Lantern Lane Primary School

Calculation/Number Policy

2020/2021

Adapted from White Rose Maths

Rationale

This policy has been designed to show progression in written methods throughout the school. Our written calculation policy is set out to show:

- The objectives stipulated for all four operations by the National Curriculum 2014.
- The calculation methods for each ear group.
- Relevant vocabulary needed at each stage
- Examples of variation

CPA — Concrete, Pictorial, Abstract

Each method has examples as to what it looks like in the concrete, pictorial and abstract forms. Learners are introduced to a calculation method for the first time using concrete manipulatives. Concrete resources used include numicon, place value counters and base 10. Children will then progress at their own pace onto pictorial and finally abstract methods. Bar modelling may be used as a problem solving strategy, utilising the written calculation methods.

Mastering Calculation

The curriculum has a strong focus on mastery and therefore, if a child is fluent in a method for their year group, they will be encouraged to explore deeper within this method. This may involve: using it in different contexts; using and applying it to other learning; using it with missing digit or values; explaining or proving answers with pictures or manipulatives; or identifying what has gone wrong in a calculation. Child should also check their calculations through the use of estimation and inverse operations.

Mathematical Vocabulary

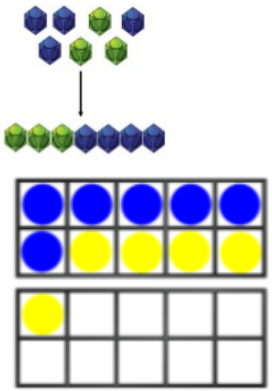
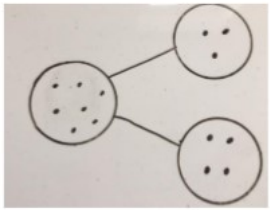
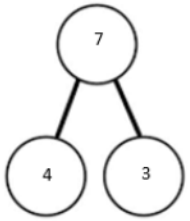
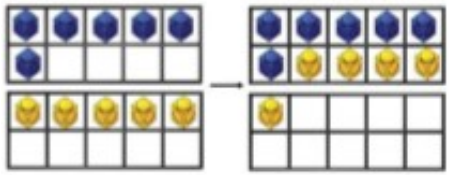
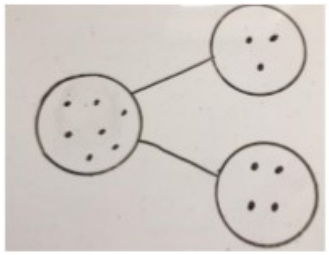
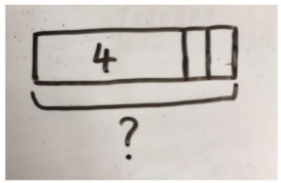
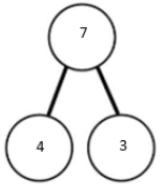
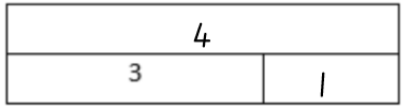
We place importance on the correct mathematical vocabulary and children developing this. Throughout school, children are strongly recommend to use and apply correct mathematical vocabulary when learning a new method or concept and to speak in full sentences. They will be constantly exposed to this, having it expertly modelled by their teacher and be expected to use it themselves when justifying methods.

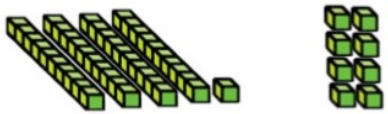
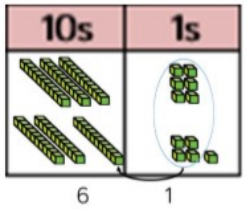
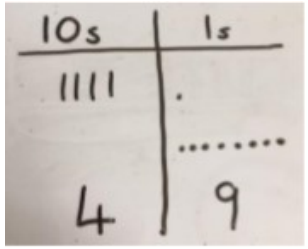
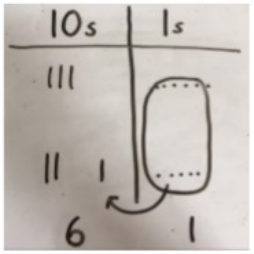
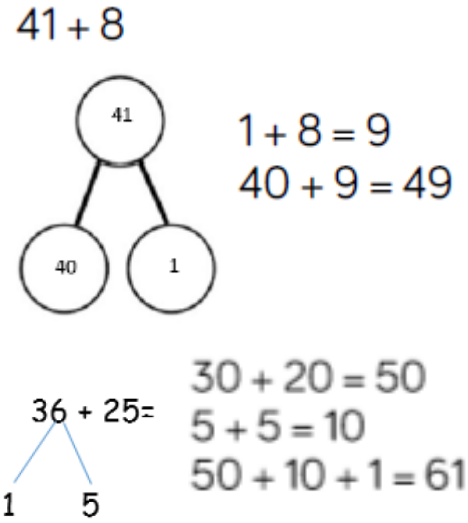
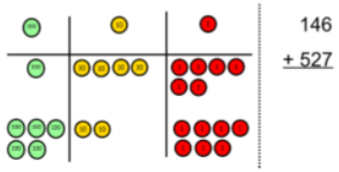
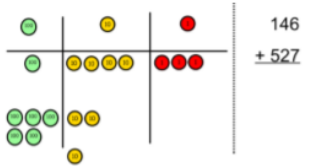
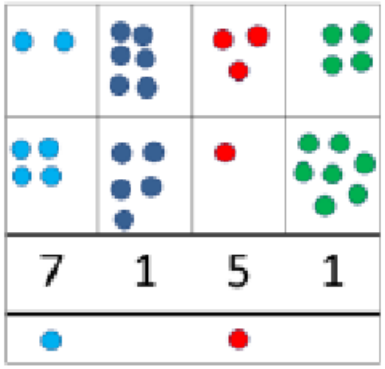
Mental Calculation

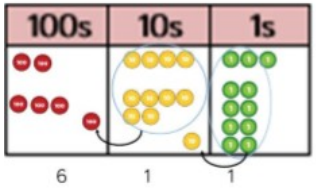
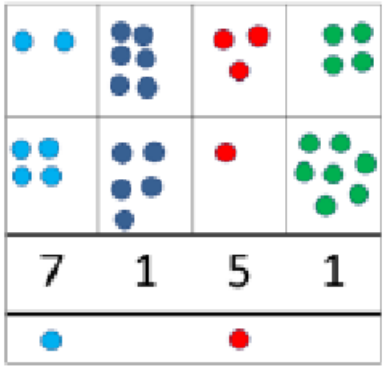
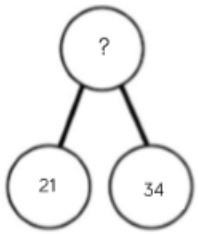
Consideration is always given to whether a written method is the most appropriate approach to a given problem. Children are taught to consider whether the answer can be found using their mental maths strategies or more informal jottings first. Regular discussion takes place as to the most appropriate approach to solving a problem.

Calculation policy—Addition

Key Language: sum of, total, parts and whole, plus, add, altogether, more, is equal to, is the same as, exchange, column method, inverse.

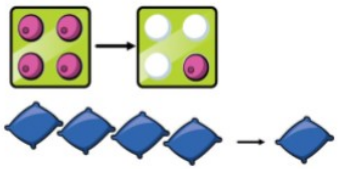
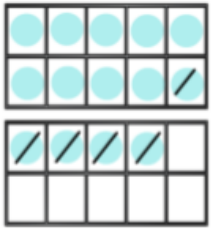
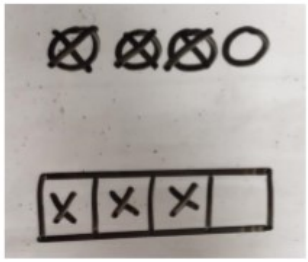
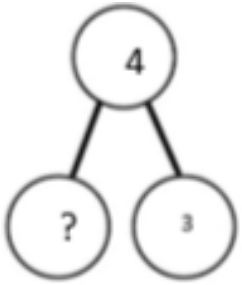
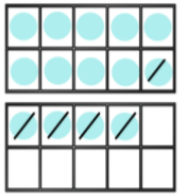
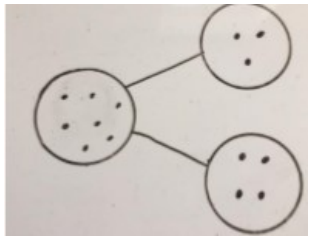
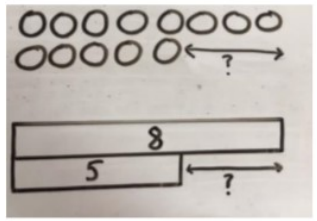
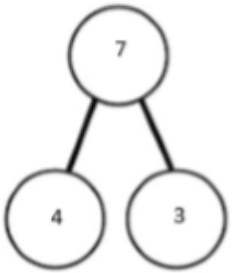
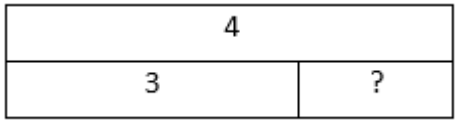
Objectives	**Concrete**	**Pictorial**	**Abstract**
EYFS Adds and subtracts, using quantities and objects, 2 single-digit numbers, and counts on or back to find the answer (ELG) Finds the total number of items in two groups by counting all of them	**Combining two parts to make a whole** (use other resources 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 

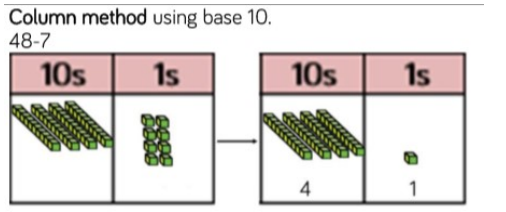
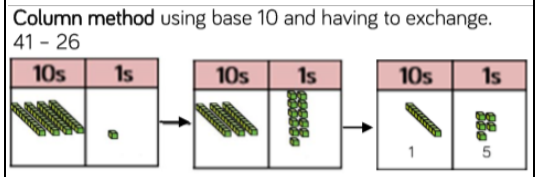
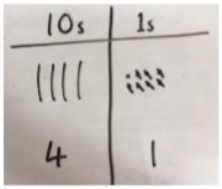
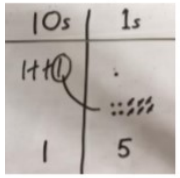
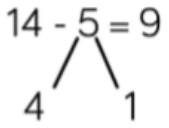
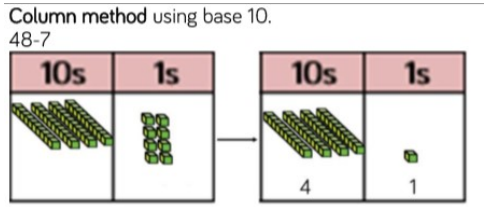
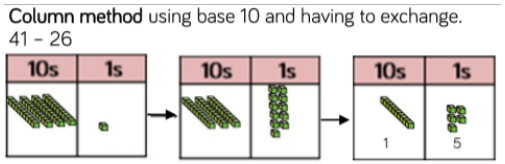
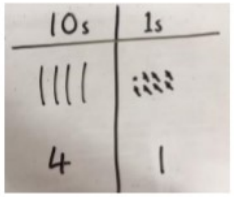
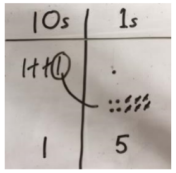
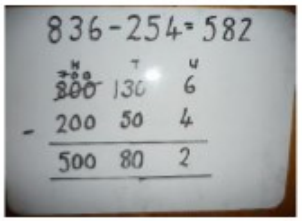
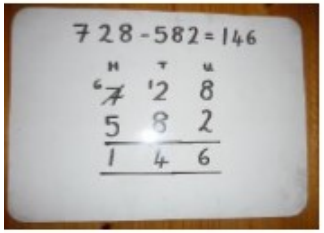
Year 2 I can solve problems with addition and subtraction including those involving numbers, quantities and measures by using objects or pictures I can answer simple addition and subtraction questions in my head as well as by writing them down I can add and subtract 2 two digit numbers mentally and when 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 place value counters/base 10. Make both numbers on a place value grid.  Add up the units and exchange 10 ones for one 10.  Add up the rest of the columns, exchanging the 10 counters from one column for the next place value column until every column has been added.	Draw the representation.  	Column method Start by partitioning the numbers before moving on to clearly show the exchange below the addition. 20 + 5 40 + 8 60 + 13 = 73 Compact column method. 536 + 85 621 1 1

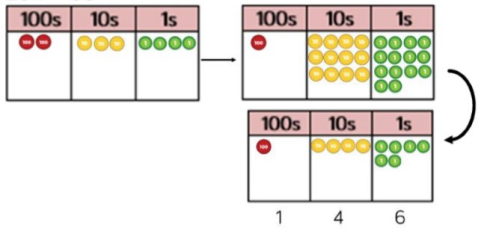
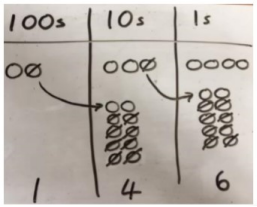
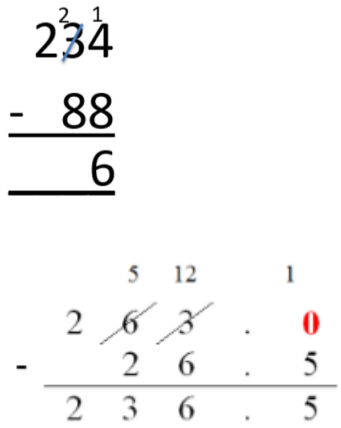
Year 5 I can add and subtract numbers with more than 4 digits using written methods I can solve addition and subtraction problems needing more than one step and can work out which operation and method is the most suitable. **Year 6** I can mentally calculate using a mix of	**Use of place value counters 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.  	Draw the representation.  	72.8 + 54.6 127.4 1 1 £ 2 3 . 5 9 + £ 7 . 5 5 £ 3 1 . 1 4 1 1 1 2 3 . 3 6 1 9 . 0 8 0 5 9 . 7 7 0 + 1 . 3 0 0 9 3 . 5 1 1 2 1 2
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: 

Calculation policy— Subtraction

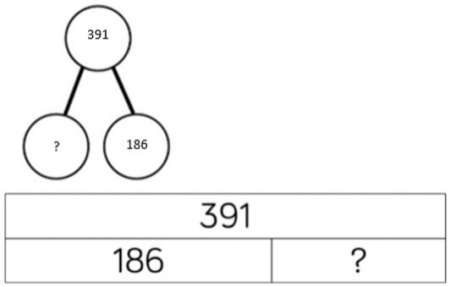
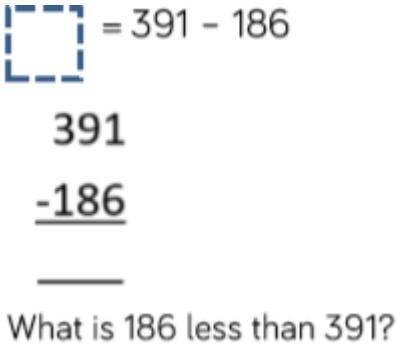
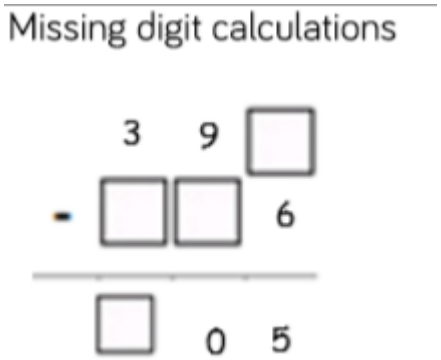
Key Language: takeaway, less than, the difference, subtract, minus, fewer, decrease, exchange, column method, inverse.

Objectives	**Concrete**	**Pictorial**	**Abstract**
EYFS Adds and subtracts, using quantities and objects, 2 single-digit numbers, and counts on or back to find the answer (ELG)	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  	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/place value counters.  	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  Children can start their formal written method by partitioning the number into clear place value columns. 

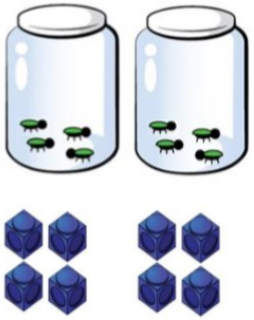
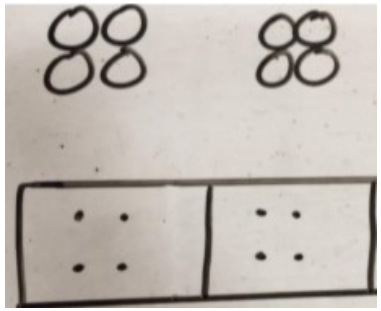
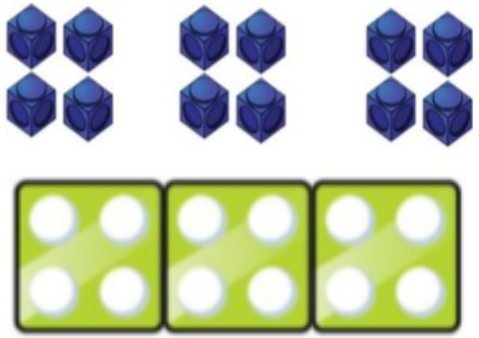
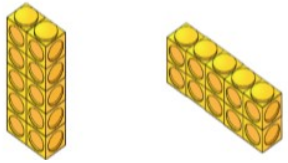
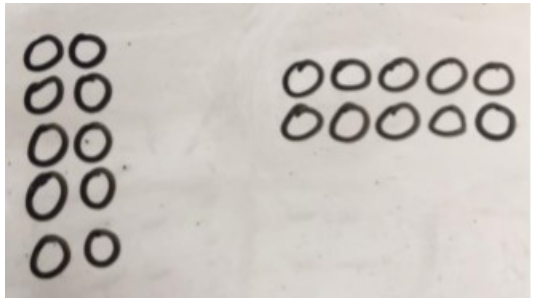
Year 5 I can add and subtract numbers with more than 4 digits using written methods I can solve addition and subtraction problems needing more than one step and can work out which operation and method is the most suitable. **Year 6** I can mentally calculate using a mix of the four operations	Use place value counters/base 10. **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. 

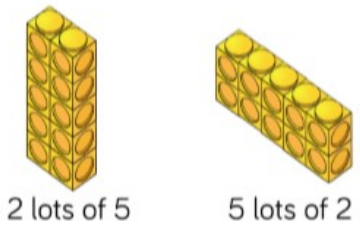
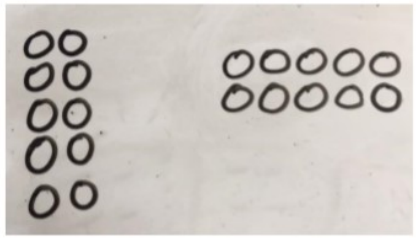
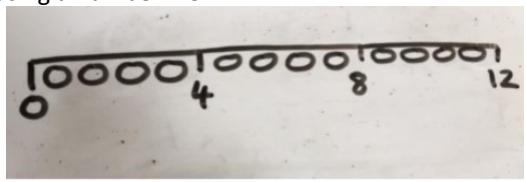
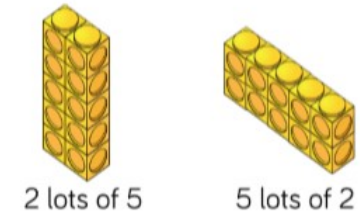
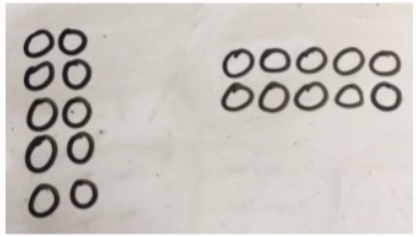
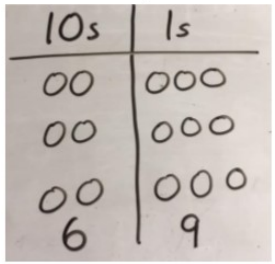
Conceptual variation; different ways to ask children to solve 391– 186

	Raj spent £391, Timmy spent £186. How much more did Raj spend? Calculate the difference between 391 and 186.		

Calculation policy— Multiplication

Key Language—double, times, multiplied by, the product of, groups of, lots of, equal groups, factor pairs, inverse, exchange.

Objectives	**Concrete**	**Pictorial**	**Abstract**
EYFS Solve problems, including doubling, halving and sharing Solve practical problems that involve combining groups of 2, 5 or 10, or sharing into equal groups (ELG Exc)	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 numberline 	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 	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 20 3 $3 \times 20 = 60$ $3 \times 3 = 9$ $60 + 9 = 69$ $\begin{array}{r} 23 \\ \times\ 3 \\ \hline 69 \end{array}$

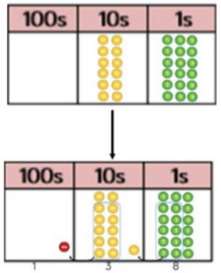
Year 5

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

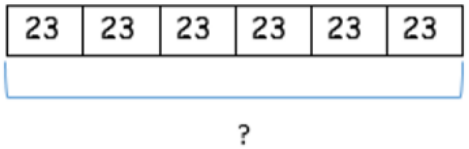
Year 6

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.

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

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

$6 \times 23 =$

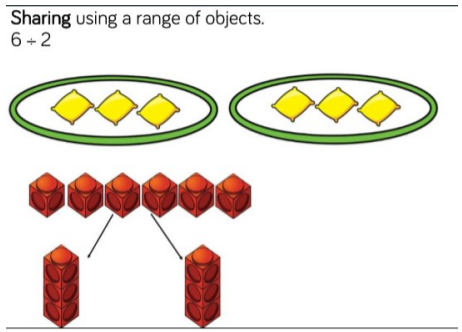
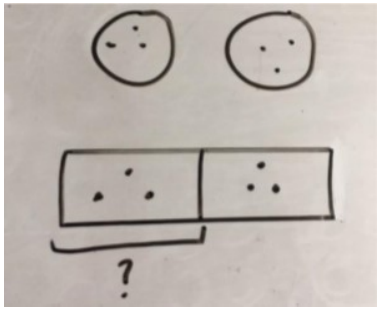
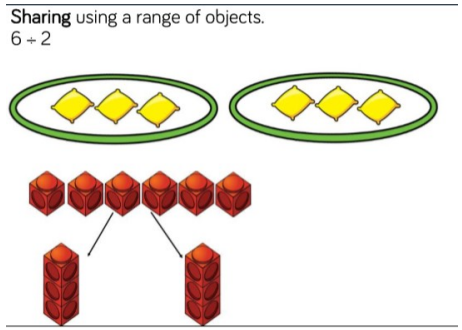
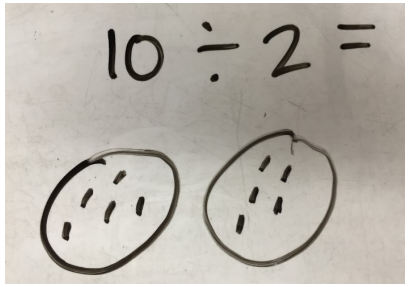
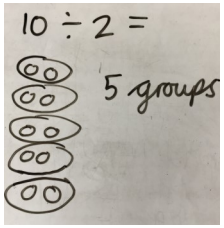
$\square = 6 \times 23$

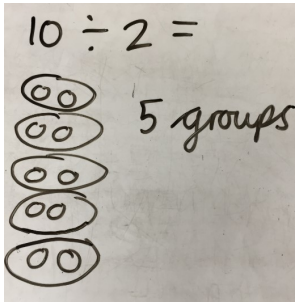
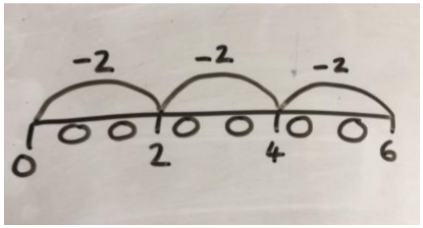
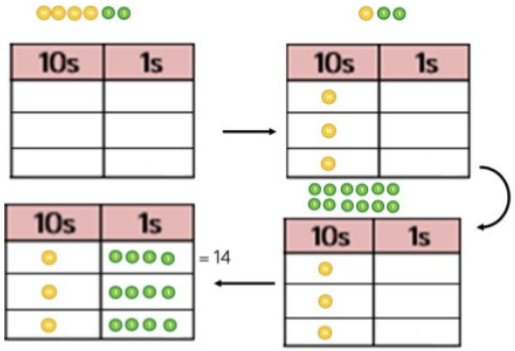
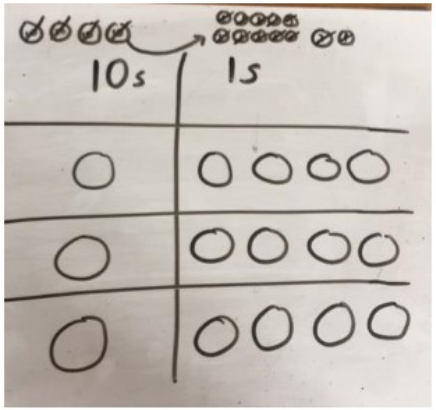
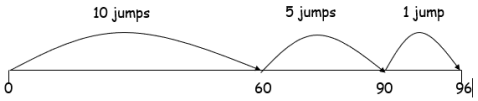
$$\begin{array}{r} 6 \\ \times\ 23 \\ \hline \\ \hline \end{array} \qquad \begin{array}{r} 23 \\ \times\ 6 \\ \hline \\ \hline \end{array}$$

What is the calculation?
What is the product?

Calculation policy— Division

Key Language— share, group, divide, divided by, half, divisor, dividend, remainder.

Objectives	**Concrete**	**Pictorial**	**Abstract**
EYFS Solve problems, including doubling, halving and sharing Solve practical problems that involve combining groups of 2, 5 or 10, or sharing into equal groups (ELG Exc)	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** Divide two-digit and three-digit numbers by a one-digit number using formal written layout	Sharing using place value counters. 42 ÷ 3 = 14 	Children to represent the place value counters pictorially. 	Year 3 96 ÷ 6 =  Year 3/Year 4 Children to the calculation using the short division scaffold. $5\overline{)615}^{123}$ Including examples with remainders.

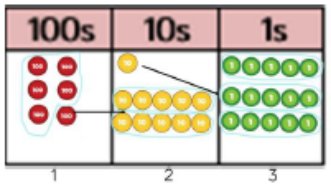
Year 5

Divide numbers up to 4 digits by a one- or two-digit number using a formal written method

Year 6

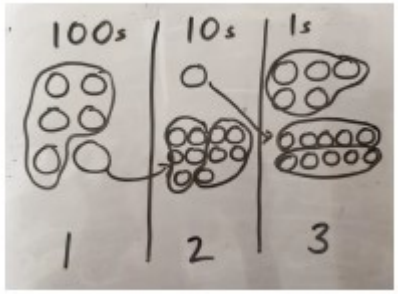
I can mentally calculate using a mix of the four operations

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.

$$5\overline{)615}\quad 123$$

Using long division for dividing by a two-digit number.

432 ÷ 15 becomes

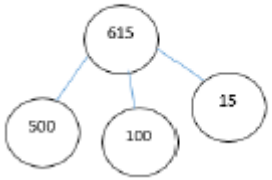
$$\begin{array}{r} 28\cdot8 \\ 15\overline{)432\cdot0} \\ 30\downarrow \\ \hline 132 \\ 120\downarrow \\ \hline 120 \\ 120 \\ \hline 0 \end{array}$$

List the multiples of the divisor (15) before they begin:

15,30,45,60,75,90,105,120,135,150

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?

Calculation policy— Fractions

Key language— unit fraction, non-unit fraction, numerator, denominator, equivalent, equal parts, improper fraction, mixed number, common denominator, lowest/highest common multiple.

Objectives	Concrete	Pictorial	Abstract

Year 3

Add and subtract fractions with the same denominator within one whole [for example, 5/7 + 1/7= 6/7]

Year 4

Add and subtract fractions with the same denominator

Subtract fractions from a whole amount

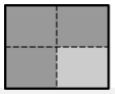
Year 3

Recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators

Year 4

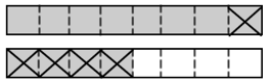
Solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities, including non-unit fractions where the answer is a whole number

Fold paper and colour the correct amount of quarters (Y3 within one whole).



$\frac{3}{4} + \frac{2}{4} = \frac{5}{4}$

Fold paper and colour to correct amount of quarters before crossing out those taken away.



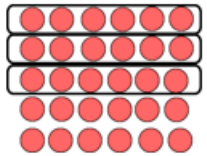
$\frac{12}{8} - \frac{5}{8} = \frac{7}{8}$

Build cube towers.

$2 - \frac{3}{4} = 1\frac{1}{4}$

Use counters.

$\frac{3}{5}$ of 30 = 18

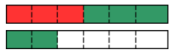


Use counters.

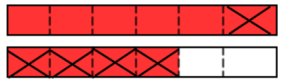
$\frac{1}{5}$ is worth 4, what is 1 whole worth?

Sketch bar models (Y3 within one whole).

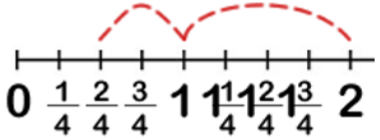
$\frac{3}{6} + \frac{5}{6} = \frac{8}{6}$



Sketch bar models.

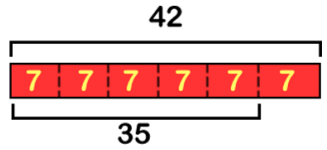


$\frac{10}{6} - \frac{5}{6} = \frac{5}{6}$



$2 - \frac{6}{4} = \frac{2}{4}$

Sketch a bar model.



$\frac{5}{6}$ of 42 = 5 x 7 = 35

Sketch a bar model.

One fifth of a bag of potatoes is 3 potatoes.

3 x 5 = 15

$\frac{1}{4} + \frac{2}{4} = \frac{3}{4}$

$\frac{9}{3} - \frac{4}{3} = \frac{5}{3}$

$2 - \frac{5}{4} = \frac{3}{4}$

$\frac{1}{10}$ of 80 = 80 ÷ 10 = 8

$\frac{6}{10}$ of 80 = 6 x 8 = 48

One fifth of a bag of potatoes is 3 potatoes.

3 x 5 = 15

The whole = 15

Year 5

Add and subtract fractions with the same denominator and denominators that are multiples of the same number

Year 6

Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions

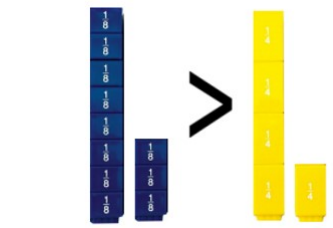
Year 5

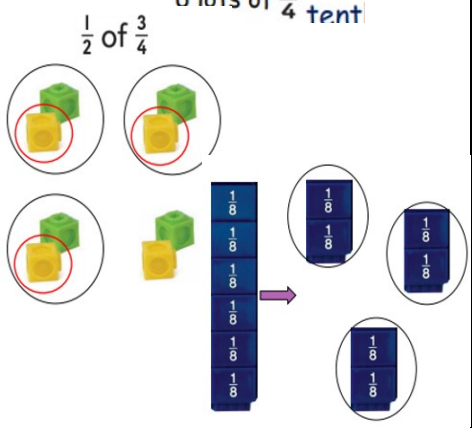
Multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams

Year 6

Multiply simple pairs of proper fractions, writing the answer in its simplest form [for example, 1/4 × 1/2 = 1/8]

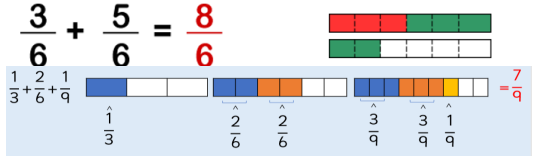
Divide proper fractions by whole numbers [for example, 1/3 ÷ 2 = 1/6]



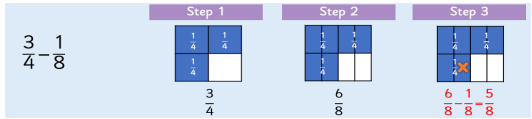


Add

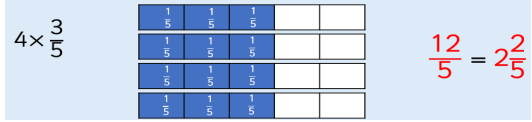
Sketch bar models.



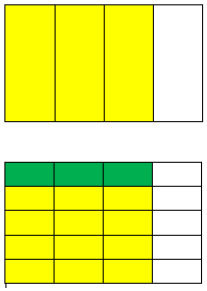
Subtract



Multiply



Divide.



Dividing by a whole number :
Example ¾ ÷ 5 = 3/20.
Steps:
-Find ¾ of the whole.
-Divide each of the three quarters by 5.
-Take one of the 5 parts made.
What is this as a part of the whole?

Add

$$\frac{1}{3}+\frac{2}{9}+\frac{5}{18}=\frac{6}{18}+\frac{4}{18}+\frac{5}{18}$$

$$=\frac{15}{18}$$

Subtract

$$\frac{12}{16}-\frac{5}{8}=\frac{12}{16}-\frac{10}{16}=\frac{2}{16}=\frac{1}{8}$$

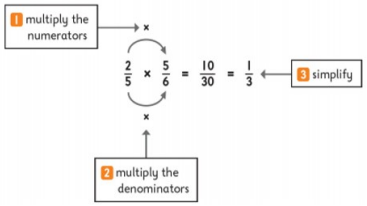
Multiply

4 x 3/5 =

4/1 x 3/5 =

(4x3) + (1x5) =

12/5 or 2 whole



Divide—Kiss & Flip

$$\frac{3}{4}\div\frac{2}{3}=$$

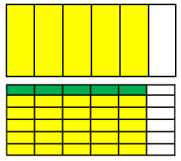
$$\frac{3}{4}\times\frac{3}{2}=\frac{9}{8}$$

Conceptual variation: different ways to show the children how to calculate: 5/6 ÷ 7

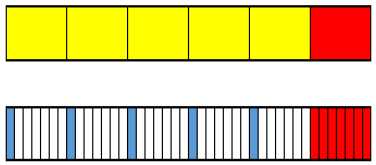
Tom and Sara make a cake for them and their 5 friends.
Mum comes along and eats 1/6 before the children realise.
They then share the remaining cake out between them and their friends (i.e. 7 children).

Sketch a model of the 6 parts and select 5.
Then divide the whole into 7 parts. 6 x 7 = 42.

1/7 of each of the 5/6 shaded gives 5 out of a possible 42 parts.



Using a more traditional bar model:



Using calculation method:

$$\frac{5}{6}\div 7=\frac{5}{6}\div\frac{7}{1}=\frac{5}{6}\times\frac{1}{7}=\frac{5}{42}$$