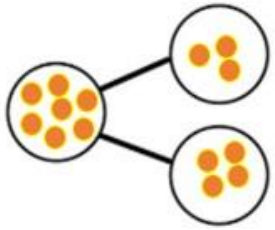
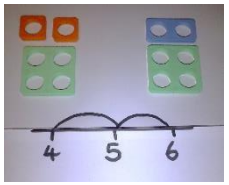
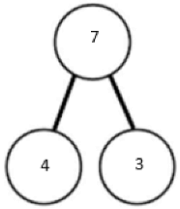
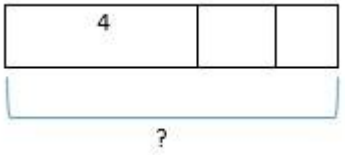
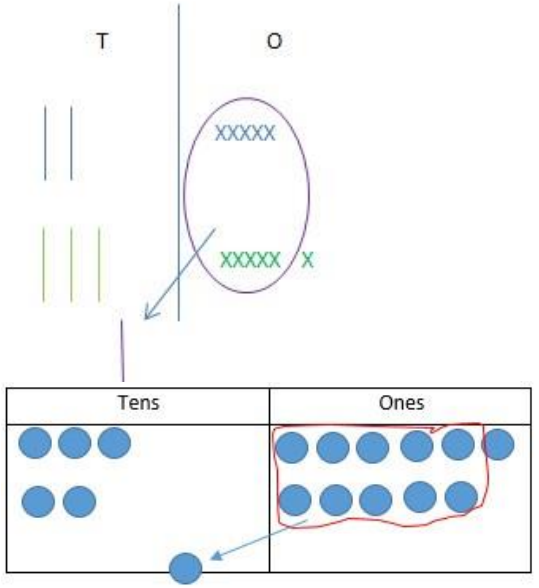
Lunsford Primary School
Maths Calculation Policy

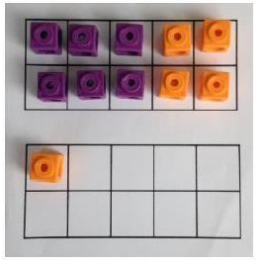
Progression in written methods of calculation (the four operations)

Addition-

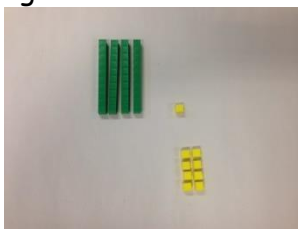
Key language which should be used: sum, total, parts and wholes, plus, add, altogether, more than, 'is equal to' 'is the same as'
Understand the relationship between addition and subtraction and how the inverse of one can be used to check the other.

Year 1	Year 2	Year 3
Counting and Combining sets of Objects - Combining two parts to make a whole (use other resources too e.g. eggs, shells, teddy bears etc). This will lead to a pictorial representation.    - Counting on using number lines by using cubes or Numicon.  	**Counting and Combining sets of Objects** - Combining two parts to make a whole using an abstract approach.  *4 + 3 = 7 (four is a part, 3 is a part and the whole is seven)* - Counting on using number lines by using a bar model. 	**Towards a Written Method** Tens and ones - Partition both numbers and then recombine, continuing on from year 2.  - Formal method of adding tens and ones

- Regrouping to make 10 by using counters/ cubes or using Numicon.



- TO + O using base 10 to develop understanding of partitioning and place value eg 41 + 8



+ = signs and missing numbers

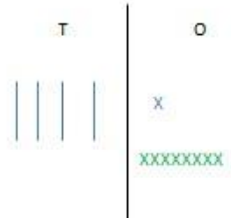
Children need to develop an understanding of equality before using the = sign. Missing numbers need to be placed in all possible places.

6 + ☐ = 11 and

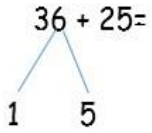
6 + 5 = 5 + ☐ 6 + 5 = ☐ + 4

Towards a Written Method

- Building on from year 1, children to represent the concrete calculation using a symbol i.e. lines for tens and dots/ crosses for ones.



- Looking for ways to make ten



30 + 20 = 50
5 + 5 = 10
50 + 10 + 1 = 61

Can be moved onto the expanded method before the final formal method, using tens and ones.

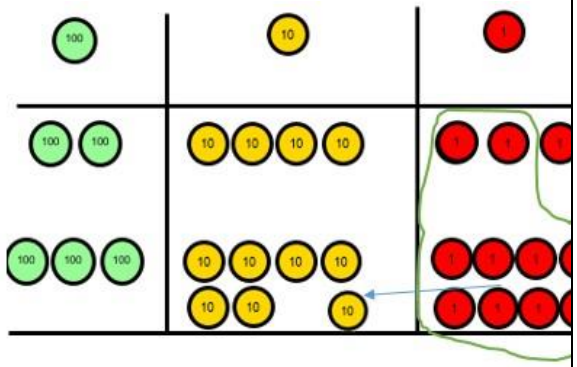
+ = signs and missing numbers

- Missing number problems, continuing to develop understanding of equality eg. 14 +6 = 10 + ?
32 + ? + ? = 150

36
+25
61
1

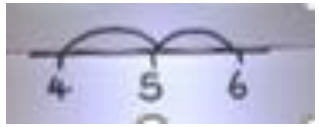
Hundreds, tens and ones

- Introduce expanded column addition modelled with place counters or a pictorial representation, using hundreds, tens and ones.

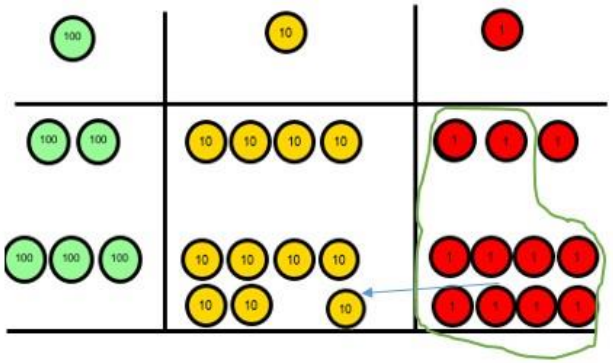


- Using a bar model to represent a word problem.

Counting on with a number line

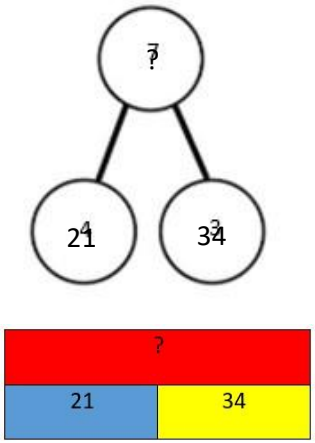
		- Use of the abstract number line: *what is 2 more than 4? What is the sum of 4 and 4? What's the total of 4 and 2?*  **<u>+ = signs and missing numbers</u>** Missing number problems using a range of equations as in year 1 and 2 but with larger numbers.

Year 4	Year 5	Year 6

Written method (progressing to thousands, hundreds, tens and ones) - Expanded column addition modelled with place value counters, progressing to calculations with 4-digit numbers.  - Compact written method, extending to numbers with at least four digits. 243 +368 611 1 1 **+ = signs and missing numbers**	**Written method (progressing to more than 4 digits)** Progressing from year 4, children to move on to the formal column method for whole numbers and decimal numbers. The expanded method with place value counters can still be used to ensure the child is secure. **Missing number problems** Children should practise with increasingly large numbers to aid fluency. When required, children to use the number line and bar model from previous years.	**Written method** As year 5 children to be progressing to larger numbers up to 7 digits. Aiming for formal column method for both whole numbers and decimal numbers with differing numbers of decimal point to be secure. **Missing number problems** Children should practise with increasingly large numbers to aid fluency. When required, children to use the number line and bar model from previous years. Pupils to have opportunity to apply their knowledge in a variety of problems to deepen understanding further.

Mental methods need to continue to develop, using the number line and bar model from previous years.		

Fluency variation, different ways to ask children to solve 21+34:



Sam saved £21 one week and £34 another. How much did he save in total?

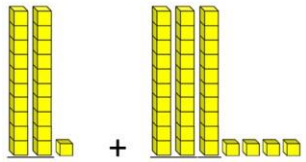
21+34=55. Prove it! (reasoning but the children need to be fluent in representing this)

21
+34
——

21 + 34 =

☐ = 21 + 34

What's the sum of twenty one and thirty four?



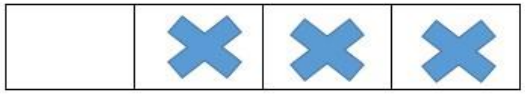
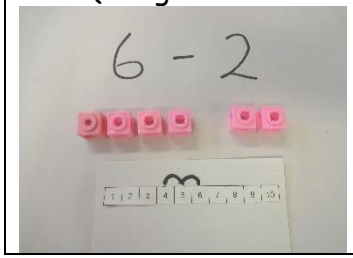
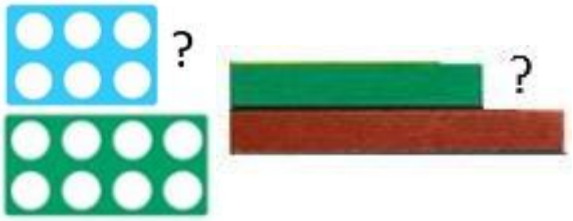
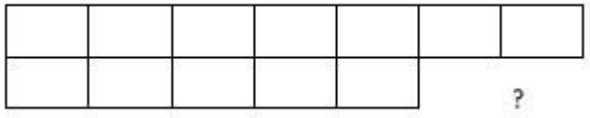
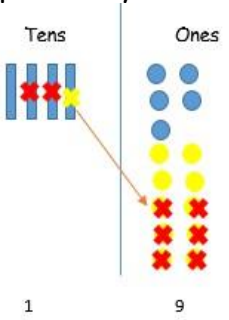
Always use missing digit problems too:

Tens	Ones
10 10	1
10 10 10	?
?	4

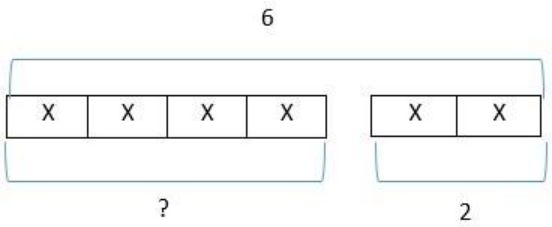
Subtraction-

Key language which should be used: take away, less than, the difference, subtract, minus, fewer, decrease, '7 take away 3, the difference is four'

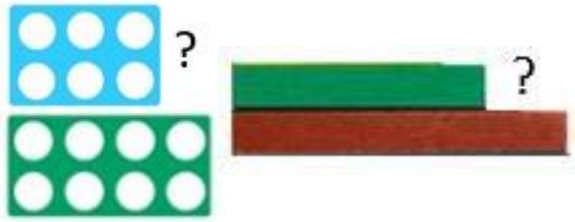
Understand the relationship between addition and subtraction and how the inverse of one can be used to check the other.

Year 1	Year 2	Year 3
- Physically taking away and removing objects from a whole $4-3=1$  To understand subtraction as taking away  Use of the bar model:  - To understand subtraction as counting back (using number lines or number tracks) 	- To understand subtraction as finding the difference, developing from year 1 (using cubes, Numicon or Cuisenaire rods)  This can be represented pictorially, using a bar model  - To understand subtraction by making 10, developing from year 1 (using Numicon)  - Use of number line to model take-away and difference	**<u>Written methods (progressing to 3 digits)</u>** - Column method (using base 10 and having to exchange)  1) Start by partitioning 45 2) Exchange one ten for ten more ones 3) Subtract the ones, then the tens. This can then be represented pictorially  It is crucial that the children understand that when they have exchanged the 10 they still have 45, for example:

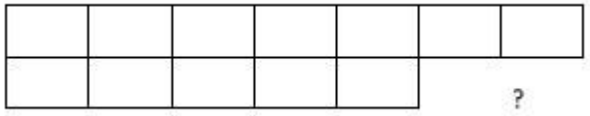
This can be represented pictorially, using a bar model



- To understand subtraction as finding the difference (using cubes, Numicon or Cuisenaire rods)

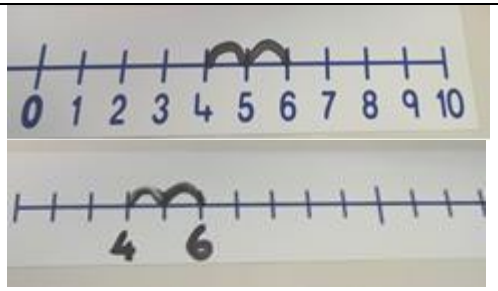


This can be represented pictorially, using a bar model



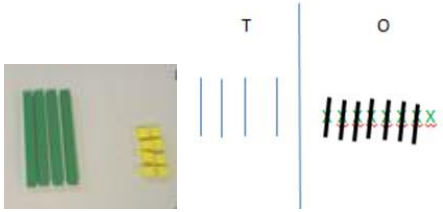
- To understand subtraction by making 10 (using Numicon)

+ = signs and missing numbers



Towards written methods

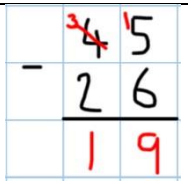
- Column method (using base 10) i.e. 48 – 7



+ = signs and missing numbers

- Missing number problems, continuing to develop understanding of equality

Children to explore why 9 – 7 = 8 – 6 (the difference of each digit has changed by 1 so the difference is the same)



A number line and column method could be compared next to each other.

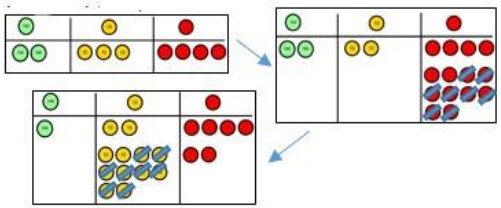
+ = signs and missing numbers

Missing number problems using a range of equations as in year 1 and 2 but with larger numbers.

Children should make choices about how to answer a subtraction word problem.

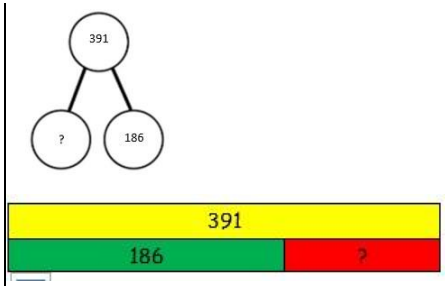
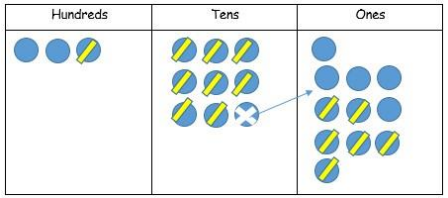
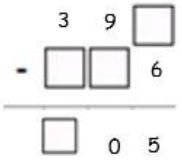
Children need to develop an understanding of equality before using the = sign. Missing numbers need to be placed in all possible places.		

Year 4	Year 5	Year 6
Written methods (progressing to 4 digits) - Column method (using place value counters)	**Written methods (progressing to more than 4 digits)** Once understanding of the method is secure, children to move onto the formal method, in which place value counters do not need to be used.	**Written methods** As year 5 children to be progressing to larger numbers. Aiming for formal column method for both whole numbers and decimal numbers with differing numbers of decimal point to be secure.

 Once the children have had practice with the concrete, they should be able to apply their knowledge to any subtraction. They can always go back to representing the calculation pictorially, using place value counters. $\begin{array}{r} 2\overset{2}{\not{3}}\overset{1}{4} \\ -\ 88 \\ \hline 6 \end{array}$ **+ = signs and missing numbers** Mental methods need to continue to develop, using the number line and bar model from previous years.	This will also include decimals, with different numbers of decimal places. **Missing number problems** Children should practise with increasingly large numbers to aid fluency. When required, children to use the number line and bar model from previous years.	Teachers many also choose to introduce children to other efficient written layouts to develop conceptual understanding. **Missing number problems** Children should practise with increasingly large numbers to aid fluency. When required, children to use the number line and bar model from previous years. Pupils to have opportunity to apply their knowledge in a variety of problems to deepen understanding further.

Fluency variation, different ways to ask children to solve 391-186:

	Raj spent £391, Timmy spent £186. How much more did Raj spend?	391 – 186 ☐	What's the calculation? What's the answer?

	I had 391 metres to run. After 186 I stopped. How many metres do I have left to run?	= 391 – 186 91 .86 — 391 the difference btween and 186 tract 186 from 391. What is 186 less than 391?	 

Multiplication –

Key language which should be used: double, multiplied by, times, the product of, groups of, lots of, 'is equal to', 'is the same as'
Understand the relationship between multiplication and division and how the inverse of one can be used to check the other.

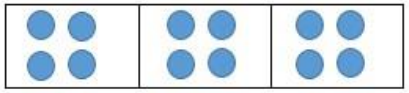
Year 1	Year 2	Year 3

Repeated grouping/ repeated addition -

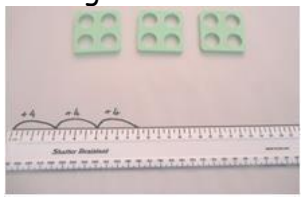
- Using cubes, bundles of straws, bead strings etc.

3 x 4 or 3 lots of 4

This can also be represented pictorially in a picture or a bar model.



- Using number lines



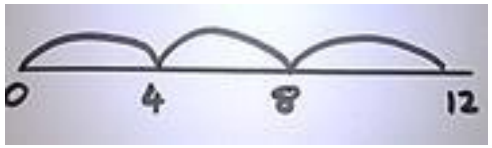
Arrays to illustrate commutativity (multiplication can be done in any order)

- Many concrete objects can be used before moving on to the children drawing their own arrays.

Develop understanding of multiplication using array and number lines (see year 1).

Repeated addition –

- Abstract number line



Arrays to illustrate commutativity

- Children to be able to use an array to write a range of calculations e.g.

2 x 5 = 10

5 x 2 = 10

2 + 2 + 2 + 2 + 2 = 10

5 + 5 = 10

Children to begin to understand multiplication as scaling (3 times bigger/ taller)

Missing number problems

To express multiplication as a number sentence.

To use understanding of the inverse and practical resources to solve missing number problems.

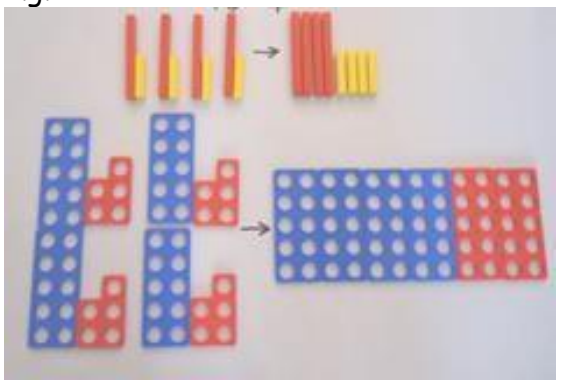
e.g. 7 x 2 = ?

7 x ? = 14

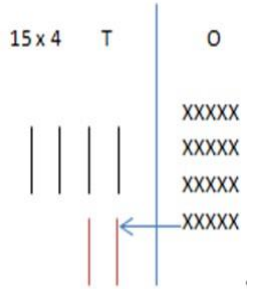
Written methods (progressing to 2d by 1d)

- Partition to multiply (using Numicon, base 10, Cuisenaire rods)

e.g. 4 x 15

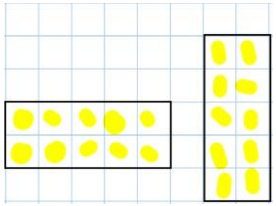


Children can then represent the concrete manipulatives in a picture.

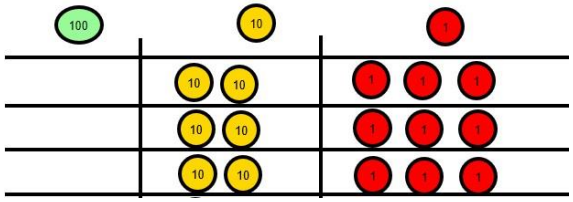


- Formal column method with place value counters (at the first stage – no exchanging)

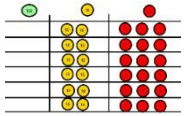
e.g. 3 x 23.



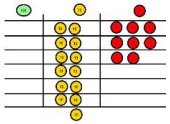
? x 2 = 14



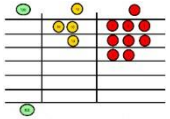
- Formal column method involving exchanging



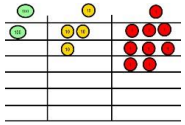
Step 1: get 6 lots of 23



Step 2: 6 x 3 is 18. Can I make an exchange? Yes! Ten ones for one ten….



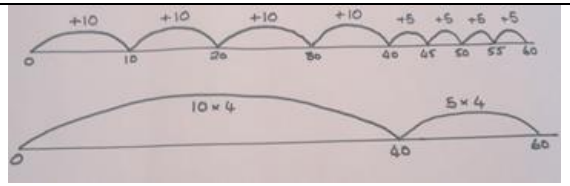
Step 3: 6 x 2 tens and my extra ten is 13 tens. Can I make an exchange? Yes! Ten tens for one hundred…



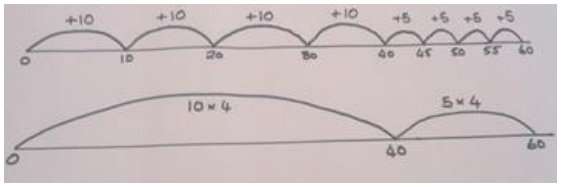
Step 4- what do I have I each column?

<u>Mental methods</u>

- Doubling 2-digit numbers using partitioning
- Demonstrating multiplication on a number line

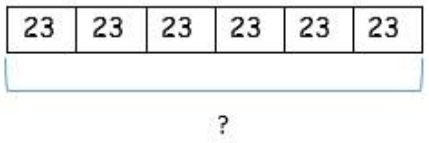
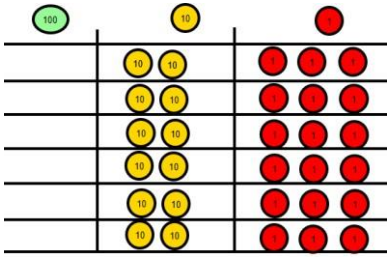
		 **Missing number problems** Missing number problems using a range of equations as in year 1 and 2 but with appropriate numbers.

Year 4	Year 5	Year 6
Written methods	**Written methods (up to 4d by 2d)**	**Written methods (up to 4d by 2d)**

- Partition to multiply (use both concrete and pictorial representations to show the steps that they have taken) 4 x 15 10 5 10 x 4 = 40 5 x 4 = 20 40 + 20 = 60 A number line can also be used  - Formal column method (represent in a pictorial way before showing in writing)  Children to record what they are doing to show understanding 3 x 23 3 x 20 = 60 3 x 3 = 9 20 3 60 + 9= 69	The aim is to get to the formal method but the children need to understand how it works. Children can always revert to any concrete or pictorial representation to develop their understanding. To get 744, children have solved 124 x 6; to get 2480, children have solved 124 x 20. 1 2 4 x 2 6 7 4 4 1 2 2 4 8 0 3 2 2 4 1 1 Answer: 3224 **Mental methods** - x by 10, 100 and 1000 using place value grids - recall of prime numbers up to 19 and identify prime numbers up to 100 - identify factor pairs for numbers - Solving practical problems where children need to scale up. **Number problems**	Continue to deepen understanding of written methods, relating to year 5 learning. To get 744, children have solved 124 x 6; to get 2480, children have solved 124 x 20. 1 2 4 x 2 6 7 4 4 1 2 2 4 8 0 3 2 2 4 1 1 Answer: 3224 **Mental methods** - identify common factors and multiples of given numbers - Solving practical problems where children need to scale up. **Number problems** Continue with a range of equations, but with appropriate numbers and missing digits.

$\begin{array}{r} 23 \\ \times\ 3 \\ \hline 69 \\ \hline \end{array}$ **Mental methods** - Counting in multiples of 6, 7, 9, 25 and 1000 - Solving practical problems where children need to scale up. - times tables up to 12 x 12 **Number problems** Continue with a range of equations, but with appropriate numbers and missing digits.	Continue with a range of equations, but with appropriate numbers and missing digits.	

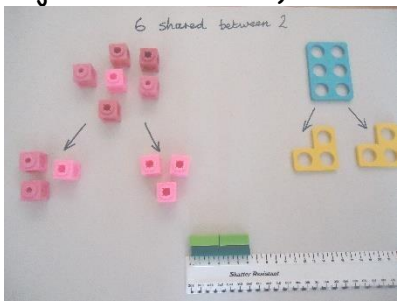
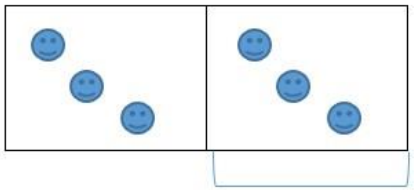
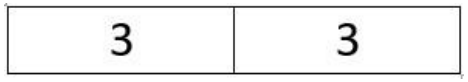
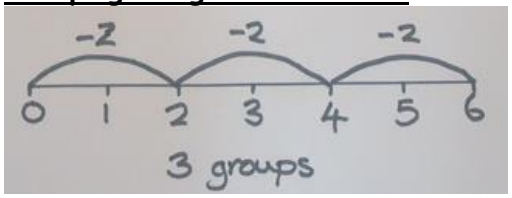
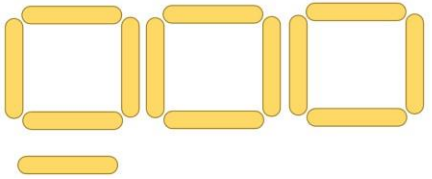
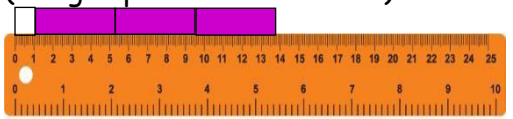
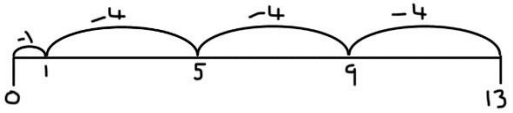
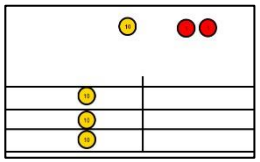
Fluency variation, different ways to ask children to solve 6 x 23:

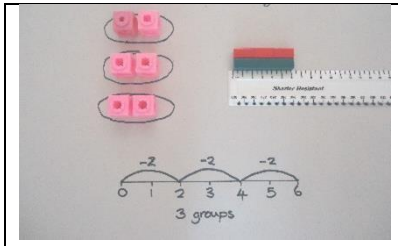
 With the counters, prove that 6 x 23 = 138 Why is 6 x 23 = 32 x 6?	Mai had to swim 23 lengths, 6 times a week. How many lengths did she swim in one week? Tom saved 23p three days a week. How much did he save in 2 weeks?	Find the product of 6 and 23 6 x 23 = □ = 6 x 23 6 × 23 ___ 23 × 6 ___	What's the calculation? What's the answer? 

Division-

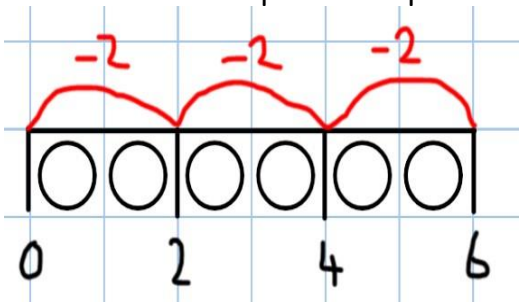
Key language which should be used: share, group, divide, divided by, half, 'is equal to' 'is the same as'

Understand the relationship between multiplication and division and how the inverse of one can be used to check the other.

Year 1	Year 2	Year 3
Sharing - Develop importance of one-to-one correspondence - 6 shared between 2 (other concrete objects can be used)  This can also be represented pictorially and with a bar model  **Grouping** - Apply counting skills e.g. 6 divided by 2	Children to continue sharing and grouping using concrete and pictorial representations, as they have done in year 1. This should lead to abstract calculations. e.g. 6 ÷ 2 = 3 What's the calculation?  **Grouping using a number line**  **÷ = signs and missing numbers** - Missing number problems, continuing to develop understanding of equality	**Remainders** - Use of lollipop sticks to form wholes  - Use of Cuisenaire rods and rulers (using repeated subtraction)  This can also be represented pictorially with a number line  Children can count their times tables facts in their heads. **Sharing using place value counters**  1. Make 42. Share the 4 tens between 3. Can we make an

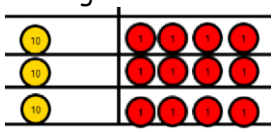


This can also be represented pictorially

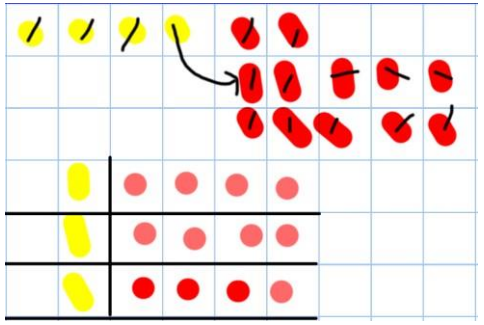


Children should be able to find $\frac{1}{2}$ and $\frac{1}{4}$ of objects, numbers and quantities.

exchange with the extra 10?



Exchange the ten for 10 ones and share out 12 ones

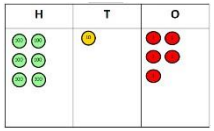
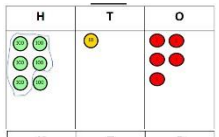
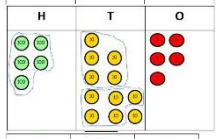
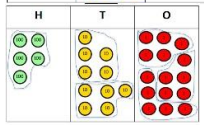
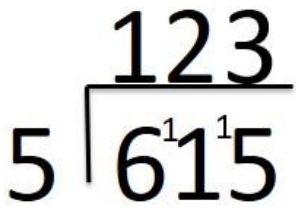


Place value counters can be used to support children apply their knowledge of grouping.

Missing number problems

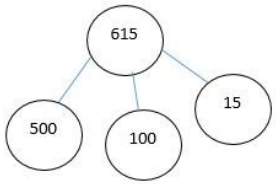
Missing number problems using a range of equations as in year 1 and 2 but with appropriate numbers.

Year 4	Year 5	Year 6
Formal short division should only be introduced once children have a good understanding of division, its links with	Continuation of year 4, leading to the quick, efficient use of a formal method (up to 4d by 1d).	**Short division (4d by 1d)** Continuation of year 5

multiplication and the idea of 'chunking up' to find a target number. **<u>Use of the bus stop method</u>** Key language for grouping – how many groups of X can we make we X hundreds? This can also be done with sharing! 615 ÷ 5 Step 1: make 615   Step 2: Circle your groups of 5  Step 3: Exchange 1H for 10T and circle groups of 5  Step 4: exchange 1T for 10ones and circles groups of 5 This can easily be represented pictorially, until the children no longer need to do it. 	Children to also begin developing their understanding of how to express the remainder as a fraction or a decimal. Ensure that practical understanding allows children to work through this.	**<u>Short division (4d by 2d)</u>** Short division and bus stop method from year 4 and 5 still to be used for 4d divided by 2d numbers. - The times table being used for that calculation to be written down the side of the page to support working out.

Fluency 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 the 'bus stop' method?



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

How many 5's go into 615?

What's the calculation? What's the answer?____