ASHLANDS PRIMARY

Calculations Policy

Updated December 2023

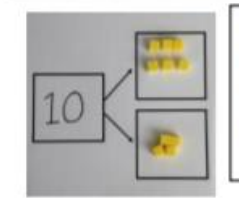
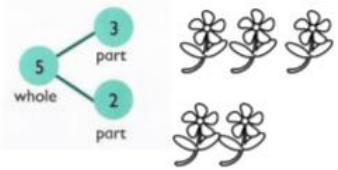
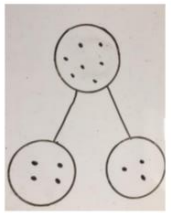
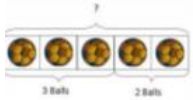
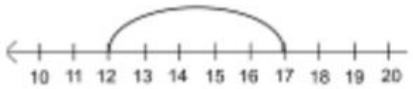
This policy has been written in line with the new national curriculum of 2014. (See appendix)
It aims to provide guidance so that all children will be able to use an efficient and accurate formal written method. The stages leading to each formal method are given in this policy. Teachers and staff should use their judgements as to where each child is currently working and begin developing their understanding from that stage.
Thanks to the White Rose Hub and NCETM for providing supporting content.

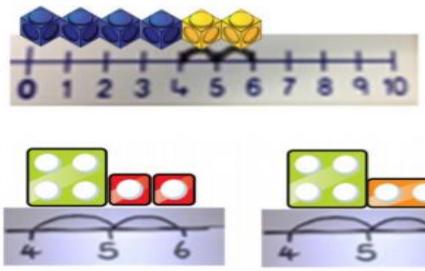
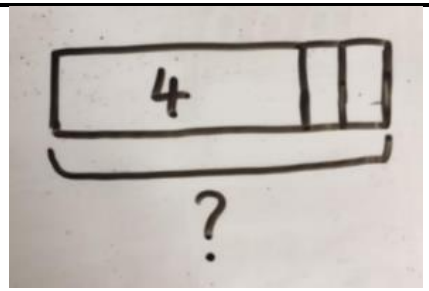
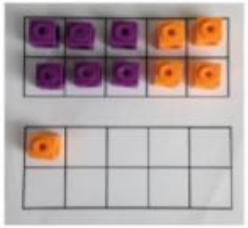
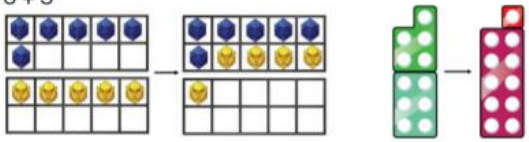
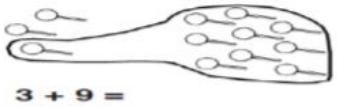
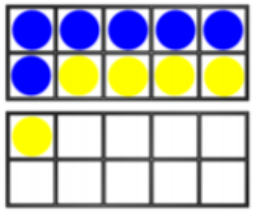
Some points to note:

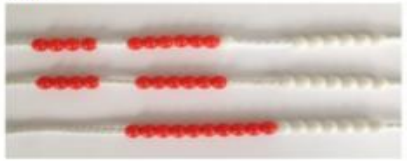
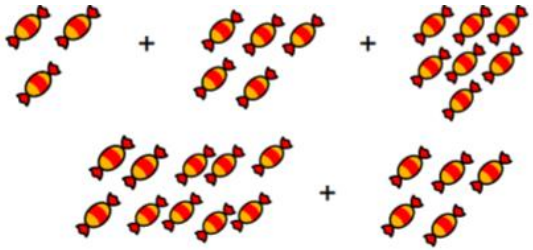
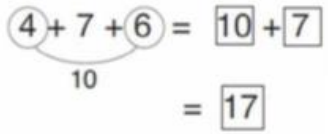
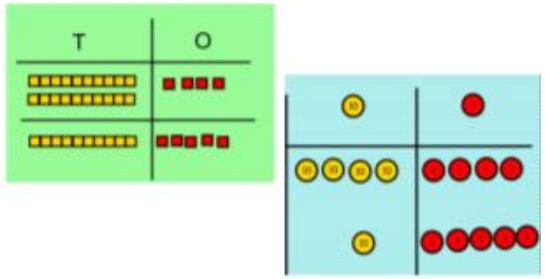
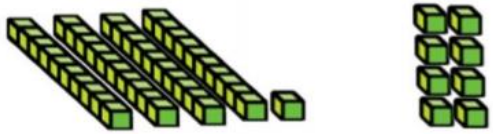
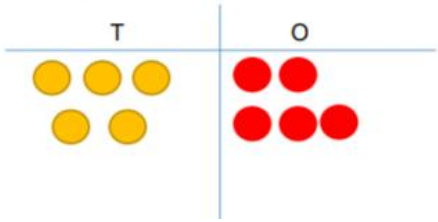
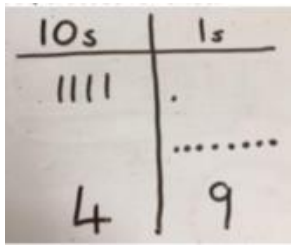
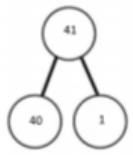
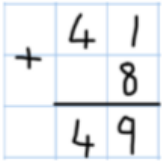
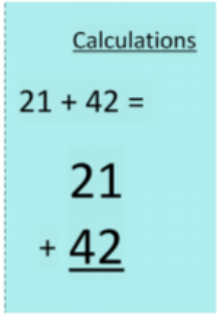
- We will use the vocabulary Thousands Hundreds Tens and Ones (TH H T O)
  Some materials may still use the term 'units' instead of 'ones' therefore children will be taught to understand both.
- When writing large numbers, we will use commas.
- When teaching x 10, 100 ÷10,100 we will use the language that the numbers slide either left or right and a zero appears which becomes the place holder (rather than add a zero).
- In formal written methods children will be asked to;
  - line up the HTO
  - start by adding the ones, when you start a written column method start from the right
  - any carrying will be shown **below** the line
  - when using decomposition, the word 'Exchange' is used.
  - remainders will be recorded as r12 (full size number)
  - Decimal points will be positioned on the line.

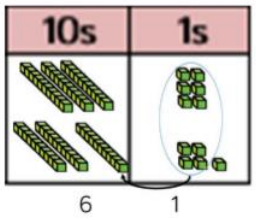
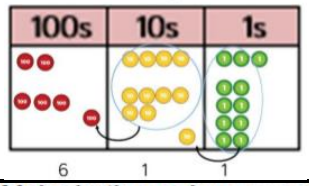
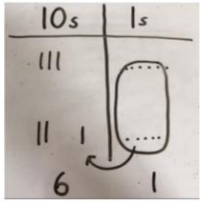
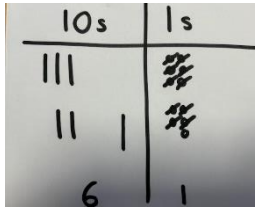
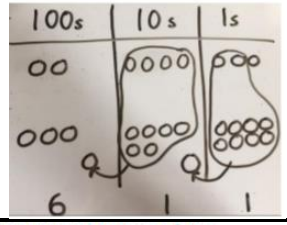
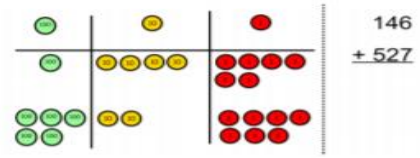
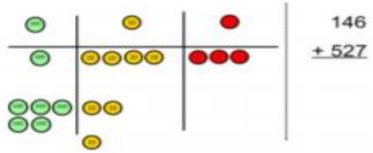
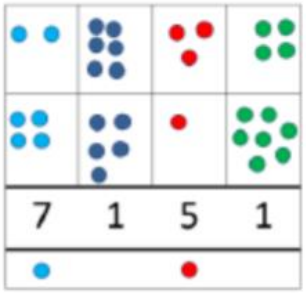
Calculation Policy: Addition

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

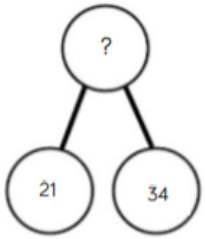
Objective and Strategy	Concrete	Pictorial	Abstract
Combining two parts to make a whole: part-whole model	  Use cubes to add two numbers together as a group or in a bar. 	   Use pictures to add two numbers together as a group or in a bar. 	$4 + 3 = 7$ Four is a part, 3 is a part and the whole is seven. $10 = 6 + 4$  Use the part-part whole diagram as shown above to move into the abstract.
Starting at the bigger number and counting on (using a number line)	 Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer.	$12 + 5 = 17$  Start at the larger number on the number line and count on in ones or in one jump to find the answer.	$5 + 12 = 17$ Place the larger number in your head and count on the smaller number to find your answer.

			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 
Regrouping to make 10.	 6 + 5 = 11  Start with the bigger number and use the smaller number to make 10. 6 + 5 	 3 + 9 = Use pictures or a number line. Regroup or partition the smaller number to make 10. 9 + 5 = 14 1 4 +1 +4 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 	7 + 4= 11 If I am at seven, how many more do I need to make 10. How many more do I add on now? 6 + □ = 11 6 + 5 = 5 + □ 6 + 5 = □ + 4

Adding three single digits.	4 + 7 + 6= 17 Put 4 and 6 together to make 10. Add on 7.  Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit. **Find the number bonds!**	 Add together three groups of objects. Draw a picture to recombine the groups to make 10. **Set out drawings in a ten-frame style to support. :::::**	 Combine the two numbers that make 10 and then add on the remainder.
Column Method (no regrouping) TO + O, TO using base 10	24 + 15= Add together the ones first then add the tens. Use the Base 10 blocks first before moving onto place value counters.  41 + 8 	After practically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions.  Children represent the tens and ones using a line for tens and a square or circle for ones. 	41 + 8  1 + 8 = 9 40 + 9 = 49  

Column method (Regrouping) HTO + TO, HTO etc using base	36 + 25   	or    	36 + 25 = 1 5 30 + 20 = 50 5 + 5 = 10 50 + 10 + 1 = 61 36 +25 61 1 Formal method: 243 +368 611 1 1
	Make both numbers on a place value grid.  Add up the units and exchange 10 ones for one 10.  Add up the rest of the columns, exchanging the 10 counters from one column for the next place value column until every column has been added. This can also be done with Base 10 to help children clearly see that 10 ones equal 1 ten and 10 tens equal 100. As children move on to decimals, money and decimal place value counters can be used to support learning.	Children can draw a pictoral representation of the columns and place value counters to further support their learning and understanding.  	Start by partitioning the numbers before moving on to clearly show the exchange below the addition. 20 + 5 40 + 8 60 + 13 = 73 As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here. 536 + 85 621 1 1 72.8 + 54.6 127.4 1 1 £ 2 3 . 5 9 + £ 7 . 5 5 £ 3 1 . 1 4 1 1 1 2 3 . 3 6 1 9 . 0 8 0 5 9 . 7 7 0 + 1 . 3 0 0 9 3 . 5 1 1 2 1 2

Conceptual Variation; different ways to ask children to solve 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?

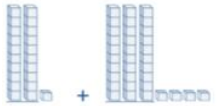
21 + 34 = 55. Prove it

21
+34
___

21 + 34 =

☐ = 21 + 34

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

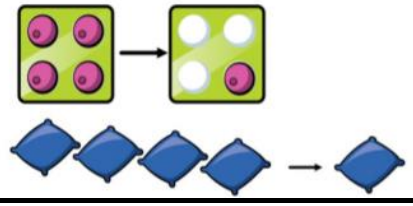
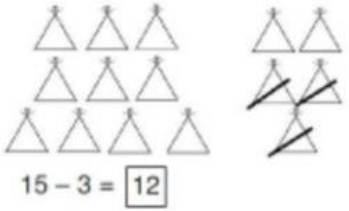
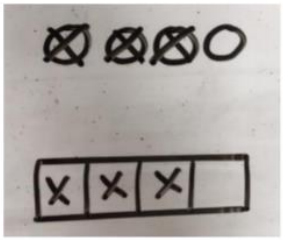
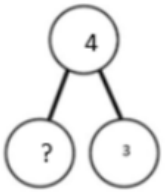


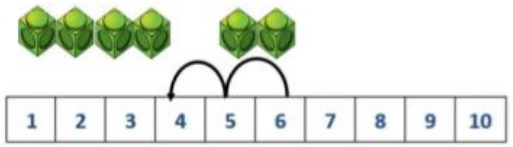
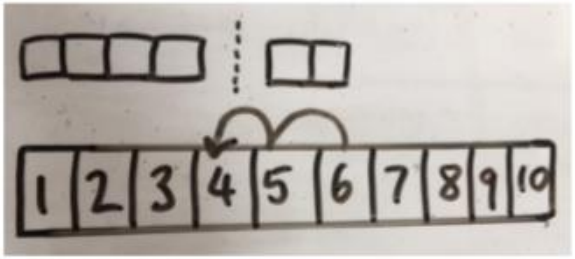
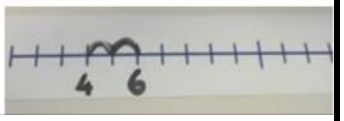
Missing digit problems:

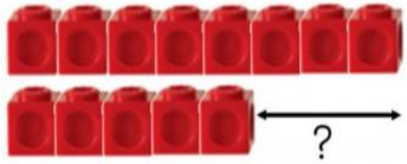
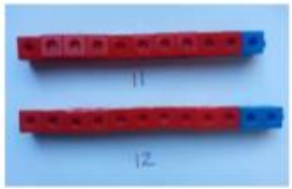
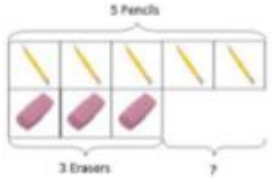
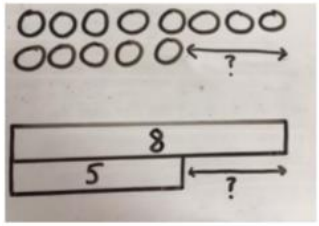
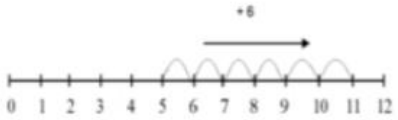
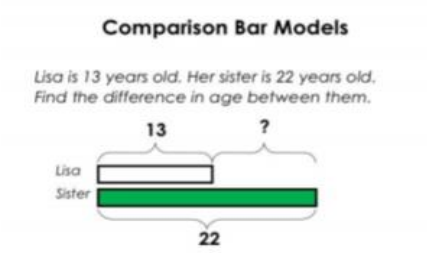
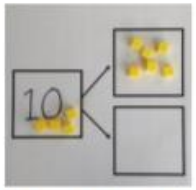
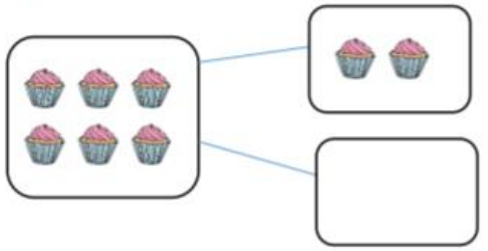
10s	1s
	?
?	5

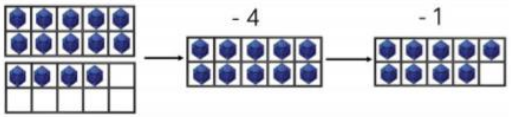
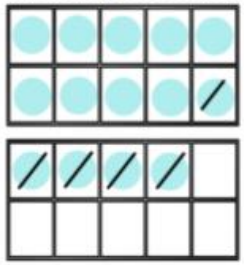
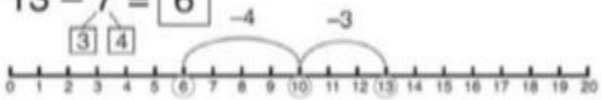
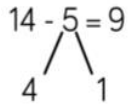
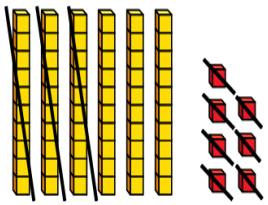
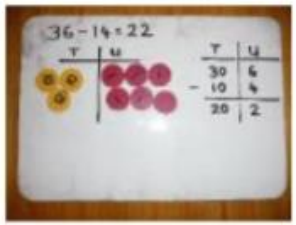
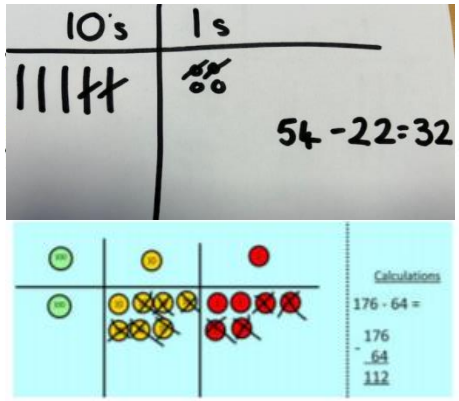
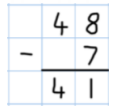
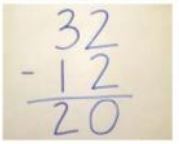
Calculation Policy: Subtraction

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

Objective and Strategy	Concrete	Pictorial	Abstract
Taking away ones	Use physical objects, counters, cubes etc to show how objects can be taken away.  6 – 2 = 4  (ten frames, Numicon, cubes and other items such as beanbags could be used). 4 - 3 = 1 	Cross out drawn objects to show what has been taken away.  15 – 3 = 12 Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also be used. 	18 -3= 15 8 – 2 = 6 4- 3 = ☐ =4 - 3  

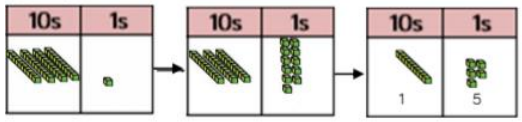
Counting back	Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones.  13 – 4 Use counters and move them away from the group as you take them away counting backwards as you go.  6 - 2 = 4  	Count back on a number line or number track  Start at the bigger number and count back the smaller number showing the jumps on the number line.  This can progress all the way to counting back using two 2 digit numbers. Children to represent what they see pictorially e.g.  1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100	Put 13 in your head, count back 4. What number are you at? Use your fingers to help. Children to represent the calculation on a number line or number track and show their jumps. Encourage children to use an empty number line  

Find the difference	**Finding the difference** (using cubes, Numicon or Cuisenaire rods, other objects can also be used). Calculate the difference between 8 and 5.   Use cubes to build towers or make bars to find the difference  Use basic bar models with items to find the difference	Children to draw the cubes/other concrete objects which they have used or use the bar model to illustrate what they need to calculate.   Count on to find the difference. Draw bars to find the difference between 2 numbers.  	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. Hannah has 23 sandwiches, Helen has 15 sandwiches. Find the difference between the number of sandwiches.
Part Part Whole model	 Link to addition- use the part whole model to help explain the inverse between addition and subtraction. If 10 is the whole and 6 is one of the parts. What is the other part? 10 - 6 =	Use a pictorial representation of objects to show the part part whole model. 	 Move to using numbers within the part whole model.

Make 10	**Making 10** using ten frames. 14 – 5 	Children to present the ten frame pictorially and discuss what they did to make 10.  13 – 7 = 6  Start at 13. Take away 3 to reach 10. Then take away the remaining 4 so you have taken away 7 altogether. You have reached your answer.	Children to show how they can make 10 by partitioning the subtrahend.  14 – 4 = 10 10 – 1 = 9 16 – 8= How many do we take off to reach the next 10? How many do we have left to take off? or complete calculation using mental methods of making ten.
Column method (no regrouping)	 67 – 37 = 30 Use Base 10 to make the bigger number then take the smaller number away. Show how you partition numbers to subtract. Again make the larger number first. 	 Draw the Base 10 or place value counters alongside the written calculation to help to show working.	47 – 24 = 23 40 + 7 – 20 + 4 20 + 3  This will lead to a clear written column subtraction. 

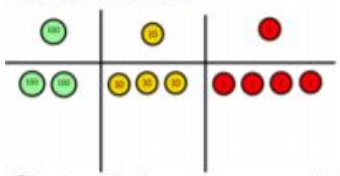
Column method (with regrouping)

41 – 26



Use Base 10 to start with before moving on to place value counters. Start with one exchange before moving onto subtractions with 2 exchanges.

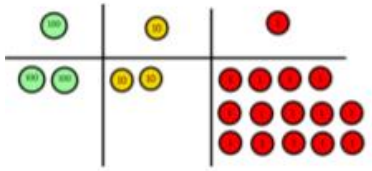
Make the larger number with the place value counters



Calculations

234
- 88

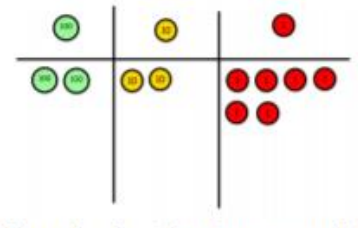
Start with the ones, can I take away 8 from 4 easily? I need to exchange one of my tens for ten ones.



Calculations

234
- 88

Now I can subtract my ones.

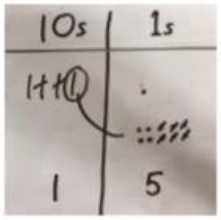


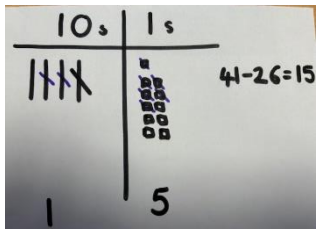
Calculations

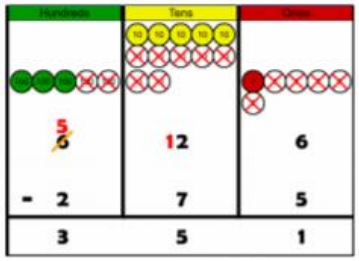
234
- 88

Now look at the tens, can I take away 8 tens easily? I need to exchange one hundred for ten tens.

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







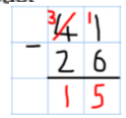
Draw the counters onto a place value grid and show what you have taken away by crossing the counters out as well as clearly showing the exchanges you make.

When confident, children can find their own way to record the exchange/regrouping.

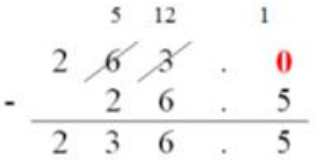
Just writing the numbers as shown here shows that the child understands the method and knows when to exchange/regroup.

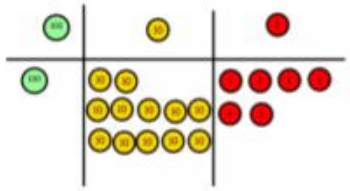
Children can start their formal written method by partitioning the number into clear place value columns.

Moving forward the children use a more compact method.



This will lead to an understanding of subtracting any number including decimals.

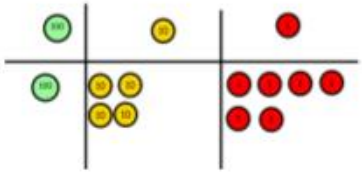




Calculations

234
- 88

Now I can take away eight tens and complete my subtraction

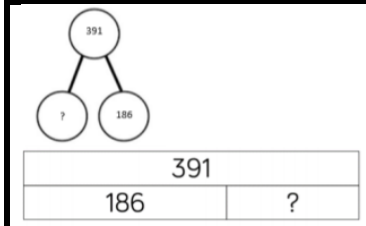


Calculations

~~2~~ 234
- 88
146

Show children how the concrete method links to the written method alongside your working. Cross out the numbers when exchanging and show where we write our new amount.

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

391
-186
———

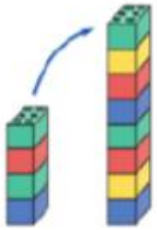
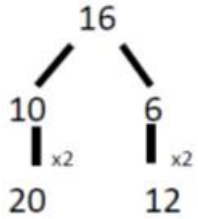
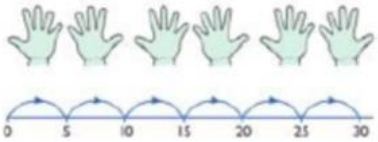
What is 186 less than 391?

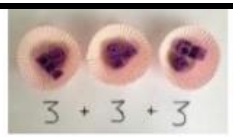
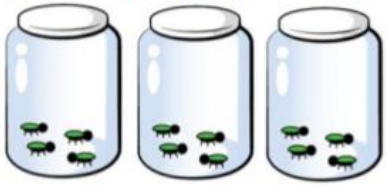
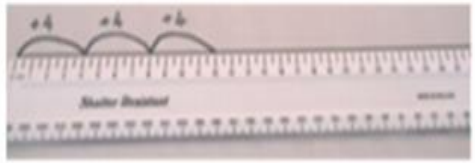
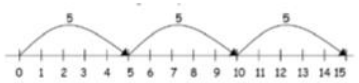
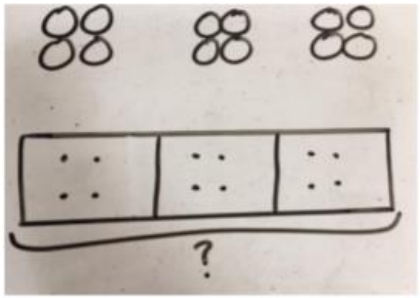
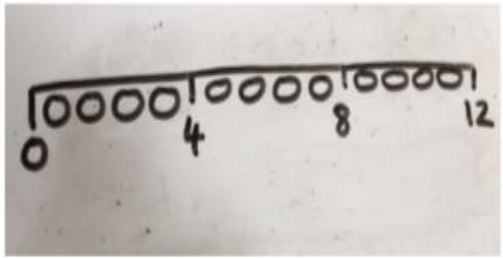
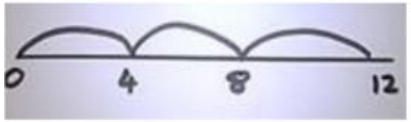
Missing digit calculations

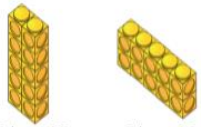
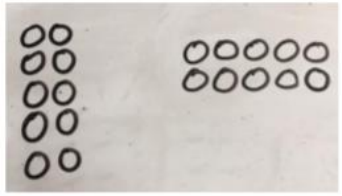
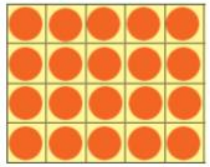
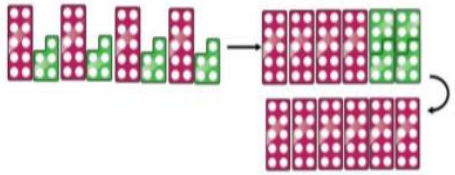
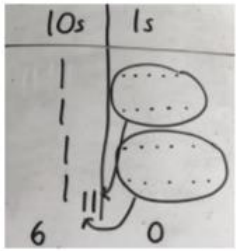
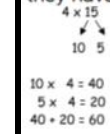
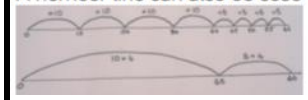
3 9 □
- □ □ 6
———
□ 0 5

Calculation Policy: Multiplication

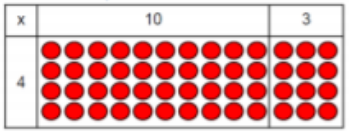
Key language: double, times, multiplied by, the product of, groups of, lots of, equal groups.

Objective and Strategy	Concrete	Pictorial	Abstract
Doubling	Use practical activities to show how to double a number.  double 4 is 8 4 × 2 = 8	Draw pictures to show how to double a number. Double 4 is 8 	 Partition a number and then double each part before recombining it back together.
Counting in multiples	  Count in multiples supported by concrete objects in equal groups.	 Use a number line or pictures to continue support in counting in multiples.	Count in multiples of a number aloud. Write sequences with multiples of numbers. 2, 4, 6, 8, 10 5, 10, 15, 20, 25 , 30

Repeated addition/grouping	   Use different objects to add equal groups. 3 × 4 4 + 4 + 4 There are 3 equal groups, with 4 in each group.   **Number lines to show repeated groups-** 3 × 4   Cuisenaire rods can be used too.	There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there?  2 add 2 add 2 equals 6  5 + 5 + 5 = 15  	**Write addition sentences to describe objects and pictures.**  2 + 2 + 2 + 2 + 2 = 10 3 × 4 = 12 4 + 4 + 4 = 12 3 × 4 = 12 

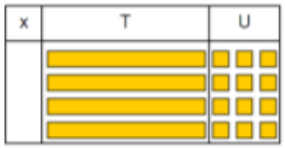
Arrays-showing commutative multiplication	**Use arrays to illustrate commutativity** counters and other objects can also be used. $2 \times 5 = 5 \times 2$  2 lots of 5 5 lots of 2  	 Draw arrays in different rotations to find **commutative** multiplication sentences.    Link arrays to area of rectangles.	Children to be able to use an array to write a range of calculations e.g. $10 = 2 \times 5$ $5 \times 2 = 10$ $2 + 2 + 2 + 2 + 2 = 10$ $10 = 5 + 5$  5 + 5 + 5 = 15 3 + 3 + 3 + 3 + 3 = 15 5 x 3 = 15 3 x 5 = 15
Partitioning	**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.  A number line can also be used 

Grid/Area method



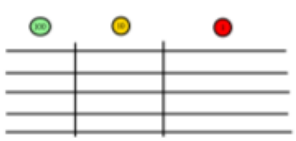
4 rows of 10
4 rows of 3

Move on to using Base 10 to move towards a more compact method.

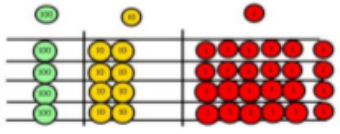


4 rows of 13

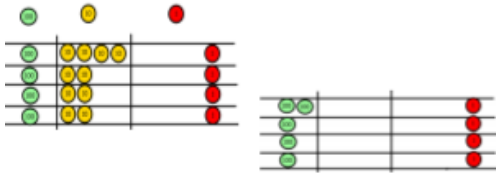
Move on to place value counters to show how we are finding groups of a number.We are multiplying by 4 so we need 4 rows.



Fill each row with 126.



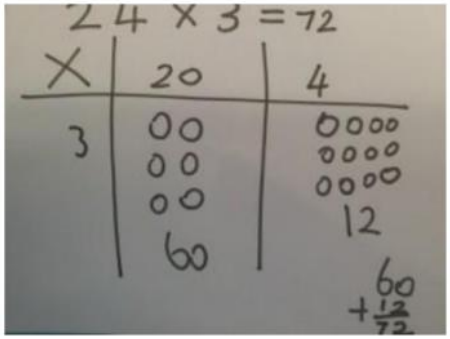
Add up each column, starting with the ones making any exchanges needed.



Then you have your answer.

Children can represent the work they have done with place value counters in a way that they understand.

They can draw the counters, using colours to show different amounts or just use circles in the different columns to show their thinking as shown below.



Start with multiplying by one digit numbers and showing the clear addition alongside the grid.

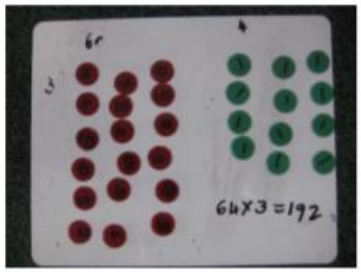
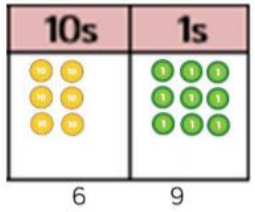
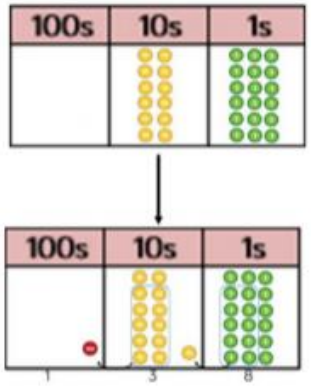
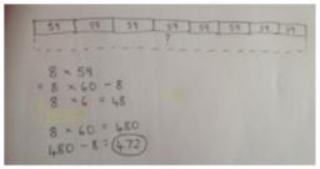
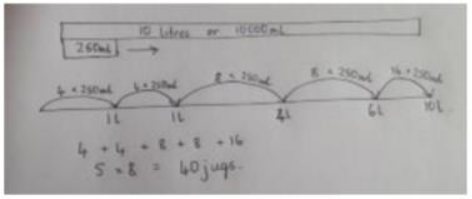
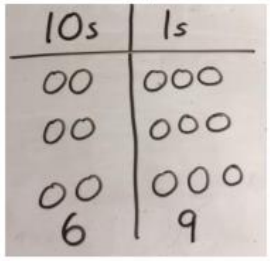
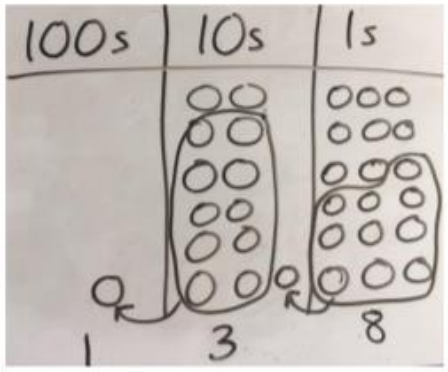
×	30	5
7	210	35

210 + 35 = 245

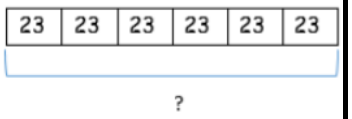
Moving forward, multiply by a 2 digit number showing the different rows within the grid method.

	10	8
10	100	80
3	30	24

X	1000	300	40	2
10	10000	3000	400	20
8	8000	2400	320	16

Formal column method	Children can continue to be supported by place value counters at the stage of multiplication.  It is important at this stage that they always multiply the ones first and note down their answer followed by the tens which they note below. **Formal column method** with place value counters (base 10 can also be used.) 3 x 23  6 x 23  	Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.     	Children to record what it is they are doing to show understanding. 3 x 23 = 3 x 20 = 60 3 x 3 = 9 20 3 60 + 9 = 69 23 x 3 69 6 x 23 = 23 x 6 138 1 1 Start with long multiplication, reminding the children about lining up their numbers clearly in columns. If it helps, children can write out what they are solving next to their answer. 32 x 24 8 (4 x 2) 120 (4 x 30) 40 (20 x 2) 600 (20 x 30) 768 1342 x 18 13420 10736 24156 74 x 63 12 210 240 + 4200 4662

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

$6 \times 23 =$

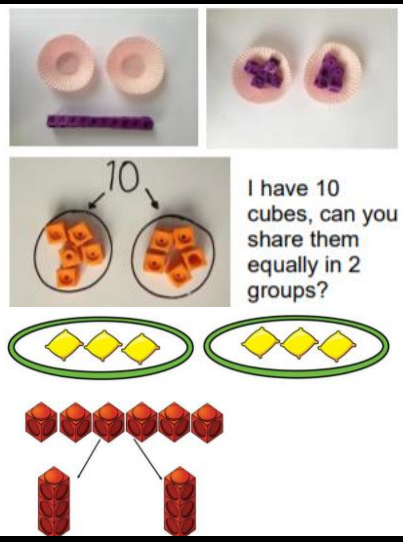
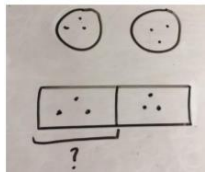
$\square = 6 \times 23$

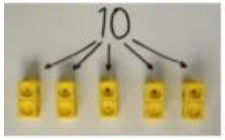
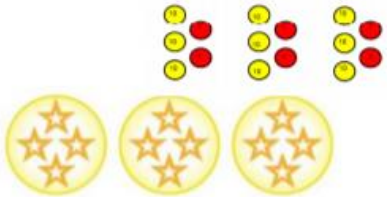
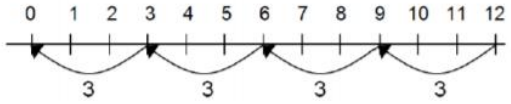
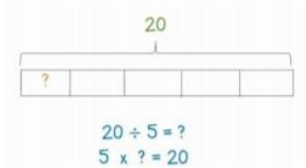
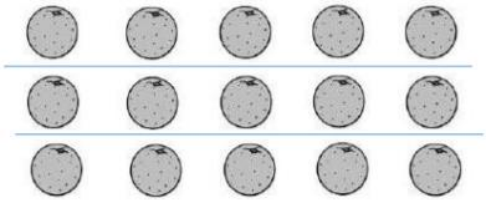
6×23 $\quad$ 23×6

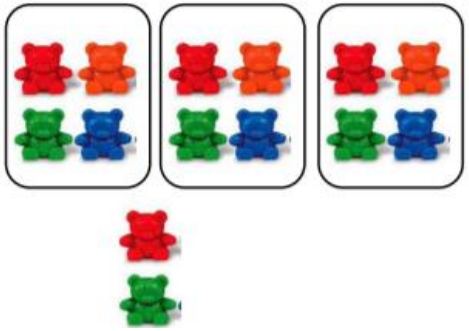
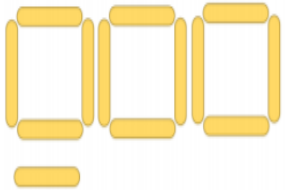
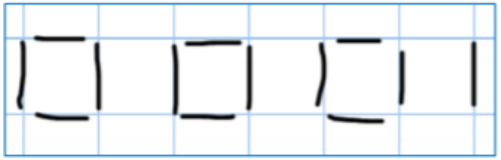
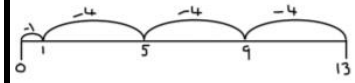
What is the calculation?
What is the product?

Calculation Policy: Division

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

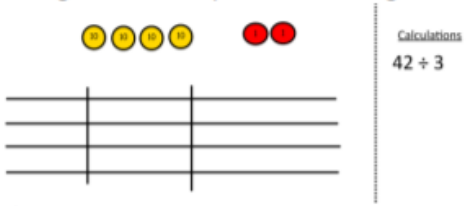
Objective and Strategy	Concrete	Pictorial	Abstract
Sharing objects into groups		Children use pictures or shapes to share quantities.  $8 \div 2 = 4$ 	Share 9 buns between three people. $9 \div 3 = 3$ $6 \div 2 = 3$  Children should also be encouraged to use their 2 times tables facts.

Division as grouping	Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.   96 ÷ 3 = 32 	Use a number line to show jumps in groups. The number of jumps equals the number of groups.  Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group.  	28 ÷ 7 = 4 Divide 28 into 7 groups. How many are in each group?
Division within arrays	 Link division to multiplication by creating an array and thinking about the number sentences that can be created. Eg 15 ÷ 3 = 5 5 x 3 = 15 15 ÷ 5 = 3 3 x 5 = 15	 Draw an array and use lines to split the array into groups to make multiplication and division sentences.	Find the inverse of multiplication and division sentences by creating four linking number sentences. 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7

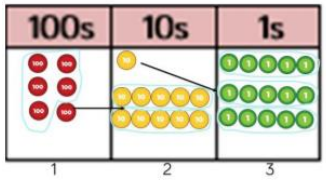
Division with a remainder	14 ÷ 3 = Divide objects between groups and see how much is left over  **2d ÷ 1d with remainders** using lollipop sticks. Cuisenaire rods, above a ruler can also be used. 13 ÷ 4 Use of lollipop sticks to form wholes- squares are made because we are dividing by 4.  There are 3 whole squares, with 1 left over.	Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder.  Draw dots and group them to divide an amount and clearly show a remainder.  Children to represent the lollipop sticks pictorially.  There are 3 whole squares, with 1 left over.	Complete written divisions and show the remainder using r.  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' 

Short division

Use place value counters to divide using the bus stop method alongside

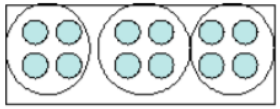


Short division using place value counters to group.
615 ÷ 5



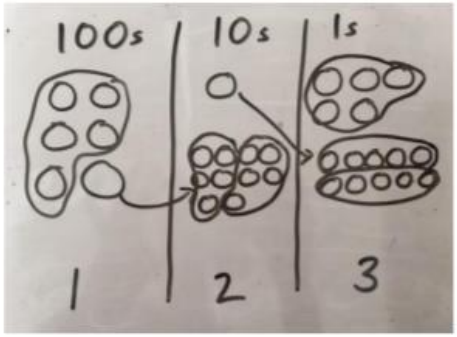
1. Make 615 with place value counters.
2. How many groups of 5 hundreds can you make with 6 hundred counters?
3. Exchange 1 hundred for 10 tens.
4. How many groups of 5 tens can you make with 11 ten counters?
5. Exchange 1 ten for 10 ones.
6. How many groups of 5 ones can you make with 15 ones?

Students can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.



Encourage them to move towards counting in multiples to divide more efficiently.

Represent the place value counters pictorially.



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

Begin with divisions that divide equally with no remainder.

$$\begin{array}{r} 218 \\ 4\overline{)\,872} \end{array}$$

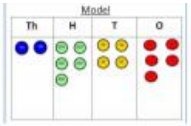
Move onto divisions with a remainder.

$$\begin{array}{r} 86\ r\ 2 \\ 5\overline{)\,432} \end{array}$$

Finally move into decimal places to divide the total accurately.

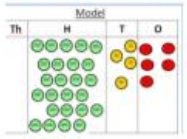
$$\begin{array}{r} 14.6 \\ 35\overline{)\,511.0} \end{array}$$

Long division



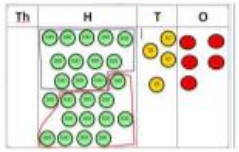
2544 ÷ 12
How many groups of 12 thousands do we have?
None

Exchange 2 thousand for 20 hundreds.



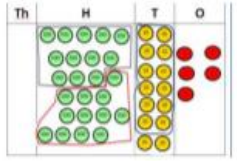
$$12\overline{)2544}\quad 0$$

How many groups of 12 are in 25 hundreds? 2 groups. Circle them.
We have grouped 24 hundreds so can take them off and we are left with one.



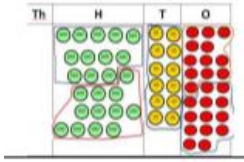
$$\begin{array}{r} 02 \\ 12\overline{)2544} \\ \underline{24} \\ 1 \end{array}$$

Exchange the one hundred for ten tens so now we have 14 tens. How many groups of 12 are in 14? 1 remainder 2



$$\begin{array}{r} 021 \\ 12\overline{)2544} \\ \underline{24} \\ 14 \\ \underline{12} \\ 2 \end{array}$$

Exchange the two tens for twenty ones so now we have 24 ones. How many groups of 12 are in 24? 2



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

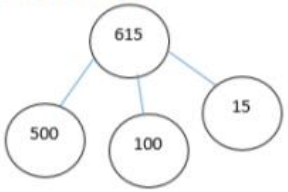
Instead of using physical counters, students can draw the counters and circle the groups on a whiteboard or in their books.

Use this method to explain what is happening and as soon as they have understood what move on to the abstract method as this can be a time consuming process.

$$\begin{array}{r} 0\,3\,1\,8\ r5 \\ 20\overline{)6\,3\,6\,5} \\ \underline{-6\,0} \\ \quad 3\,6 \\ \quad \underline{-2\,0} \\ \quad 1\,6\,5 \\ \quad \underline{-1\,6\,0} \\ \quad\quad 5 \end{array}$$

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

Using the part whole model below, ho can you divide 615 by 5 without using short division?



I have £615 and share it equally between 5 bank accounts. How much will be in each account?

615 pupils need to be put into 5 groups. How many will be in each group?

$5\overline{)615}$

615 ÷ 5 =

☐ = 615 ÷ 5

What is the calculation?
What is the answer?