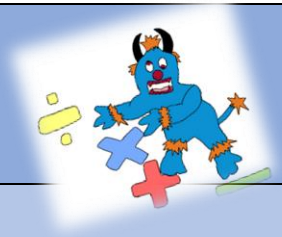
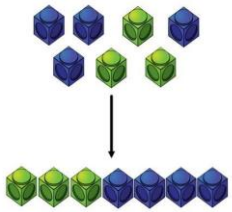
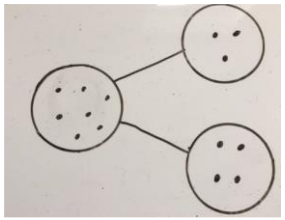
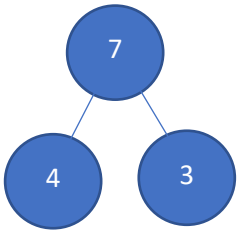
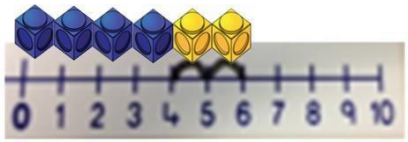
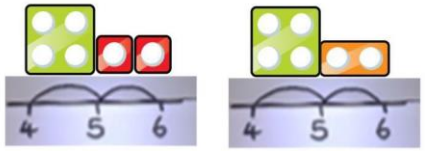
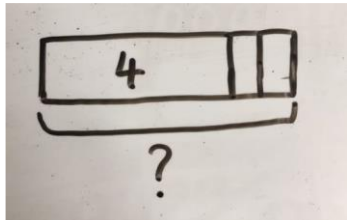
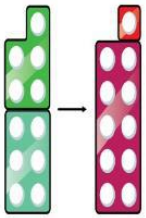
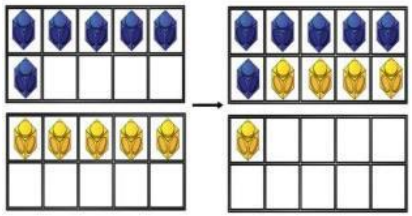
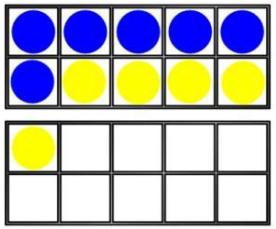


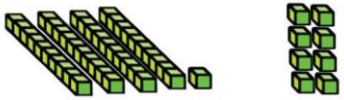
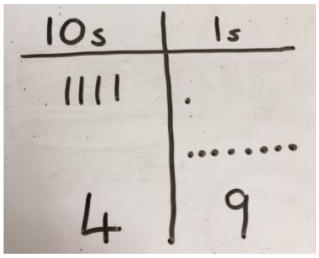
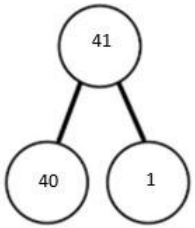
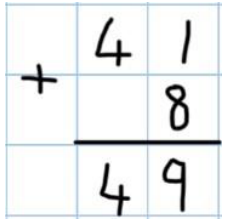
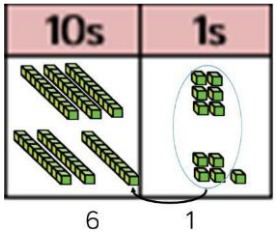
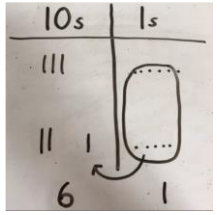
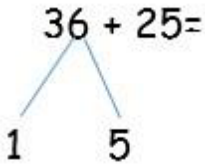
Priestley Primary School
Calculation Policy

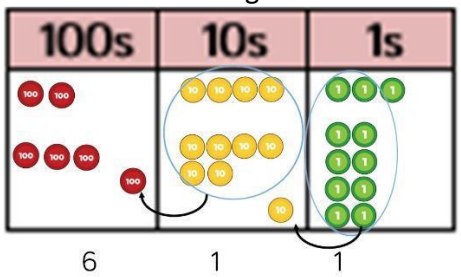
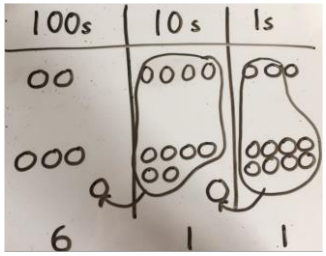
Addition

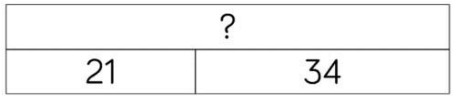
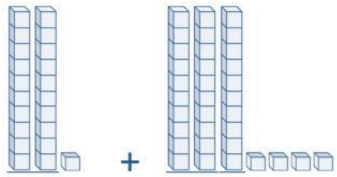
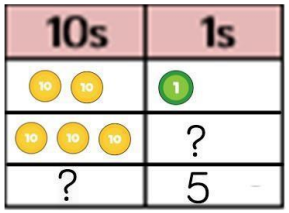
Key language – sum, total, parts and wholes, plus, add , altogether, more, ‘is equal to’, ‘is the same as’.

Concrete	Pictorial	Abstract	
Combining two parts to make a whole (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, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs ▪ represent and use number bonds and related subtraction facts within 20 ▪ add and subtract one-digit and two-digit numbers to 20, including zero ▪ solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = – 9.

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  	Year 1 ▪ read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs ▪ represent and use number bonds and related subtraction facts within 20 ▪ add and subtract one-digit and two-digit numbers to 20, including zero ▪ solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = – 9.
Regrouping to make 10; using ten frames and counters/cubes or using Numicon.  	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	As above and: Year 2 ▪ solve problems with addition and subtraction: ▪ using concrete objects and pictorial representations, including those involving numbers, quantities and measures ▪ applying their increasing knowledge of mental and written methods ▪ add and subtract numbers using concrete objects, pictorial representations, and mentally, including: ▪ a two-digit number and ones ▪ a two-digit number and tens ▪ two two-digit numbers ▪ adding three one-digit numbers show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot .

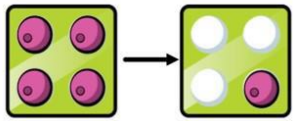
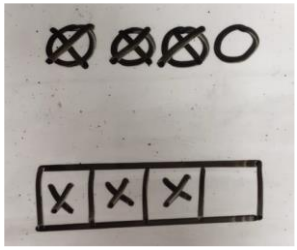
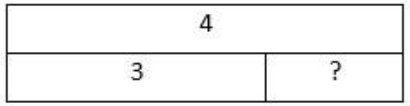
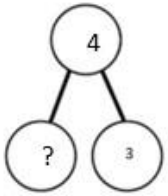
TO + O using base 10. Continue to develop understanding of partitioning and place value. 41 + 8 	Children to represent the base 10 e.g. lines for tens and dot / crosses for the ones. 	40 + 1 = 41  1+ 8 = 9 40 + 9 = 49 	Year 2 ▪ solve problems with addition and subtraction: ▪ using concrete objects and pictorial representations, including those involving numbers, quantities and measures ▪ applying their increasing knowledge of mental and written methods ▪ add and subtract numbers using concrete objects, pictorial representations, and mentally, including: ▪ a two-digit number and ones ▪ a two-digit number and tens ▪ two two-digit numbers ▪ adding three one-digit numbers show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot.
TO + TO using base 10. Continue to develop understanding of partitioning and place value. 36 + 25 	Children to represent the base 10 in a place value chart. 	Looking for ways to make 10. 30 + 20 = 50 5+ 5 = 10 50 + 10 + 1 = 61  Formal method 36 +25 61 1	As above and: Year 3 ▪ add and subtract numbers mentally, including: ▪ a three-digit number and ones ▪ a three-digit number and tens ▪ a three-digit number and hundreds ▪ add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction.

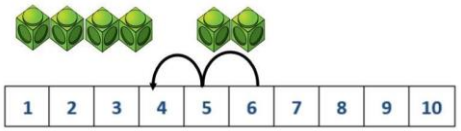
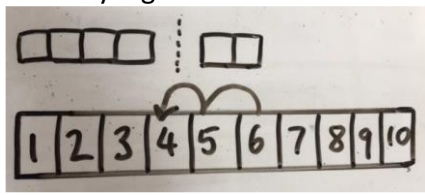
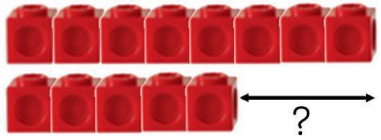
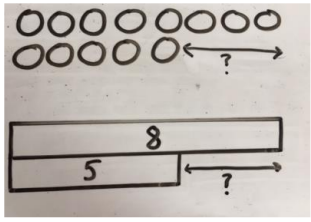
Use of place value counters to add HTO + TO, HTO + HTO etc. When there are 10 ones in the 1s column- we exchange for 1 ten, when there are 10 tens in the 10s column- we exchange for 1 hundred.  	Children to represent the counters in a place value chart, circling when they make an exchange.  	243 +368 611 1 1	Year 3 ▪ add and subtract numbers mentally, including: ▪ a three-digit number and ones ▪ a three-digit number and tens ▪ a three-digit number and hundreds ▪ add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction ▪ solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction. Year 4 ▪ add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate ▪ solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why. Year 5 ▪ add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction) ▪ add and subtract numbers mentally with increasingly large numbers ▪ solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why. Year 6 solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why
Conceptual Variation - different ways to ask children to solve 21 + 34			
	Word problems:		

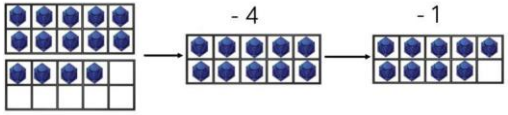
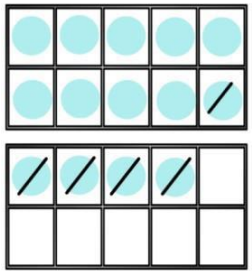
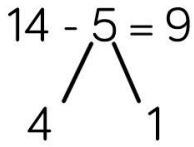
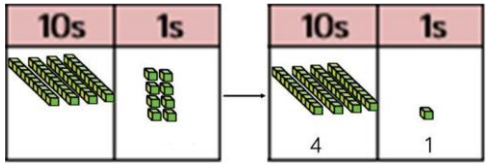
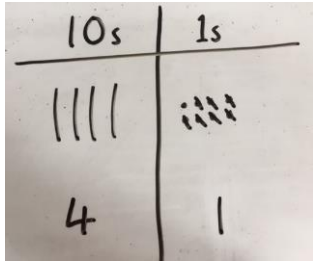
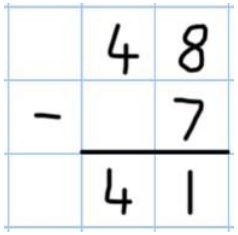
	In year 3, there are 21 children and in year 4, there are 34 children. How many children in total? 21 + 34 = 55. Prove it	Calculate the sum of twenty-one and thirty-four. 21 +34 ___	 

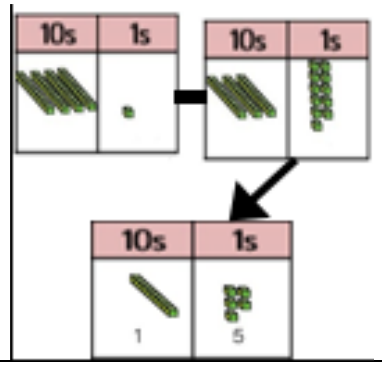
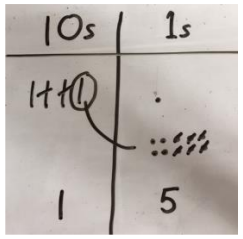
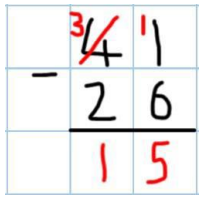
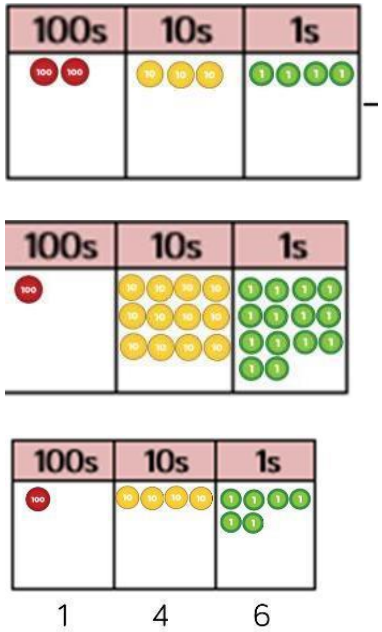
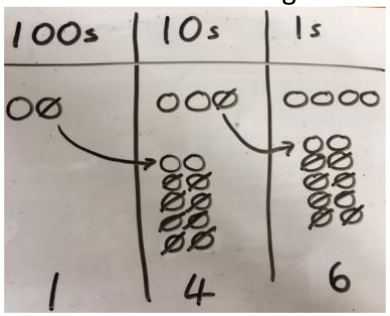
Subtraction

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

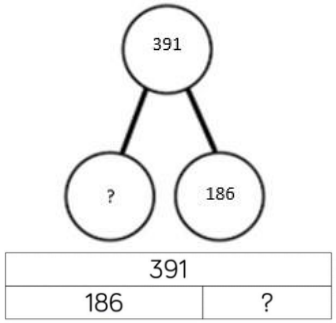
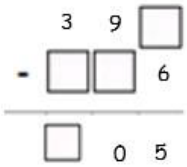
Concrete	Pictorial	Abstract	
Physically taking away and removing objects from a whole (ten frames, Numicon, cubes and other items such as beanbags could be used).  	Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also be used. 	4- 3 = = 4-3  	Year 1 ▪ read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs ▪ represent and use number bonds and related subtraction facts within 20 ▪ add and subtract one-digit and two-digit numbers to 20, including zero Solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = – 9. And Year 2 (below).

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.  	Year 1 (above) and Year 2 ▪ solve problems with addition and subtraction: ▪ using concrete objects and pictorial representations, including those involving numbers, quantities and measures ▪ applying their increasing knowledge of mental and written methods ▪ add and subtract numbers using concrete objects, pictorial representations, and mentally, including: ▪ a two-digit number and ones ▪ a two-digit number and tens ▪ two two-digit number
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.	Year 2 ▪ solve problems with addition and subtraction: ▪ using concrete objects and pictorial representations, including those involving numbers, quantities and measures ▪ applying their increasing knowledge of mental and written methods ▪ add and subtract numbers using concrete objects, pictorial representations, and mentally, including: ▪ a two-digit number and ones ▪ a two-digit number and tens ▪ two two-digit number ▪ recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.

Making 10 using ten frames.  	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  	Year 2 ▪ solve problems with addition and subtraction: ▪ using concrete objects and pictorial representations, including those involving numbers, quantities and measures ▪ applying their increasing knowledge of mental and written methods ▪ add and subtract numbers using concrete objects, pictorial representations, and mentally, including: ▪ a two-digit number and ones ▪ a two-digit number and tens ▪ two two-digit number ▪ recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.
Column method using base 10.  	Children to represent the base 10 pictorially.  	Column method or children could count back 7.  	Year 3: ▪ add and subtract numbers mentally, including: ▪ a three-digit number and ones ▪ a three-digit number and tens ▪ a three-digit number and hundreds ▪ add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction ▪ estimate the answer to a calculation and use inverse operations to check answers
Column method using base 10 and having to exchange	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.	Year 3 (above) and Year 4: ▪ add and subtract numbers with up to 4 digits using the formal written methods of

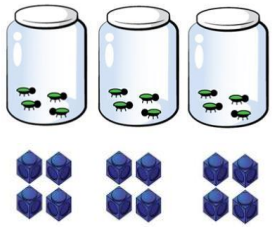
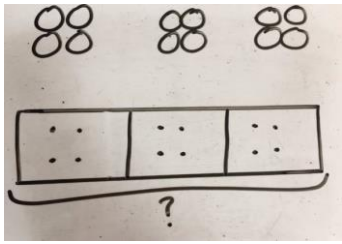
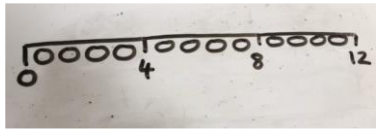
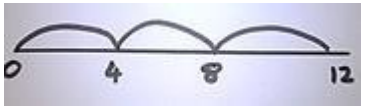
41 -26  	 	 	columnar addition and subtraction where appropriate ▪ estimate and use inverse operations to check answers to a calculation ▪ solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.
Column method using place value counters.  234-88 =	Represent the place value counters pictorially; remembering to show what has been exchanged.  	Formal column method. Children must understand what has happened when they have crossed out digits. 2 1 2~~3~~4 - 88 6	Year 3 and Year 4 Year 5 ▪ add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction) ▪ solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why Year 6 solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why

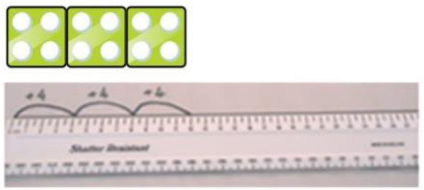
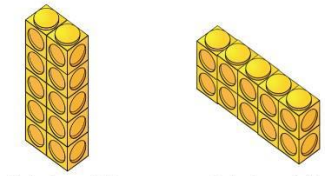
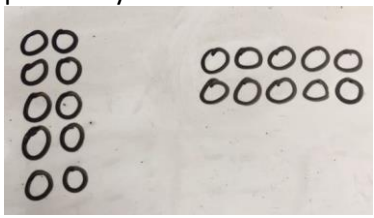
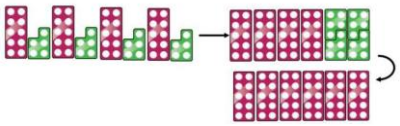
Conceptual variation- different ways to ask children to solve 391 - 186

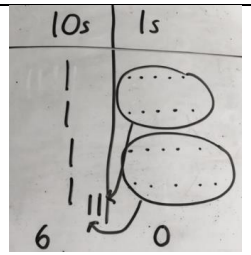
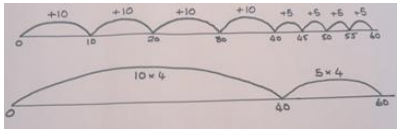
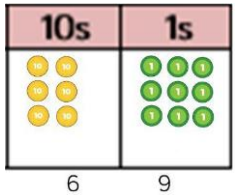
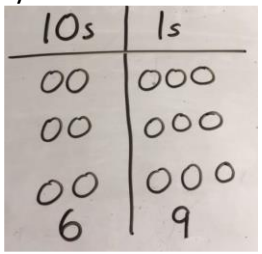
	Raj spent £391, Timmy spent £186. How much more did Raj spend? Calculate the difference between 391 and 186.	391 -186 ____ What is 186 less than 391?	Missing digit calculations 

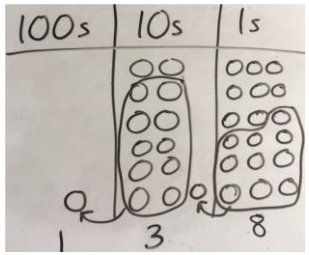
Multiplication

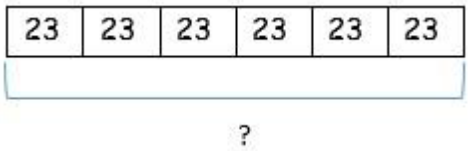
Key language – doubled, times, multiply by, the product of, groups of, lots of, equal groups

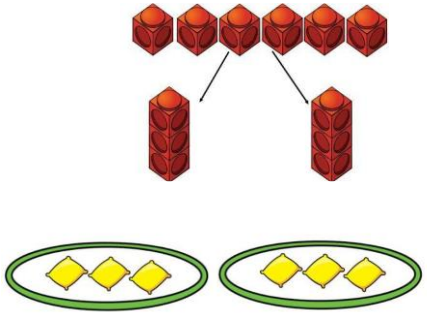
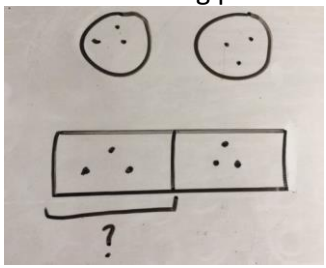
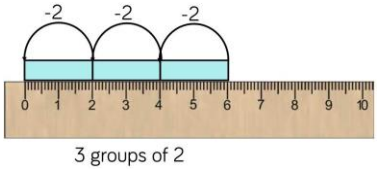
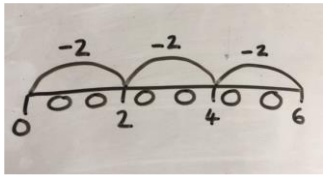
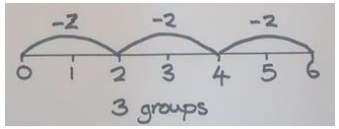
Repeated grouping/repeated addition 3 × 4 4 + 4 + 4 	Children to represent the practical resources in a picture and use a bar model. 	3 × 4 = 12 4 + 4 + 4 = 12	Year 1: • solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.
Number lines to show repeated groups- 3 × 4	Represent this pictorially alongside a number line e.g.: 	Abstract number line showing three jumps of four. 3 × 4 = 12 	Year 2: ▪ calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs

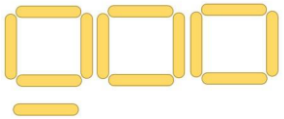
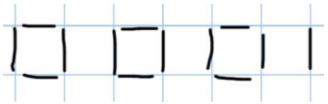
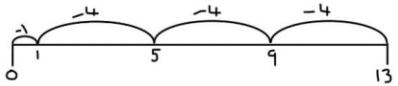
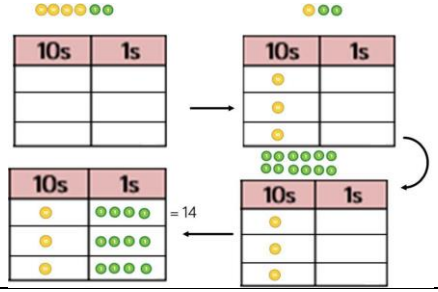
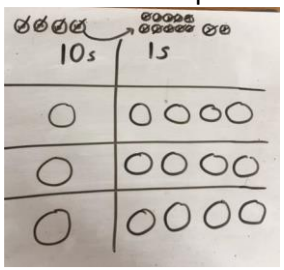
			▪ show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot ▪ solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.
Use arrays to illustrate commutativity counters and other objects can also be used. 2 × 5 = 5 × 2  2 lots of 5 5 lots of 2	Children to represent the arrays pictorially. 	Children to be able to use an array to write a range of calculations e.g. 10 = 2 × 5 5 × 2 = 10 2 + 2 + 2 + 2 + 2 = 10 10 = 5 + 5	Year 2: ▪ calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs ▪ show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot. ▪ solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.
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.	Year 3: • write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for

		4 × 15 10 5 10 × 4 = 40 5 × 4 = 20 40 + 20 = 60  A number line can also be used.	two-digit numbers times one-digit numbers, using mental and progressing to formal written methods ▯ solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.
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 3 × 20 = 60 3 × 3 = 9 20 3 60 + 9 = 69 23 × 3 69	Year 3: ▯ write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods Year 4: ▪ recognise and use factor pairs and commutativity in mental calculations ▪ multiply two-digit and three-digit numbers by a one-digit number using formal written layout ▪ solve problems involving multiplying and adding, including using the distributive law to multiply

			two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.
	Children to represent the counters/base 10, pictorially e.g. the image below.  	Formal written method 6 x 23 = $\begin{array}{r} 23 \\ \times\ \ 6 \\ \hline 138 \\ \hline {\scriptstyle 1\ 1} \end{array}$	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 ▪ multiply and divide whole numbers and those involving decimals by 10, 100 and 1000 ▪ solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes Year 6: ▪ multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context

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.	$\begin{array}{r} 124 \\ \times\ 26 \\ \hline 744 \\ {\scriptstyle 1}\quad {\scriptstyle 2} \\ 2480 \\ \hline 3224 \\ \hline {\scriptstyle 1}\ {\scriptstyle 1} \end{array}$ Answer: 3224	Year 6: ▪ multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication ▪ divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
Conceptual variation - different ways to ask children to solve 6 × 23		
Mai had to swim 23 lengths, 6 times a week. How many lengths did she swim in one week? With the counters, prove that 6 x 23 = 138  	Find the product of 6 and 23 $\begin{array}{r} 6 \\ \times\ 23 \\ \hline \\ \hline \end{array}$ $\begin{array}{r} 23 \\ \times\ 6 \\ \hline \\ \hline \end{array}$ 6 x 23 =	What is the calculation? What is the product?
Division **Key language – share, group, divide, divide by, half**		

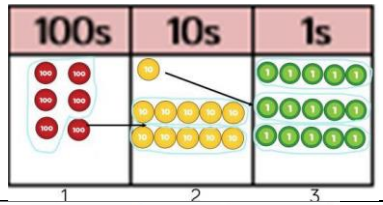
Sharing using a range of objects. 6 ÷ 2 	Represent the sharing pictorially  	6 ÷ 2 = 3 3 | 3 Children should also be encouraged to use their 2 times tables facts.	Year 1: • solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher. 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 materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts
Repeated subtraction using Cuisenaire rods above a ruler. 6 ÷ 2  	Children to represent repeated subtraction pictorially.  	Abstract number line to represent the equal groups that have been subtracted.  	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 materials, arrays, repeated addition, mental methods, and multiplication

			and division facts, including problems in contexts
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' 	Year 3: ▪ write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods ▪ solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.
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	Year 4: ▪ use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers

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

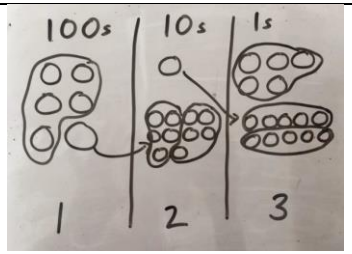
1. Make 615 with place value counters.
2. How many groups of 5 hundreds can you make with 6 hundred counters?
3. Exchange 1 hundred for 10 tens.

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?



Children to the calculation using the short division scaffold.

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

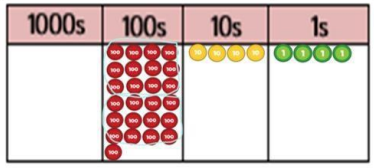


Represent the place value counters pictorially.

Year 5:
- multiply and divide numbers mentally drawing upon known facts
- divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context
- multiply and divide whole numbers and those involving decimals by 10, 100 and 1000
- solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates

And Year 6 (below)

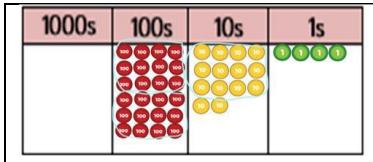
We can't group 2 thousands into groups of 12 so will exchange them.



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

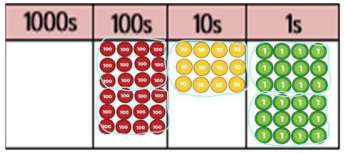
$$\begin{array}{r} 02 \\ 12\overline{)\,2^{2}544} \\ 24 \\ \hline 1 \end{array}$$

Year 6
- divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context



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

```
     0 2 1
12 | 2544
     24
      14
      12
       2
```

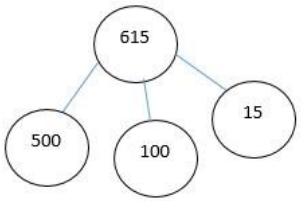


After exchanging the 2 tens, we have 24 ones. We can group 24 ones into 2 group of 12, which leaves no remainder.

```
     0 2 1 2
12 | 2544
     24
      14
      12
       24
       24
        0
```

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 ÷ 15 =

___ = 615 ÷15