Maths Calculation Policy

Walverden Primary School

2021 - 2022

This policy has been largely adapted from the White Rose Maths Hub Calculation Policy and Guidance. It is a working document and will be revised and amended as necessary.

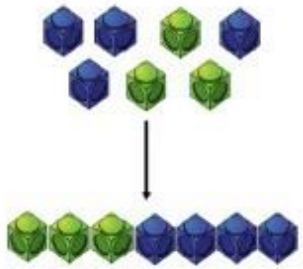
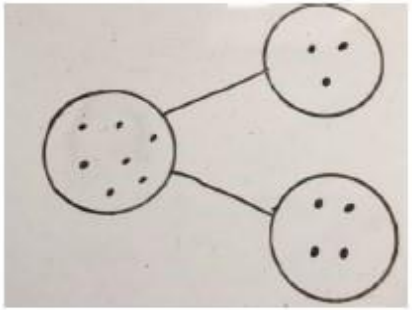
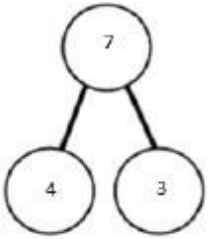
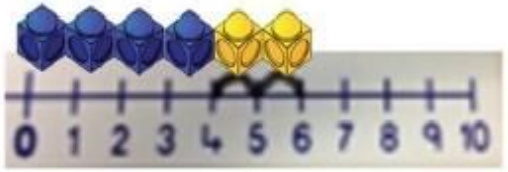
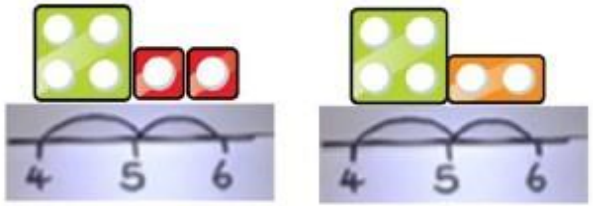
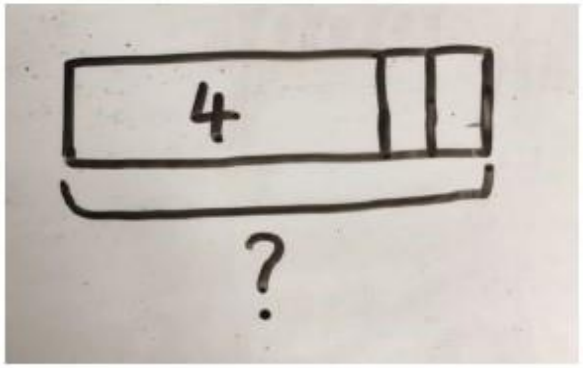
Calculation Policy: Guidance

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

Calculation Policy: Guidance

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

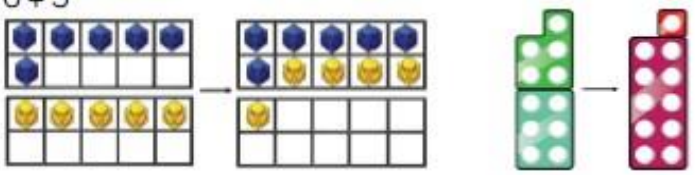
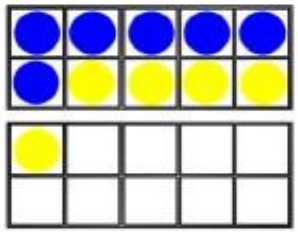
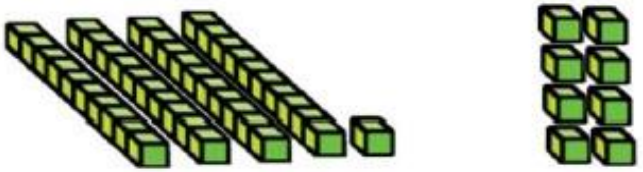
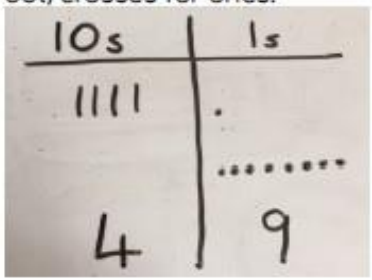
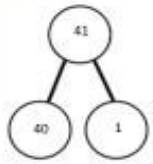
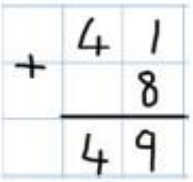
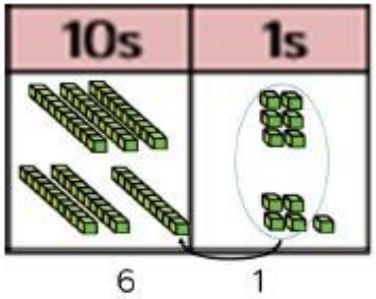
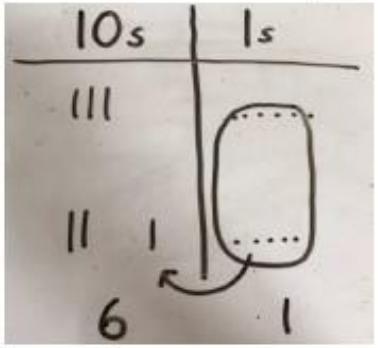
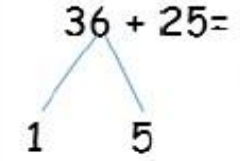
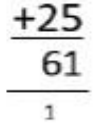
Calculation Policy: Addition

Concrete	Pictorial	Abstract
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. 
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 

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

Key question: Do we need to exchange?

Calculation Policy: Addition

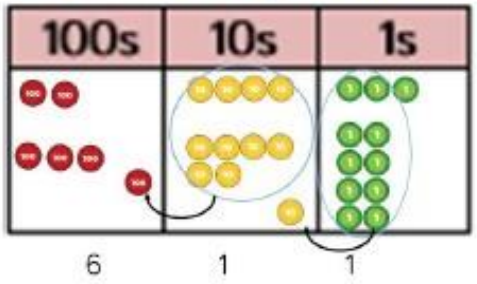
Regrouping to make 10; using ten frames and counters/cubes or using Numicon. 6 + 5 	Children to draw the ten frame and counters/cubes. 	Children to develop an understanding of equality e.g. 6 + □ = 11 6 + 5 = 5 + □ 6 + 5 = □ + 4
TO + O using base 10. Continue to develop understanding of partitioning 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 
TO + TO using base 10. Continue to develop understanding of partitioning and place value. 36 + 25 	Chidlren 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: 

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

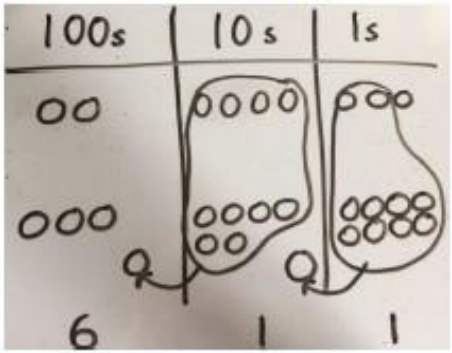
Key question: Do we need to exchange?

Calculation Policy: Addition

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.

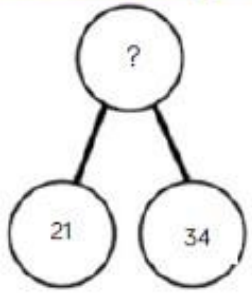


Chidren to represent the counters in a place value chart, circling when they make an exchange.



$$\begin{array}{r} 243 \\ +368 \\ \hline 611 \\ \hline 1\ 1 \end{array}$$

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



?	
21	34

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

21 + 34 = 55. Prove it

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

21 + 34 =

$\square$ = 21 + 34

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



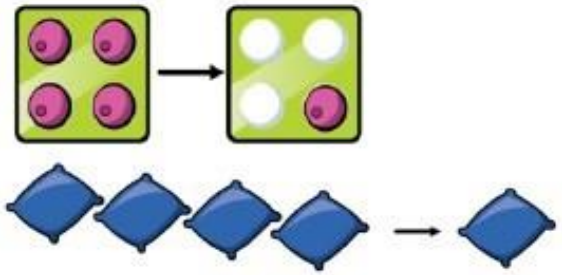
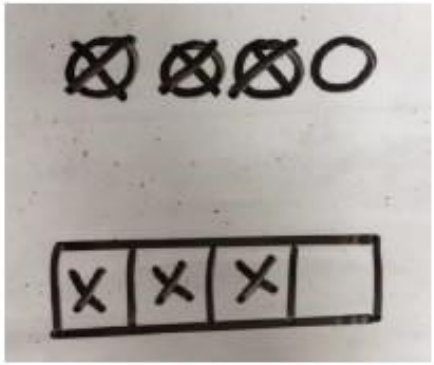
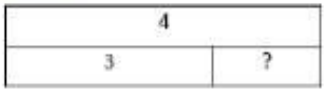
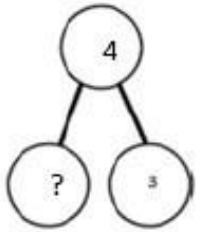
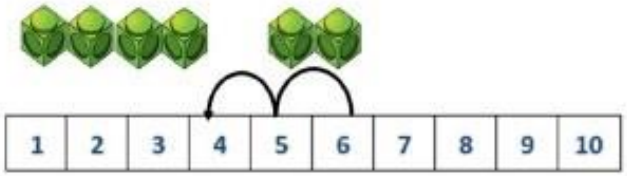
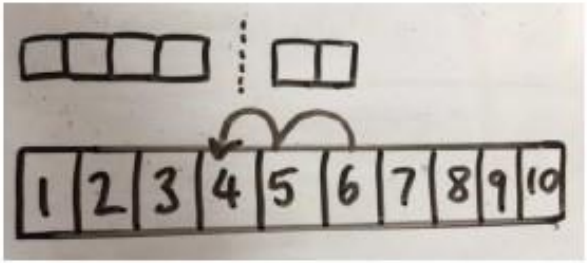
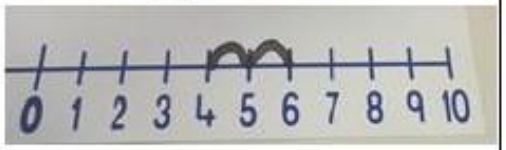
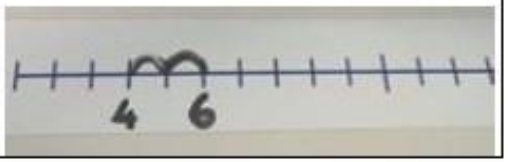
Missing digit problems:

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

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

Key question: Do we need to exchange?

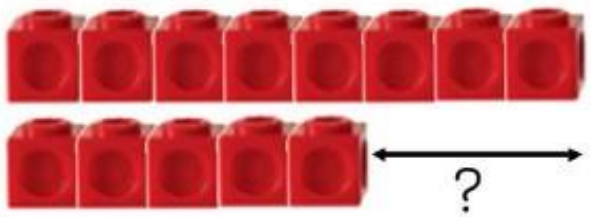
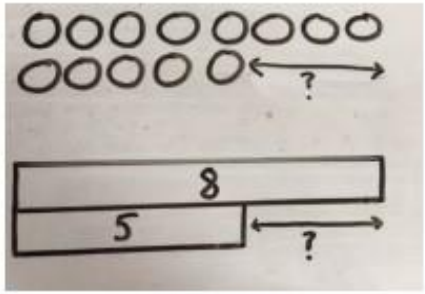
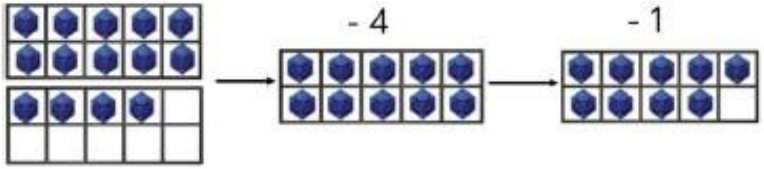
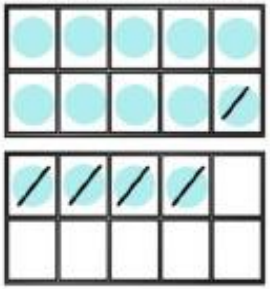
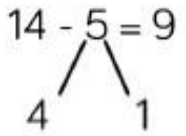
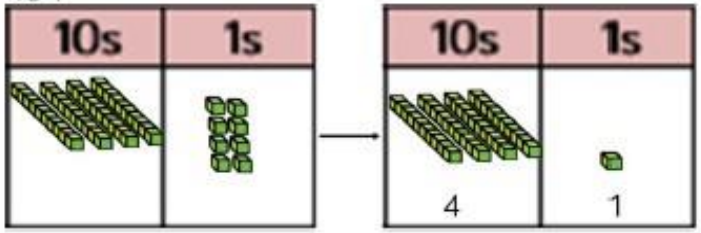
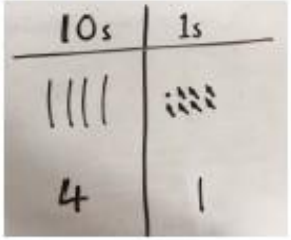
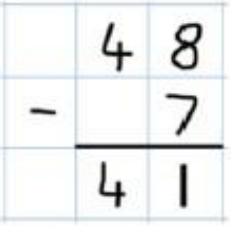
Calculation Policy: Subtraction

Concrete	Pictorial	Abstract
Physically taking away and removing objects from a whole (ten frames, Numicon, cubes and other items such as beanbags could be used). 4 – 3 = 1 	Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also be used. 	4- 3 = □ = 4 – 3  
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  

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

Key question: Do we need to exchange?

Calculation Policy: Subtraction

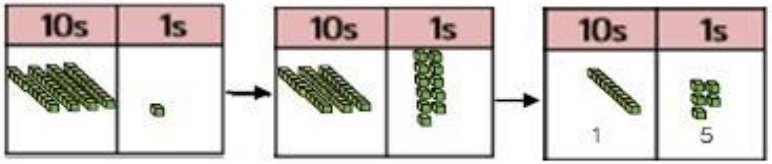
Finding the difference (using cubes, Numicon or Cuisenaire rods, other objects can also be used). Calculate the difference between 8 and 5. 	Children to draw the cubes/other concrete objects which they have used or use the bar model to illustrate what they need to calculate. 	Find the difference between 8 and 5. 8 – 5, the difference is ☐ Children to explore why 9 - 6 = 8 – 5 = 7 – 4 have the same difference.
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
Column method using base 10. 48-7 	Children to represent the base 10 pictorially. 	Column method or children could count back 7. 

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

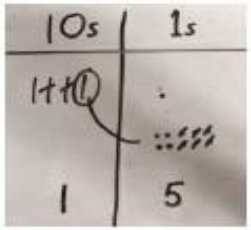
Key question: Do we need to exchange?

Calculation Policy: Subtraction

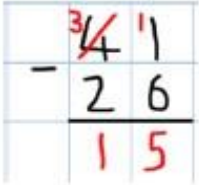
Column method using base 10 and having to exchange.
41 – 26



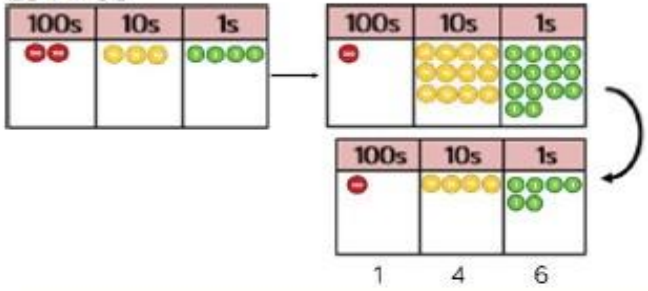
Represent the base 10 pictorially, remembering to show the exchange.



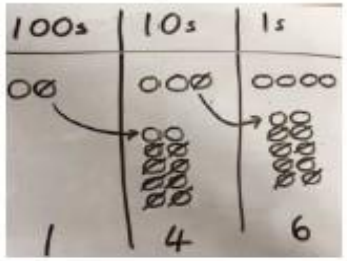
Formal column method. Children must understand that when they have exchanged the 10 they still have 41 because 41 = 30 + 11.



Column method using place value counters.
234 – 88



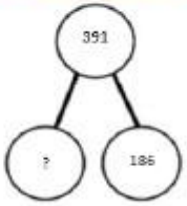
Represent the place value counters pictorially; remembering to show what has been exchanged.



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

$$\begin{array}{r} {}^{2}\not{2}\,{}^{1}\not{3}4 \\ -\ 88 \\ \hline 6 \end{array}$$

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.

☐ = 391 – 186

391
-186
———

What is 186 less than 391?

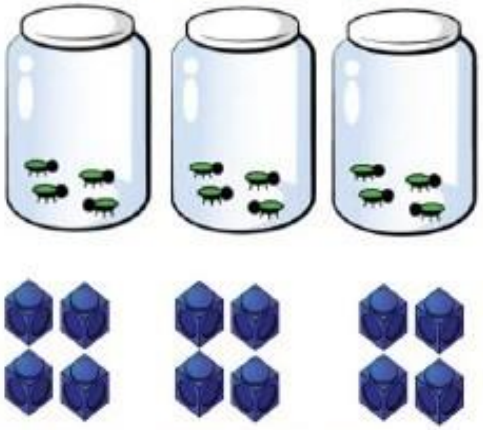
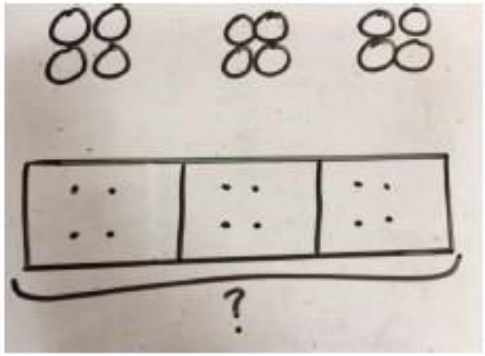
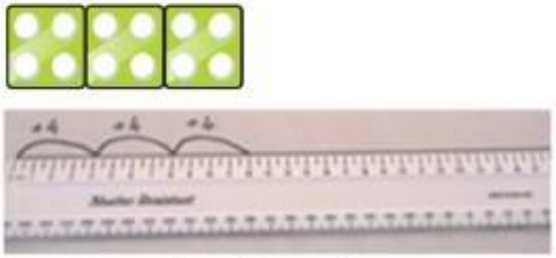
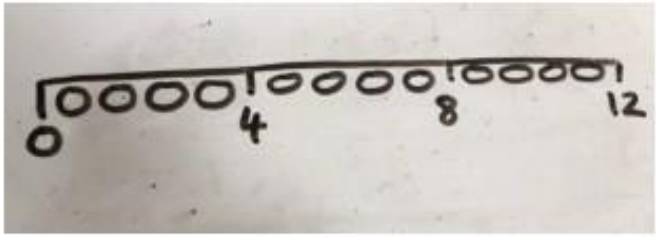
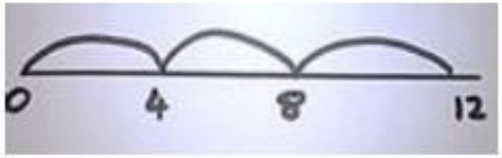
Missing digit calculations

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

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

Key question: Do we need to exchange?

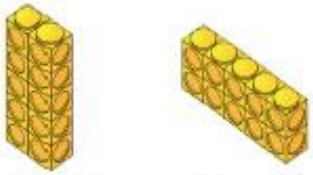
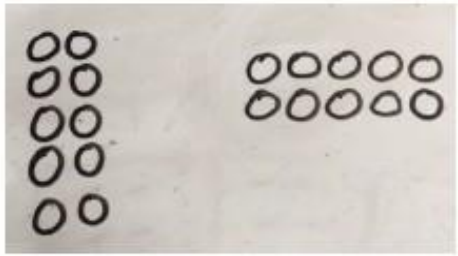
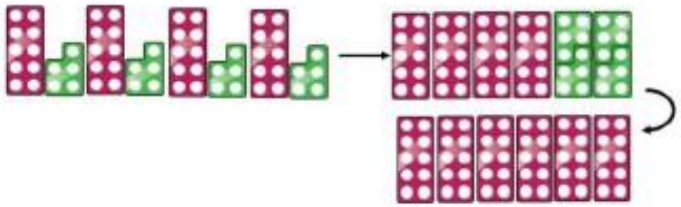
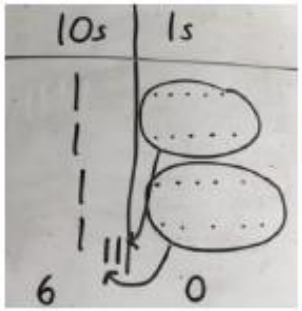
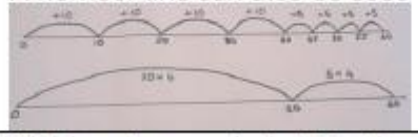
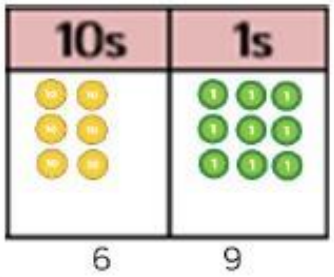
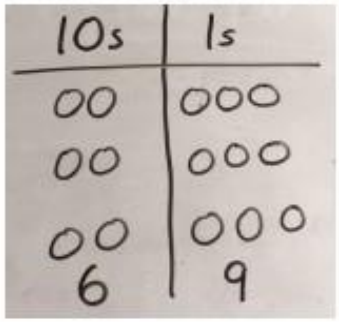
Calculation Policy: Multiplication

Concrete	Pictorial	Abstract
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
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 

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

Key question: Do we need to exchange?

Calculation Policy: Multiplication

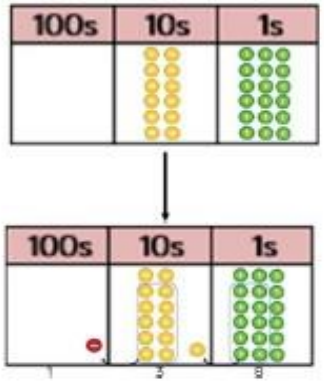
Use arrays to illustrate commutativity counters and other objects can also be used. $2 \times 5 = 5 \times 2$  2 lots of 5 5 lots of 2	Children to represent the arrays pictorially. 	Children to be able to use an array to write a range of calculations e.g. $10 = 2 \times 5$ $5 \times 2 = 10$ $2 + 2 + 2 + 2 + 2 = 10$ $10 = 5 + 5$
Partition to multiply using Numicon, base 10 or Cuisenaire rods. 4×15 	Children to represent the concrete manipulatives pictorially. 	Children to be encouraged to show the steps they have taken. 4×15 $10 \quad 5$ $10 \times 4 = 40$ $5 \times 4 = 20$ $40 + 20 = 60$ A number line can also be used 
Formal column method with place value counters (base 10 can also be used.) 3×23 	Children to represent the counters pictorially. 	Children to record what it is they are doing to show understanding. 3×23 $20 \quad 3$ $3 \times 20 = 60$ $3 \times 3 = 9$ $60 + 9 = 69$ $23 \times 3 = 69$

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

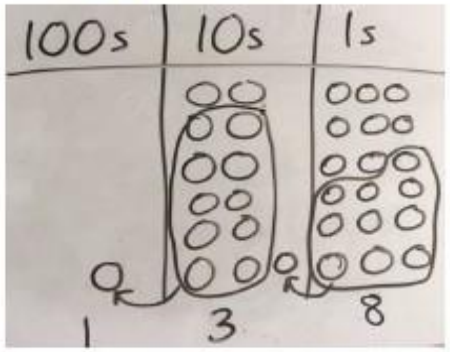
Key question: Do we need to exchange?

Calculation Policy: Multiplication

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

$$6 \times 23 =$$

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

When children start to multiply 3d × 3d and 4d × 2d etc., they should be confident with the abstract:

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

$$\begin{array}{r} {\scriptstyle 1\ 2} \\ 124 \\ \times\ \ 26 \\ \hline 744 \\ 2480 \\ \hline 3224 \\ \hline {\scriptstyle 1\ 1} \end{array}$$

Answer: 3224

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

23	23	23	23	23	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

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

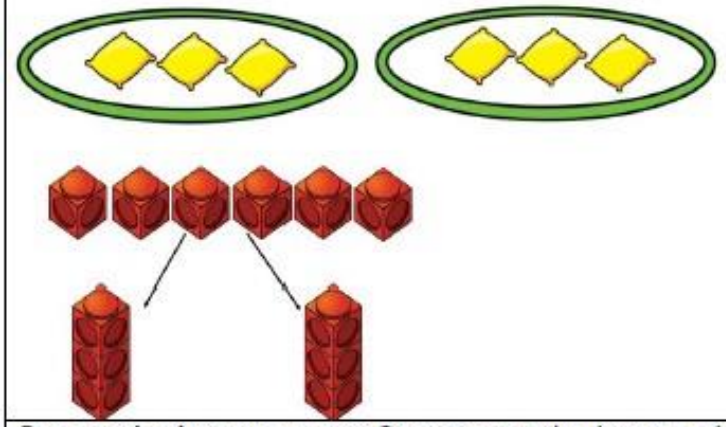
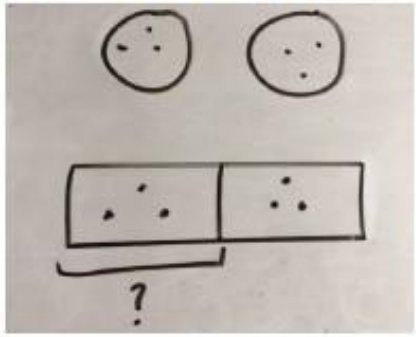
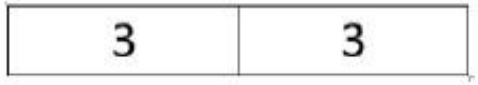
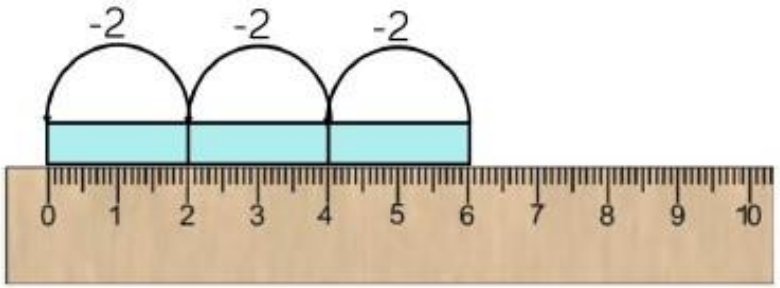
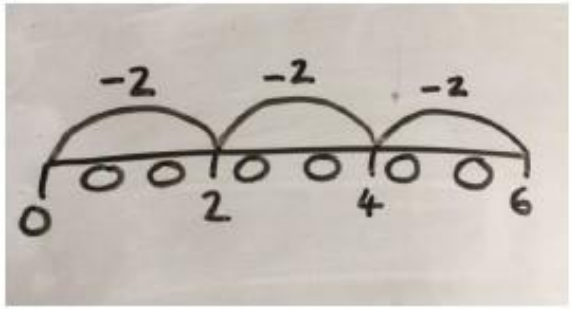
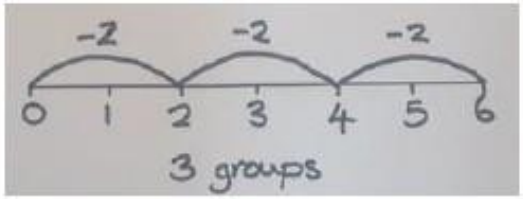
What is the calculation?
What is the product?



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

Key question: Do we need to exchange?

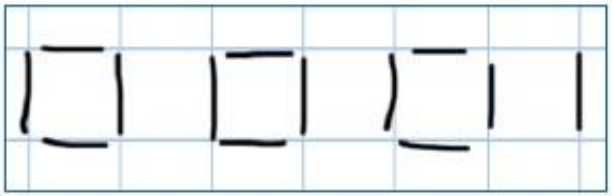
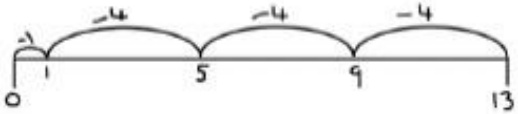
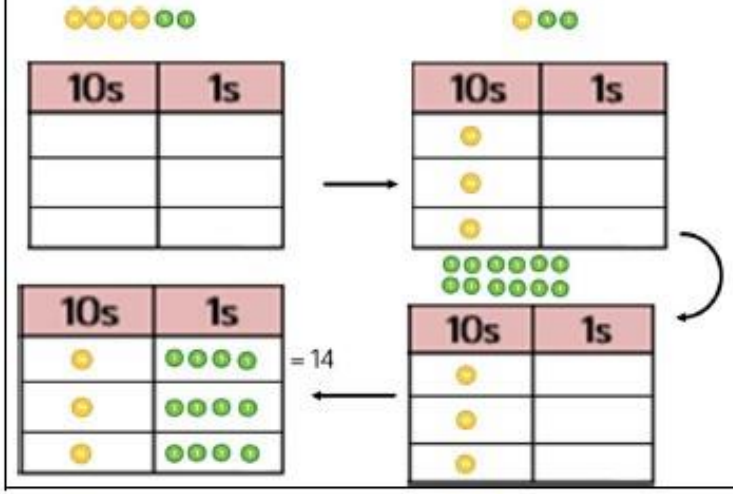
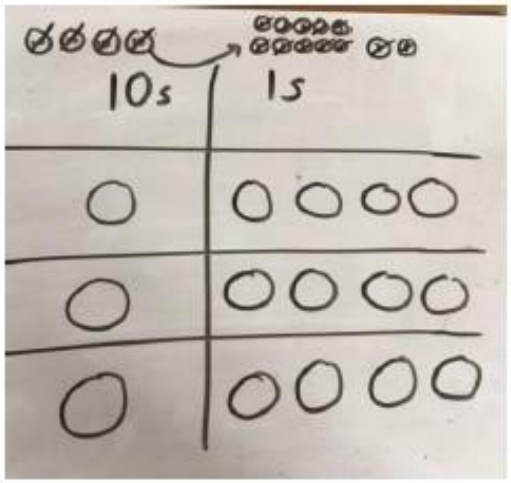
Calculation Policy: Division

Concrete	Pictorial	Abstract
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.
Repeated subtraction using Cuisenaire rods above a ruler. 6 ÷ 2  3 groups of 2	Children to represent repeated subtraction pictorially. 	Abstract number line to represent the equal groups that have been subtracted. 

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

Key question: Do we need to exchange?

Calculation Policy: Division

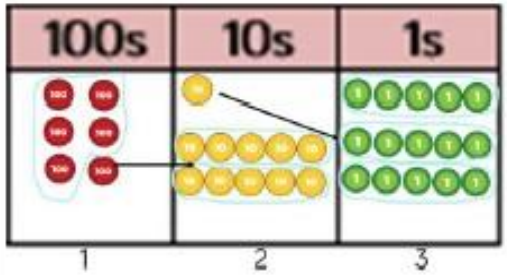
2d ÷ 1d with remainders using lollipop sticks. Cuisenaire rods, above a ruler can also be used. 13 ÷ 4 Use of lollipop sticks to form wholes- squares are made because we are dividing by 4.  There are 3 whole squares, with 1 left over.	Children to represent the lollipop sticks pictorially.  There are 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' 
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

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

Key question: Do we need to exchange?

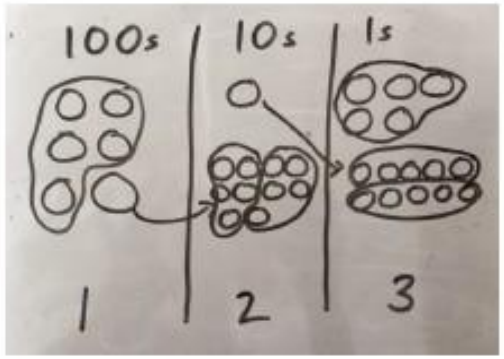
Calculation Policy: Division

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.

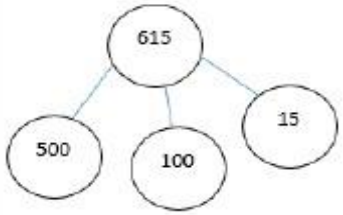


Children to the calculation using the short division scaffold.

$$\begin{array}{r} 123 \\ 5\overline{)6^{1}1^{1}5} \end{array}$$

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 =

$\square$ = 615 ÷ 5

What is the calculation?
What is the answer?



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

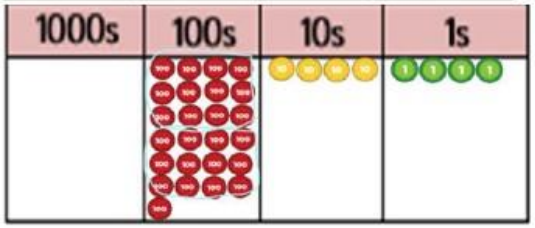
Key question: Do we need to exchange?

Calculation Policy: Division

Long division using place value counters
2544 ÷ 12

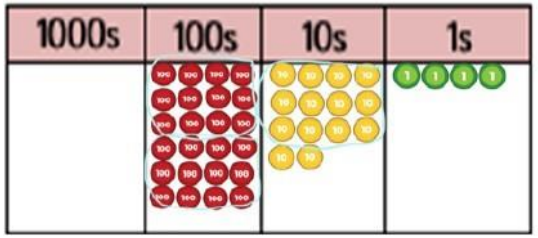


We can't group 2 thousands into groups of 12 so will exchange them.



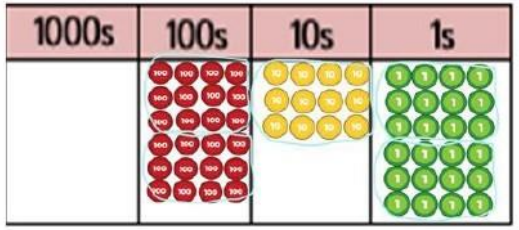
We can group 24 hundreds into groups of 12 which leaves with 1 hundred.

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



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.

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

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

Key question: Do we need to exchange?

Calculation Policy: Key Language

=	is equal to, is the same as
+	sum, total, parts and wholes, plus, add, altogether, more, exchange
-	take away, less than, the difference, subtract, minus, fewer, decrease, exchange
×	groups of, lots of, equal groups, times, multiplied by, the product of, double, exchange
÷	share, group, divide, divided by, half, exchange

Glossary

Concept	Definition
Acute	Describes angles between 0 and 90 degrees.
Adjacent	Adjoining (as used to describe lines and angles).
Alternate	Every other one in a sequence.
Angle	The number of degrees rotated around a point.
Area	The amount of space within a perimeter (expressed in square units).
Ascending order	The arrangement of numbers from smallest to largest.
Average	A number representing a set of numbers (obtained by dividing the total of the numbers by the numbers itself).
Axis of symmetry	A line dividing a shape into two symmetrical parts.
Baker's dozen	The colloquial name given to the number 13.
Base	The line or face on which a shape is standing.
Base angles	Those angles adjacent to the base of a shape.
Bisect	To divide into two equal parts.
Breadth	Breadth is another name for width. It is the distance across from side to side.
Capacity	The amount of space in an object (the amount of liquid or air it contains).
Cardinal number	A number that shows quantity but not order.

Carroll Diagram	A number that shows quantity but not order.
Circumference	The distance around a circle (its perimeter).
Composite number	A number with more than two factors.
Congruent	Congruent shapes are the same shape and size (equal).
Consecutive	Consecutive numbers follow in order without interruption (e.g. 2,3,4,5).
Coordinates	Numbers used to locate a point on a grid.
Denominator	The number below the line in a fraction.
Descending order	The arrangement of numbers from the largest to smallest.
Diagonal	A straight line connecting two non- adjacent vertices (corners) of a polygon.
Difference	By how much a number is bigger or smaller than another.
Digit	Any number from 0 to 9 (inclusive).
Digital root	The digital root of 58 is 4 because 5 + 8 = 13 and 1 + 3 = 4
Dimensions	The measurements of a shape (i.e. length, width, height).
Dodecagon	A twelve sided polygon.
Edge	The intersection of two faces of a three-dimensional object.
Equation	A statement of equality between two expressions (e.g. 3 x 4 = 6 + 6).
Equilateral triangle	A triangle with congruent (equal) sides and angles.
Even number	A positive or negative number exactly divisible by 2.

Exterior	Outside.
Face	A plane surface of a three-dimensional object.
Face value	The numeral itself despite its position in a number (e.g. the face value of 8 in 38,250 is 8).
Factor	A number which will divide exactly into another number.
Greater than	An inequality between numbers. The symbol used to represent greater than is an arrow pointing towards the smallest number.
Gross	The name given to the number 144.
Hendecagon	A two dimensional shape with eleven sides and eleven angles also called an undecagon.
Heptagon	A two dimensional shape with seven sides and seven angles also called a septagon.
Hexagon	A polygon with six sides.
Horizontal	Describes a line or plane parallel to the earth's surface.
Improper fraction	A fraction whose numerator is equal to or greater than its denominator.
Integer	A negative or positive whole number.
Interior	Inside.
Intersection	The point or line where two lines or two faces meet.
Irregular shapes	Shapes which do not have all congruent sides and all congruent angles.
Isosceles triangle	A triangle which has two equal sides of equal length.
Kite	A quadrilateral that has two adjacent pairs of sides that are equal in length, and at least one pair of opposite angles are equal.

Less than	An inequality between numbers. The symbol used to represent less than is an arrow pointing towards the smallest number.
Lozenge	Another name for a rhombus.
Mean	The average of a set of numbers. The sum of the values in a set of data divided by the total number of items in that set.
Median	The middle value of a set of ordered data.
Mode	The value that occurs the most often in a set of data
Multiple	The product of a given number with another factor.
Numerator	The number above the line in a fraction.
Oblique	Oblique means sloping or slanting.
Oblong	A shape with two pairs of straight, unequal sides and four right angles. Also known as a rectangle.
Obtuse angle	An angle between 90 and 180 degrees.
Octagon	A polygon with eight sides and eight angles.
Odd number	A number that when divided by two leaves a remainder of one.
Ordinal number	Describes a position in a number sequence.
Parallel lines	Lines with no common points and always the same distance apart.
Parallelogram	A four-sided polygon with opposite sides equal and parallel and the opposite angles are equal in size.
Perimeter	The length of the distance around the boundary of a shape.

Perpendicular line	A line at right angles to another line or plane.
Polyhedron	A three dimensional shape with plane faces.
Place value	Indicates the position of a numeral (e.g. the place value of the 3 in 738 is 30)
Prime number	A number with only two factors, 1 and itself (e.g. 2,3,5,7,11, 13, 17, 19, 23…)
Product	The result when two or more numbers are multiplied.
Quadrant	A quarter of the area of a circle which also contains a right angle.
Quotient	The result when one number is divided by another number.
Quindecagon	A polygon with fifteen sides and fifteen angles.
Rectangle	A quadrilateral with opposite sides equal and parallel and containing four right angles
Reflex angle	An angle greater than 180 degrees.
Rhombus	A parallelogram with congruent sides. Opposite sides are parallel and opposite sides are equal in size.
Roman numerals	Seven letters are used in combination to write numbers: I = 1 V = 5 X = 10 L = 50 C = 100 D = 500 M = 1000
Rotational symmetry	A shape is said to have rotational symmetry if it looks the same in different positions when rotated about its centre.
Rounding	An approximation used to express a number in a more convenient way.
Scalene triangle	A triangle that has three sides of different length and no equal angles.
Score	The name given to the number 20.
Squared	A number squared is a number multiplied by itself.

Square number	A number whose units can be arranged into a square (e.g. 1,4,9,16,25,36,49,64…)
Sum	The result when two or more numbers are added together.
Symmetrical	A shape is symmetrical if it is identical on either side of a line dividing it into two parts.
Tally	A record of items using vertical and oblique lines to represent each item.
Tetragon	A four sided shape.
Tessellation	Shapes fitted together with a number of exact copies and with no overlaps or gaps.
Translation	This takes place when a shape is moved from one place to another just by sliding it (without rotating, reflecting or enlarging).
Trapezium	A quadrilateral with two parallel sides.
Triangular number	A number whose units can be arranged into a triangle (e.g. 1, 3, 6, 10, 15, 21…)
Trigon	A three sided shape.
Vertex	The point at which two or more line segments or two or more edges of a polyhedron meet.
Vertical line	A line which is at right angles to a horizontal line.