exchanged.



Formal colum method. Children must understand what has happened when they have crossed out digits.

$$\begin{array}{r} {}^{2}\not{2}\,{}^{1}4 \\ -\ 88 \\ \hline 6 \end{array}$$

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.

$\square = 391 - 186$

$$\begin{array}{r} 391 \\ -186 \\ \hline \quad \end{array}$$

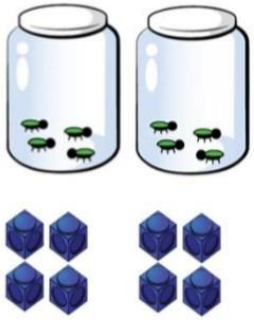
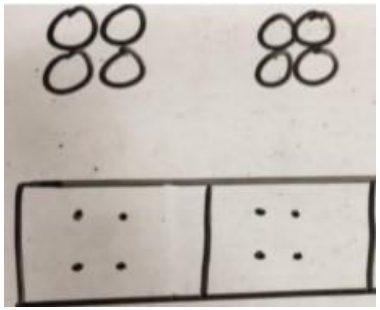
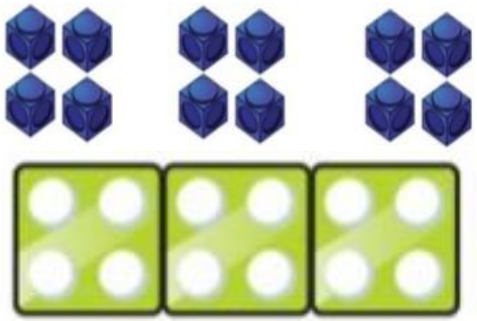
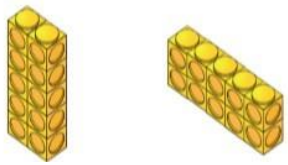
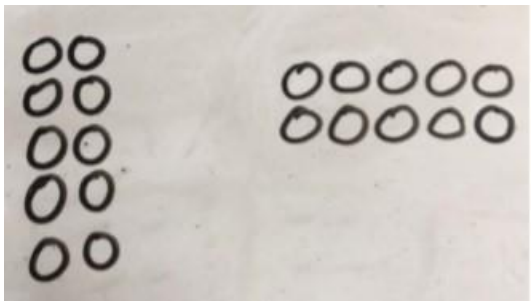
What is 186 less than 391?

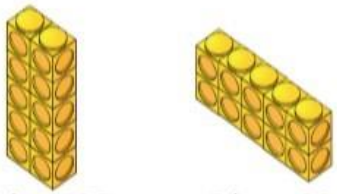
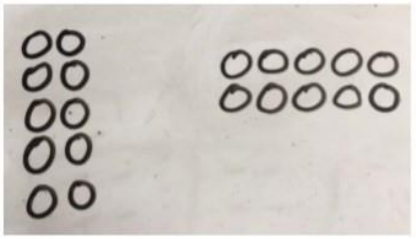
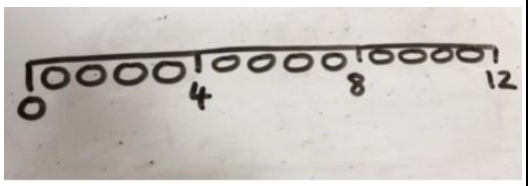
Missing digit calculations

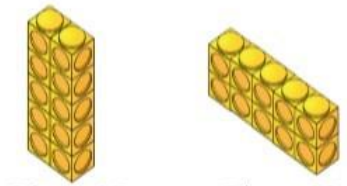
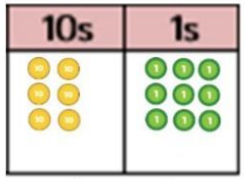
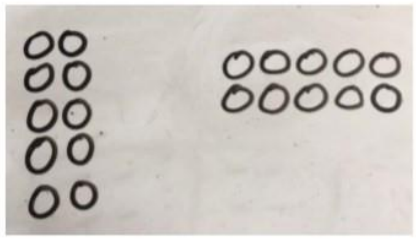
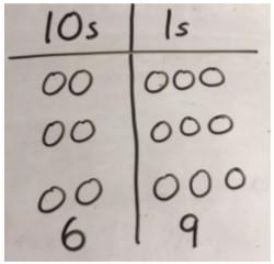
$$\begin{array}{r} 3\ 9\ \square \\ -\ \square\ \square\ 6 \\ \hline \square\ 0\ 5 \end{array}$$

Multiplication

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

Objectives	Concrete	Pictorial	Abstract
EYFS – Numerical patterns Is able to explore and represent patterns within numbers up to 10, including evens and odd, double facts and how quantities can be distributed equally (ELG). Can compare quantities up to 10 in different contexts, recognising when one quantity is greater than, less than or the same as the other quantity (ELG).	Doubling using objects 	Doubling using pictures 	Double 2 2 + 2 = 4
Year 1 Solve one-step problems involving multiplication by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.	Repeated groups  Create arrays 	Draw arrays 	Write repeated additions 2 + 2 + 2 + 2 + 2 = 10

Year 2 Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs Solve problems involving multiplication and division, using arrays, repeated addition and multiplication and division facts, including problems in contexts e.g. knowing that 2 × 7 = 14 and 2 × 8 = 16, explains that making pairs of socks from 15 identical socks will give 7 pairs and one sock will be left.	Create arrays $2 \times 5 = 5 \times 2$  2 lots of 5 5 lots of 2	Children to represent the arrays pictorially.   Using a number line	Children to be able to use an array to write a range of calculations e.g. $10 = 2 \times 5$ $5 \times 2 = 10$ $2 + 2 + 2 + 2 + 2 = 10$ $10 = 5 + 5$

Year 3 Write and calculate mathematical statements for multiplication and division using the multiplication tables that he/she knows, including for two digit numbers times one-digit numbers, using mental and progressing to formal written methods. **Year 4** Multiply two-digit and three-digit numbers by a one-digit number using formal written layout.	Create arrays $2 \times 5 = 5 \times 2$  2 lots of 5 5 lots of 2 **Formal column method** with place value counters (base 10 can also be used.) 3×23  6 9	Children to represent the arrays pictorially.  Children to represent the counters pictorially. 	Children to record what it is they are doing to show understanding. 3×23 $3 \times 20 = 60$ $3 \times 3 = 9$ $20 \quad 3$ $60 + 9 = 69$ $\begin{array}{r} 23 \\ \times \quad 3 \\ \hline 69 \end{array}$

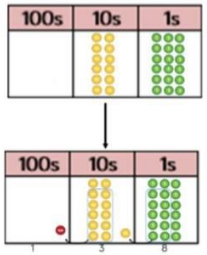
Year 5

Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers.

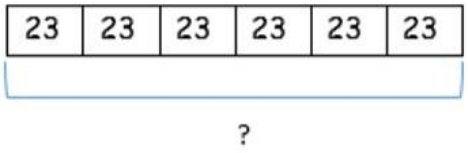
Year 6

I can mentally calculate using a mix of the four operations.

Formal column method with place value counters.
6 x 23



Draw bar model



Formal written method

$$6 \times 23 =$$

$$\begin{array}{r} 23 \\ \times\ 6 \\ \hline 138 \\ \hline 1\ 1 \end{array}$$

To get 744 children have solved 6 × 124.
To get 2480 they have solved 20 × 124.

$$\begin{array}{r} 1\ 2\ 4 \\ \times\ \ 2\ 6 \\ \hline 7\ 4\ 4 \\ 2\ 4\ 8\ 0 \\ \hline 3\ 2\ 2\ 4 \\ \hline 1\ 1 \end{array}$$

Answer: 3224

Conceptual variation; 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 =

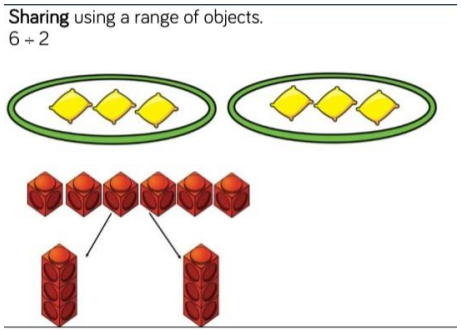
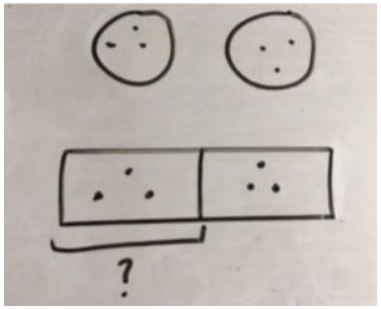
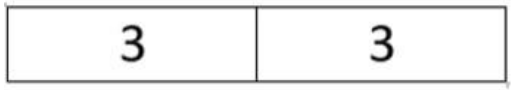
□ = 6 × 23

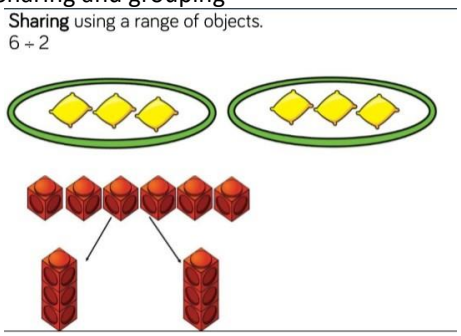
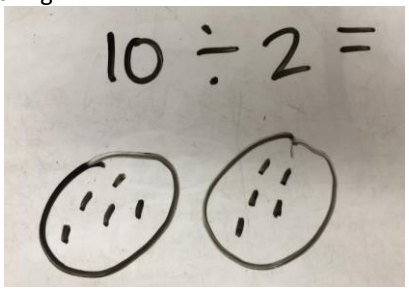
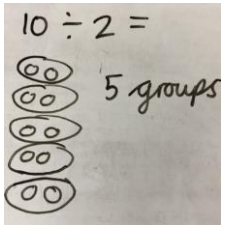
$$\begin{array}{r} 6 \\ \times\ 23 \\ \hline \\ \hline \end{array} \qquad \begin{array}{r} 23 \\ \times\ 6 \\ \hline \\ \hline \end{array}$$

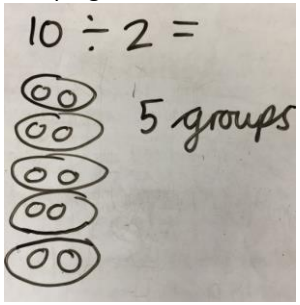
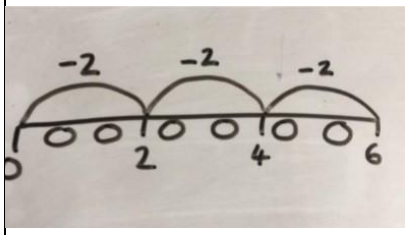
What is the calculation?
What is the product?

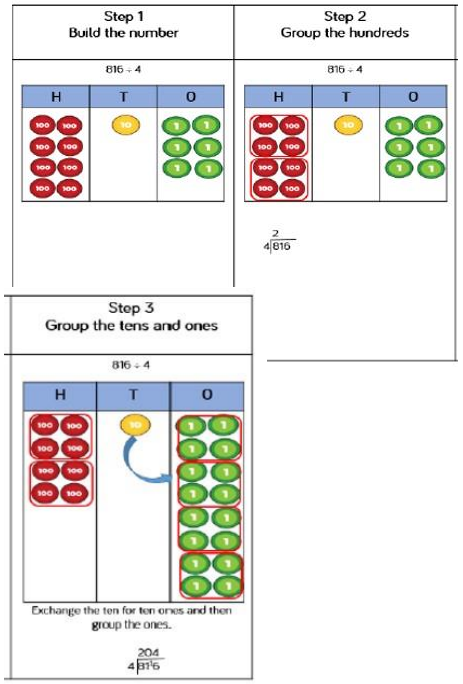
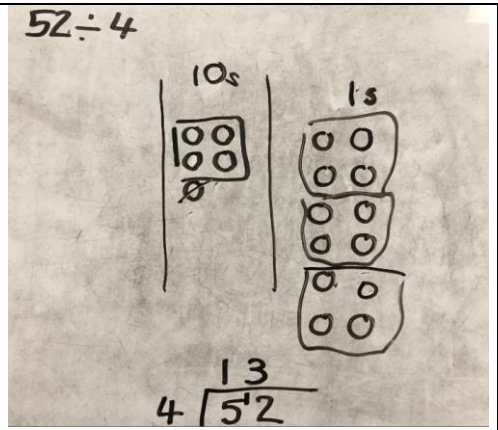
Calculation policy— Division

Key language: Share, group, divide, divided by, half

Objectives	Concrete	Pictorial	Abstract
EYFS – Numerical Patterns Is able to explore and represent patterns within numbers up to 10, including evens and odd, double facts and how quantities can be distributed equally (ELG).	Halving using objects 	Halving using pictures 	Half of 6 

Year 1 Solve one-step problems involving division by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.	Sharing and grouping  	Sharing   Grouping	2 groups of 5 5 5 5 groups of 2 2 2 2 2 2

Year 2 Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs Solve problems involving multiplication and division, using arrays, repeated addition and multiplication and division facts, including problems in contexts e.g. knowing that 2 × 7 = 14 and 2 × 8 = 16, explains that making pairs of socks from 15 identical socks will give 7 pairs and one sock will be left.	Grouping using equipment 	Grouping  Number lines  	Division number sentences 10 ÷ 2 = 5 10 ÷ 5 = 2

Year 3 Write and calculate mathematical statements for multiplication and division using the multiplication tables that he/she knows, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods. **Year 4** Multiply two-digit and three-digit numbers by a one-digit number using formal written layout			Children to the calculation using the short division scaffold. 123 5 6 1 1 5

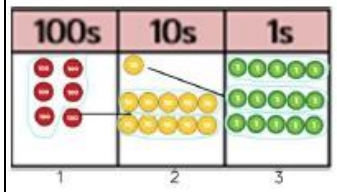
Year 5

Multiply numbers up to 4 digits by a one or two-digit number using a formal written method, including long multiplication for two-digit numbers.

Year 6

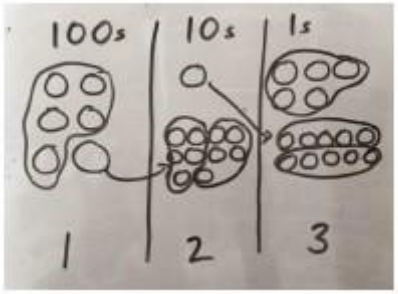
I can mentally calculate using a mix of the four operations.

Short division using place value counters to group.
615 ÷ 5

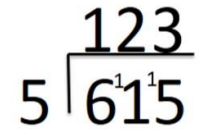


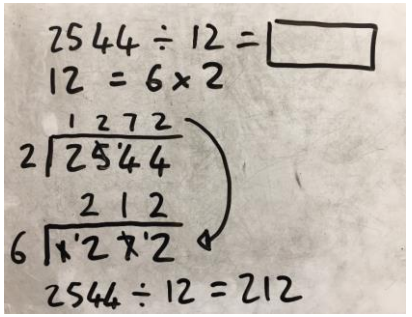
1. Make 615 with place value counters.
2. How many groups of 5 hundreds can you make with 6 hundred counters?
3. Exchange 1 hundred for 10 tens.
4. How many groups of 5 tens can you make with 11 ten counters?
5. Exchange 1 ten for 10 ones.
6. How many groups of 5 ones can you make with 15 ones?

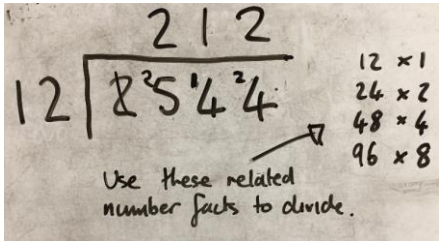
Represent the place value counters pictorially.



Children to the calculation using the short division scaffold.

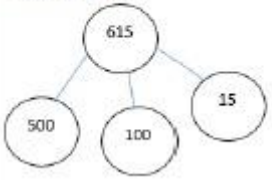






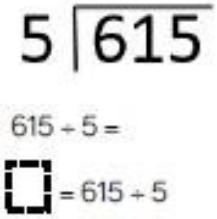
Conceptual variation; different ways to ask children to solve 615 ÷ 5

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?



What is the calculation?
What is the answer?