Calculation Policy

2024-25

Wolsingham Primary School

Calculation Policy

Introduction

This policy has been written in response to the New National Curriculum 2014, and aims to ensure consistency in teaching, progression and presentation of calculations across Year 1-6. Reception needs will be met through Development Matters and Early Learning Goals.

Our Approach

This policy has been adapted from NCETM to ensure that it gives all pupils at our school the potential to succeed, in accordance with an increased emphasis on fluency. All pupils will study the same curriculum areas, but pupils who are able to, will deepen their conceptual understanding by tackling more challenging and varied problems. It is essential that pupils are taught *their* next step in order to advance their learning. With calculation strategies, children must not simply rote learn procedures but demonstrate their understanding of these procedures through the use of concrete materials and pictorial representations **(Appendix A).**

Progression in written methods

Progression in Written Methods is organised into a sequence of teaching, and teachers will use this as appropriate to meet the year group objectives of their class. It is crucial that presentation of written calculations is consistent across the school and children are taught to consider which the best method is according to the numbers. **(Appendix B)**

Mathematical Vocabulary

The 2014 National Curriculum is explicit in articulating the importance of children using the correct mathematical language as a central part of their learning. Indeed, in certain year groups, the non-statutory guidance highlights the requirement for children to extend their language around certain concepts. It is therefore essential that teaching using the strategies outlined in this policy is accompanied by the use of appropriate and precise mathematical vocabulary. New vocabulary should be introduced in a suitable context (for example, with relevant real objects, apparatus, pictures or diagrams) and explained carefully. High expectations of the mathematical language used are essential, with teachers only accepting what is correct. The school agreed list of terminology is located in the document “Vocabulary Year Group Progression”.

How to use this document

This document is organised into:

Appendix A: Concrete, Pictorial and Abstract progression in teaching calculations.

Appendix B: Progression in Presentation of Written Methods.

Appendix C: Mathematical Language

This policy is for all staff at Wolsingham Primary School and draws strongly on work by NCETM. It is purposely set out as a progression of mathematical skills and not into year group phases to encourage a flexible approach to teaching and learning. It is expected that teachers will use their professional judgement as to when consolidation of existing skills is required or if to move onto the next concept. However, the focus must always remain on breadth and depth rather than accelerating through concepts**.** Children should not be extended with new learning before they are ready, they should deepen their conceptual understanding by tackling challenging and varied problems. It is important that across all year groups, teachers create real-life contexts for learning maths. As part of a child's learning in calculation, they need to be taught how to select the best method according to the numbers. A suggested hierarchy of thinking for this is:

Can I do it in my head?

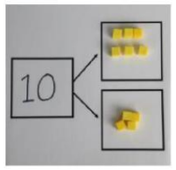
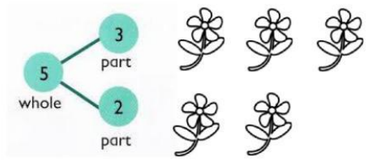
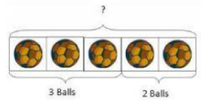
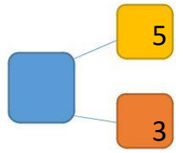
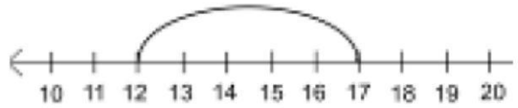
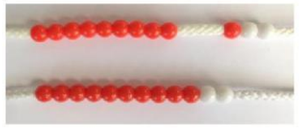
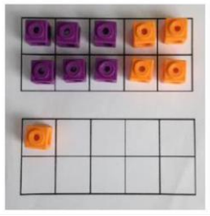
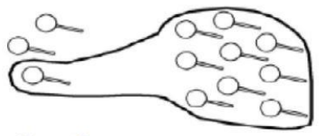
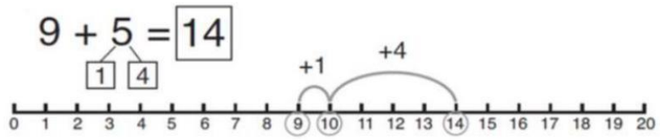
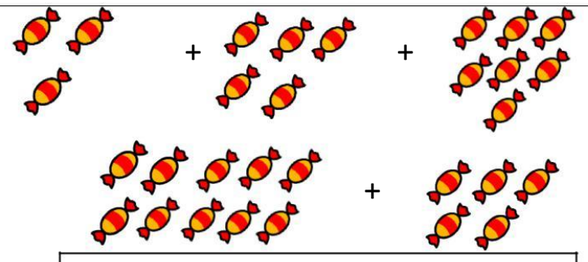
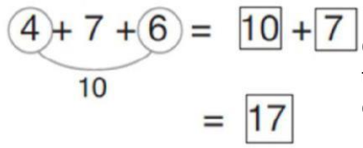
Can I use some jottings to help me?

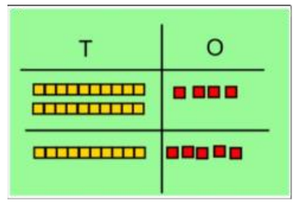
Should I use a written method?

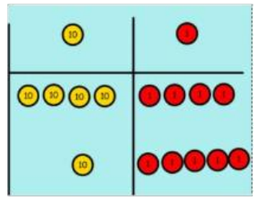
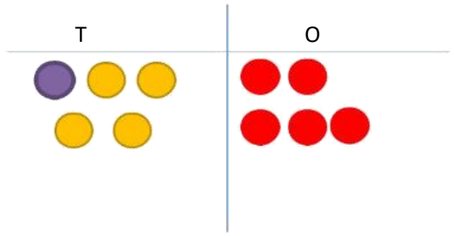
Teachers can use any teaching resources that they wish to use and the policy does not recommend one set of resources over another, rather that, a variety of resources are used. For each of the four rules of number, different strategies are laid out, together with examples of what concrete materials can be used and how, along with suggested pictorial representations. The principle of the concrete-pictorial-abstract (CPA) approach (Make it, Draw it, Write it) is for children to have a true understanding of a mathematical concept, they need to master all three phases within a year group's scheme of work.

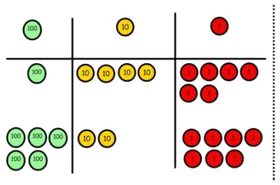
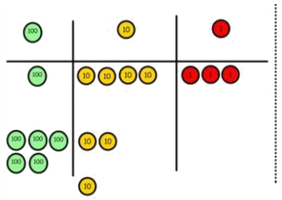
Appendix A

Addition

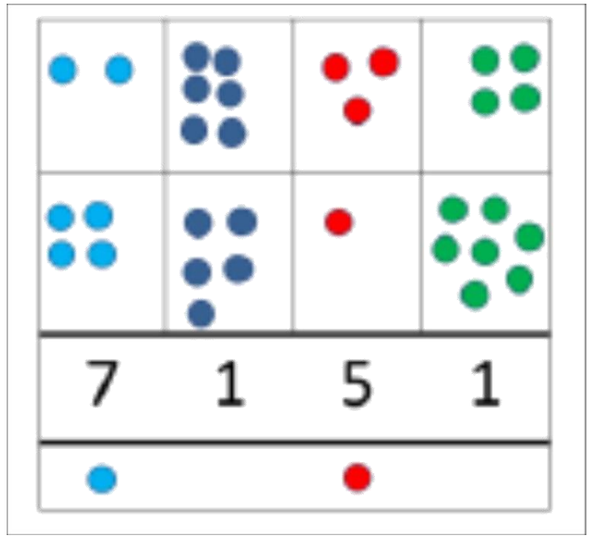
Objective and Strategies	Concrete	Pictorial	Abstract
Combining two parts to make a whole: part- whole model	    Use cubes to add two numbers together as a group or in a bar.	  Use pictures to add two numbers together as a group or in a bar. 	 Use the part-part whole diagram as shown above to move into the abstract. **4 + 3 = 7** **10= 6 + 4**
Starting at the bigger number and counting on	 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.
Regrouping to make 10.	 6 + 5 = 11  Start with the bigger number and use the smaller number to make 10.	 3 + 9 = Use pictures or a number line. Regroup or partition the smaller number to make 10. 	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?
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.	 Add together three groups of objects. Draw a picture to recombine the groups to make 10.	 Combine the two numbers that make 10 and then add on the remainder.

<table>
<tr>
<td>Column method- no regrouping</td>
<td>
24 + 15=
Add together the ones first then add the tens. Use the Base 10 blocks first before moving onto place value counters.



</td>
<td>
After practically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions.


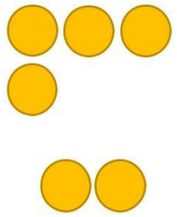
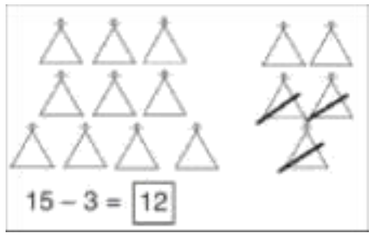
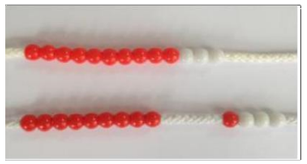
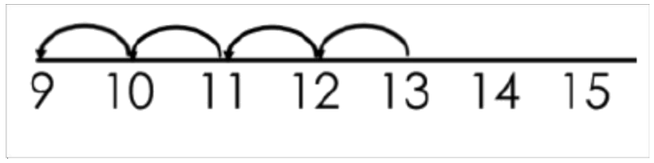
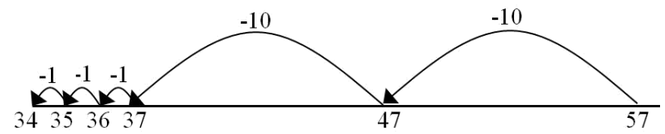
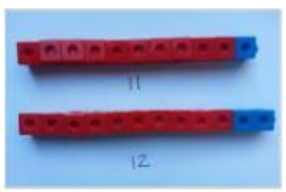
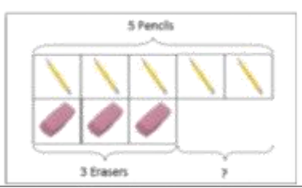
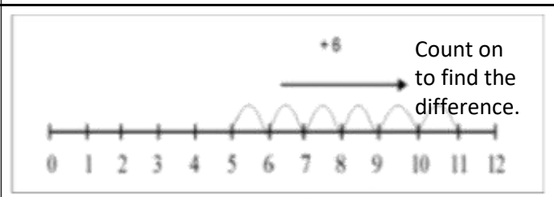
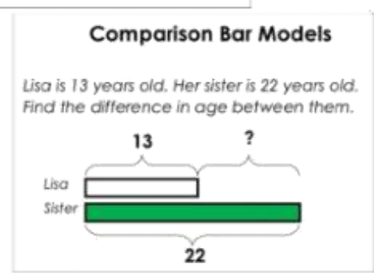
</td>
<td>
Calculations
21 + 42 =
21
+ 42
</td>
</tr>
<tr>
<td>Column method- regrouping</td>
<td>
Make both numbers on a place value grid.

146
+ 527
Add up the ones and exchange 10 ones for one 10.

146
+ 527
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.

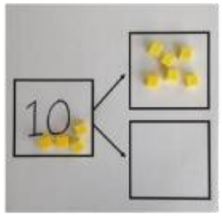
This can also be done with Base 10 to help children clearly see that 10 ones equal 1 ten and 10 tens equal 100.

As children move on to decimals, money and decimal place value counters can be used to support learning.
</td>
<td>
Children can draw a pictoral representation of the columns and place value counters to further support their learning and understanding.


</td>
<td>
Start by partitioning the numbers before moving on to clearly show the exchange below the addition.
20 + 5
40 + 8
60 + 13 = 73
536
+ 85
621
1 1
As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here.
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
</td>
</tr>
</table>

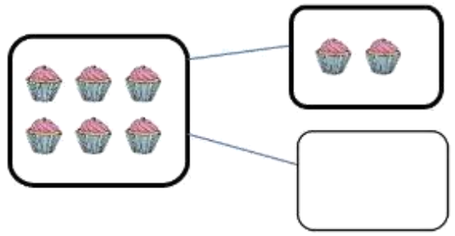
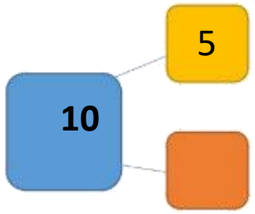
Subtraction

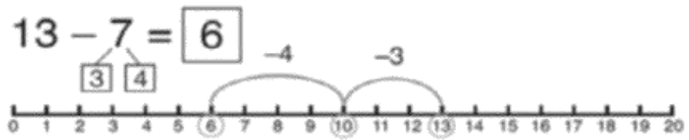
Objective and Strategies	Concrete	Pictorial	Abstract
6 – 2 = 4 Taking away ones	Use physical objects, counters, cubes etc to show how objects can be taken away. 	Cross out drawn objects to show what has been taken away.  	**18 -3= 15** **8 – 2 = 6**
Counting back	Make the larger number in your subtraction. 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. 	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.	Put 13 in your head, count back 4. What number are you at? Use your fingers to help.
Find the difference	Compare amounts and objects to find the difference.  Use cubes to build towers or make bars to find the difference  Use basic bar models with items to find the difference.	 Draw bars to find the difference between 2 numbers. 	Hannah has 23 sandwiches, Helen has 15 sandwiches. Find the difference between the number of sandwiches.

<table>
<tr>
<td>Part Part Whole Model</td>
<td> 

Link to addition- use the part whole model to help explain the inverse between addition and subtraction.

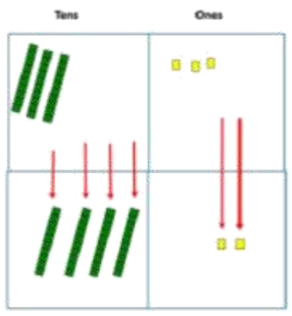
If 10 is the whole and 6 is one of the parts. What is the other part?

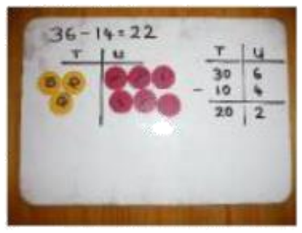
10 - 6 =</td>
<td>Use a pictorial representation of objects to show the part part whole model.
  </td>
<td> 

Move to using numbers within the part whole model.</td>
</tr>
<tr>
<td>Make 10</td>
<td>14 – 9 =
 
Make 14 on the ten frame. Take away the four first to make 10 and then takeaway one more so you have taken away 5. You are left with the answer of 9.</td>
<td> 

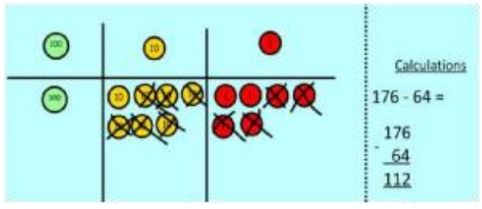
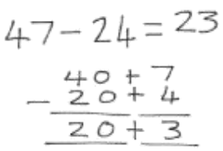
Start at 13. Take away 3 to reach 10. Then take away the remaining 4 so you have taken away 7 altogether. You have reached your answer.</td>
<td>16 – 8=

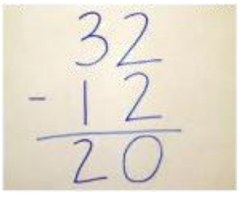
How many do we take off to reach the next 10?

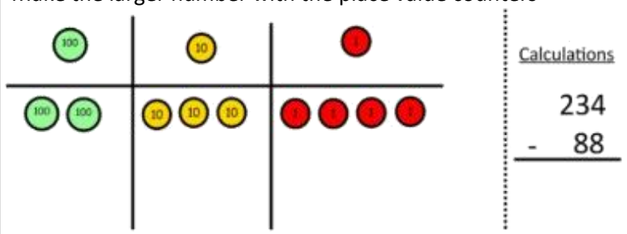
How many do we have left to take off?</td>
</tr>
<tr>
<td>Column method without regrouping</td>
<td> 

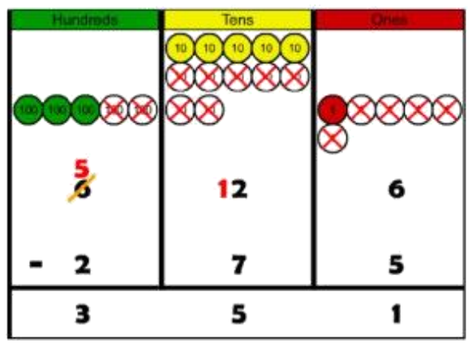
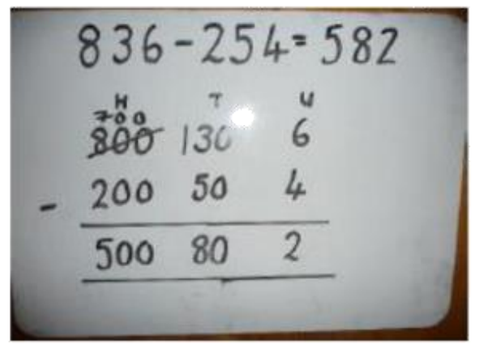
Use Base 10 to make the bigger number then take the smaller number away.
 

Show how you partition numbers to subtract. Again make the larger number first.</td>
<td>Draw the Base 10 or place value counters alongside the written calculation to help to show working.
 

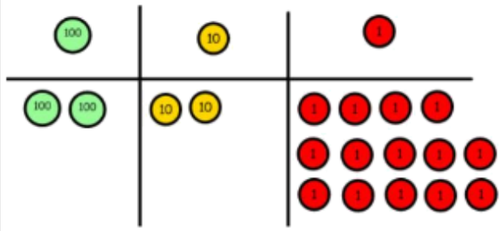

</td>
<td> 

This will lead to a clear written column subtraction.
 
</td>
</tr>
<tr>
<td>Column method with regrouping</td>
<td>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
 

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

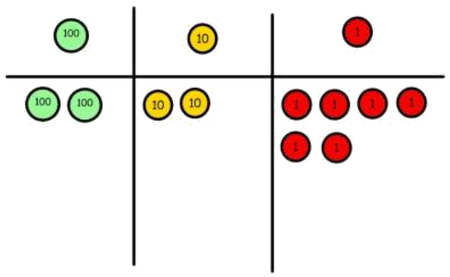
Children can start their formal written method by partitioning the number into clear place value columns.</td>
</tr>
</table>



Calculations

234
- 88

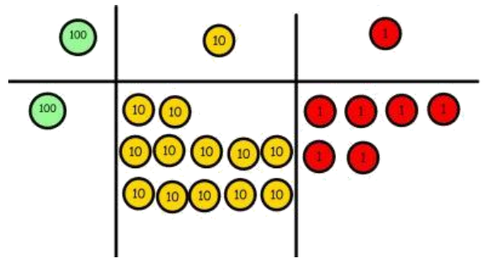
Now I can subtract my ones.



Calculations

234
- 88

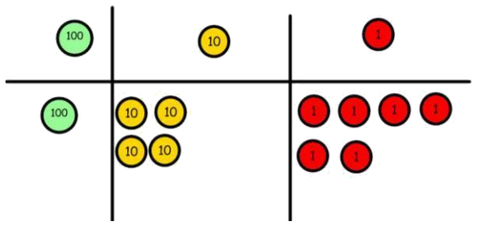
Now look at the tens, can I take away 8 tens easily? I need to exchange one hundred for ten tens.



Calculations

234
- 88

Now I can take away eight tens and complete my subtraction

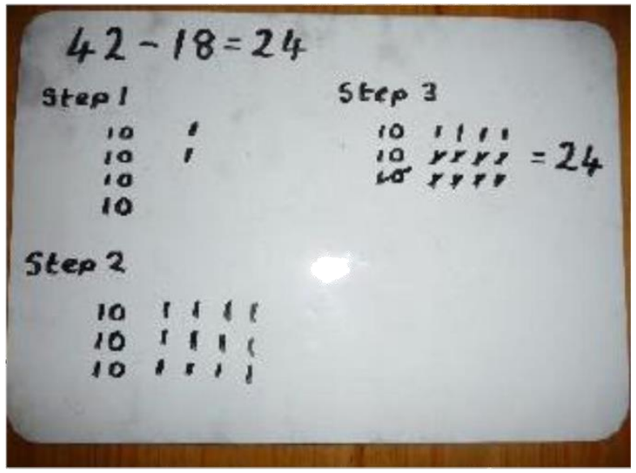


Calculations

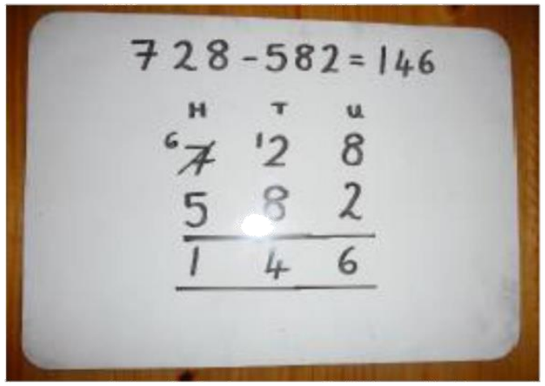
~~2~~ ~~3~~ 4
- 88
146

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.

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

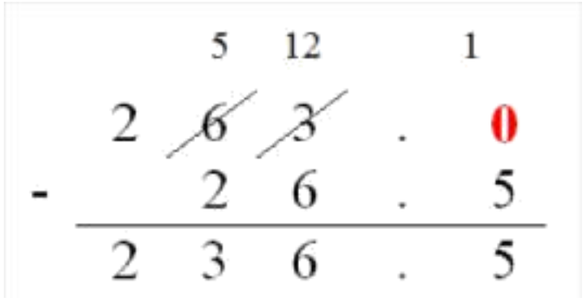


Just writing the numbers as shown here shows that the child understands the method and knows when to exchange/regroup.

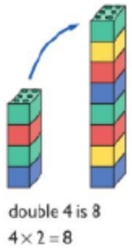
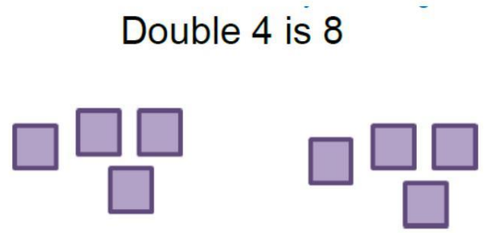
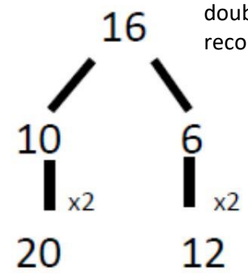
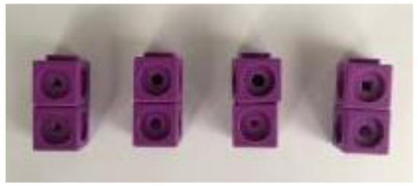
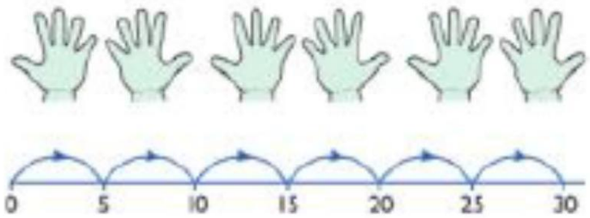
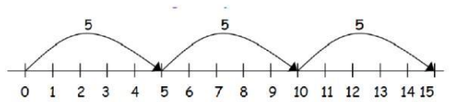
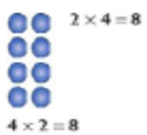


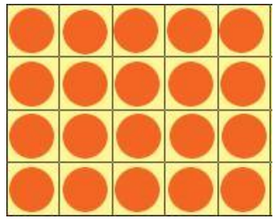
Moving forward the children use a more compact method.

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



Multiplication

Objective and Strategies	Concrete	Pictorial	Abstract
Doubling	Use practical activities to show how to double a number.  	Draw pictures to show how to double a number.  	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	  Use different objects to add equal groups.	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
Arrays- showing commutative multiplication	Create arrays using counters/ cubes to show multiplication sentences. 	  Draw arrays in different rotations to find **commutative** multiplication sentences.	Use an array to write multiplication sentences and reinforce repeated addition.



Link arrays to area of rectangles.

5 + 5 + 5 = 15

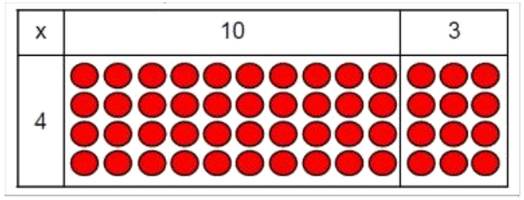
3 + 3 + 3 + 3 + 3 = 15

5 x 3 = 15

3 x 5 = 15

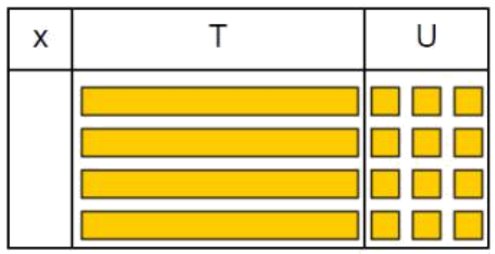
Grid Method

Show the link with arrays to first introduce the grid method.



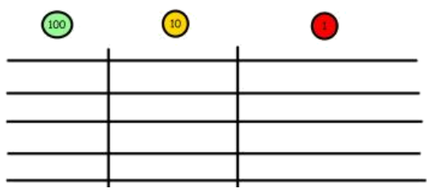
4 rows of 10
4 rows of 3

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



4 rows of 13

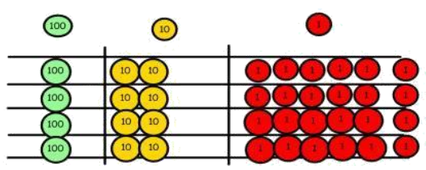
Move on to place value counters to show how we are finding groups of a number. We are multiplying by 4 so we need 4 rows.



Calculations

4 x 126

Fill each row with 126.



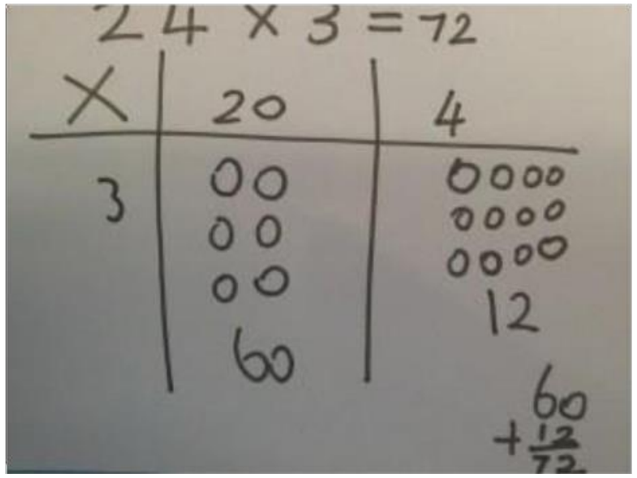
Calculations

4 x 126

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

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.

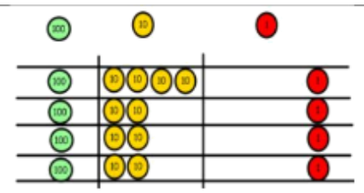
×	30	5
7	210	35

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

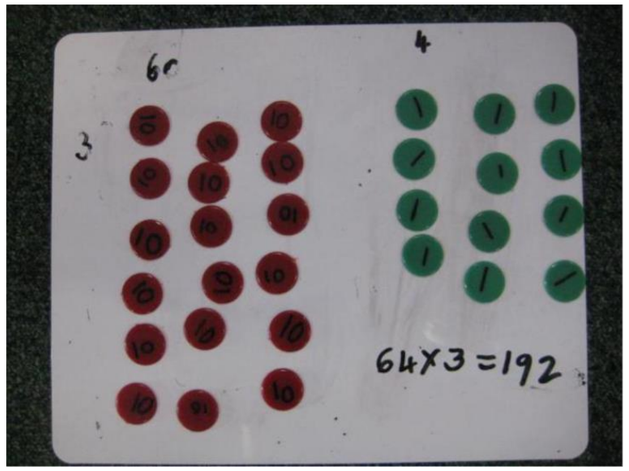
X	1000	300	40	2
10	10000	3000	400	20
8	8000	2400	320	16



Then you have your answer.

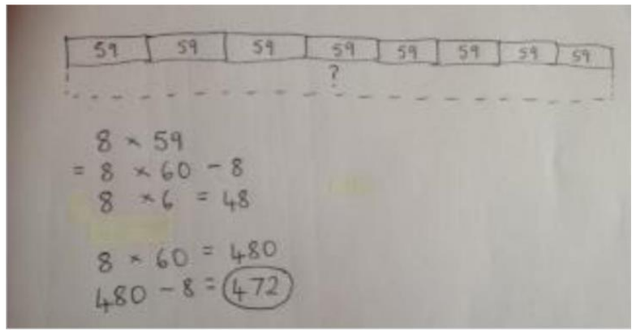
Column multiplication

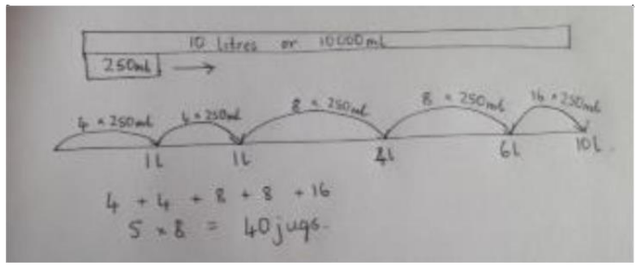
Children can continue to be supported by place value counters at the stage of multiplication.



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.

Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.





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.

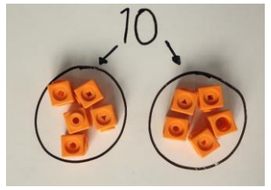
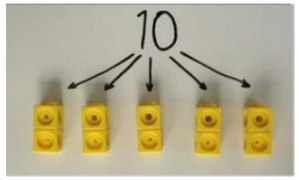
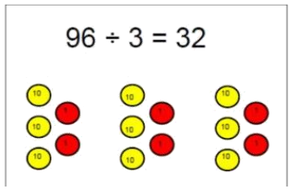
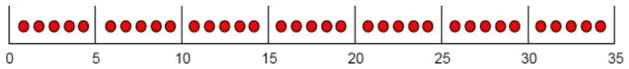
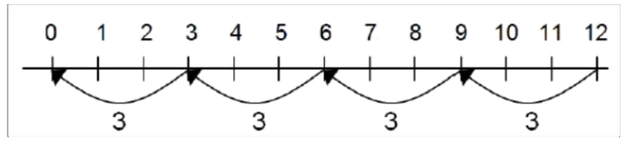
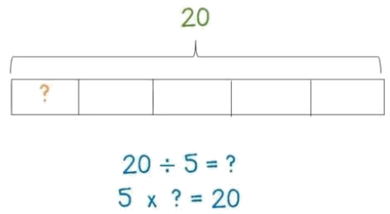
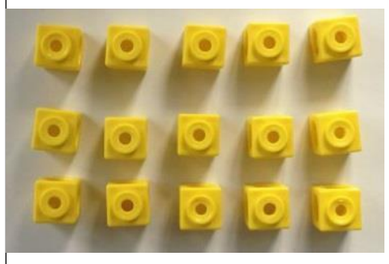
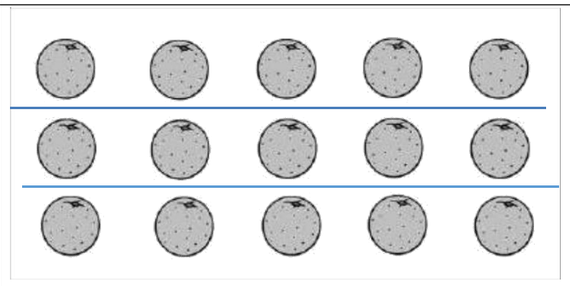
```
  32
x 24
   8   (4 x 2)
 120   (4 x 30)
  40   (20 x 2)
 600   (20 x 30)
 768
```

```
      7 4
    x 6 3
    ------
      1 2
    2 1 0
    2 4 0
+ 4 2 0 0
  ---------
  4 6 6 2
```

This moves to the more compact method.

```
  2 3 1
  1342
x   18
-------
13420
10736
-------
24156
  1
```

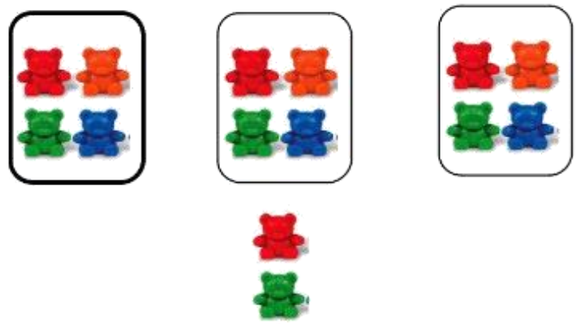
Division

Objective and Strategies	Concrete	Pictorial	Abstract
Sharing objects into groups	   I have 10 cubes, can you share them equally in 2 groups?	Children use pictures or shapes to share quantities.  8 ÷ 2 = 4	**Share 9 buns between three people.** **9 ÷ 3 = 3**
Division as grouping	Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.    	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. E.g. 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



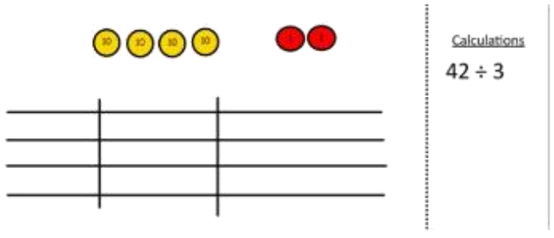
Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder.

Draw dots and group them to divide an amount and clearly show a remainder.

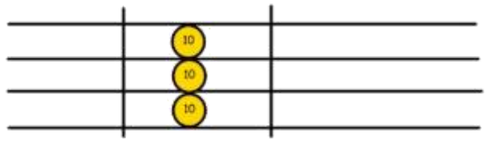
Complete written divisions and show the remainder using r.

Short division

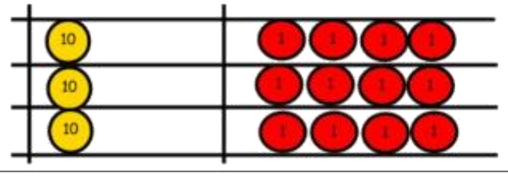
Use place value counters to divide using the bus stop method alongside



Start with the biggest place value, we are sharing 40 into three groups. We can put 1 ten in each group and we have 1 ten left over.

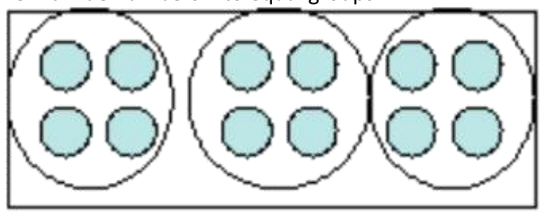


We exchange this ten for ten ones and then share the ones equally among the groups.



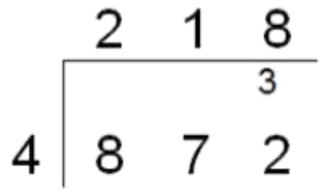
We look how much in 1 group so the answer is

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

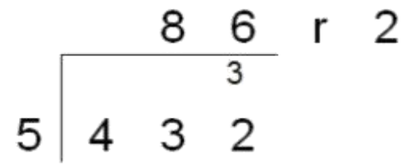


Encourage them to move towards counting in multiples to divide more efficiently.

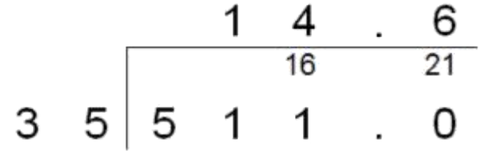
Begin with divisions that divide equally with no remainder.



Move onto divisions with a remainder.



Finally move into decimal places to divide the total accurately.

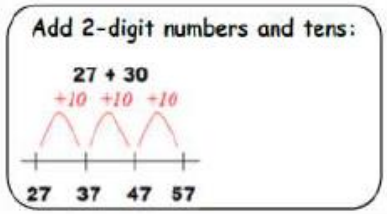


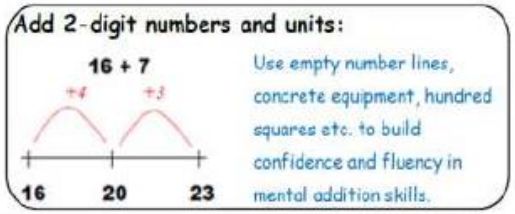
Appendix B

Progression in Presentation

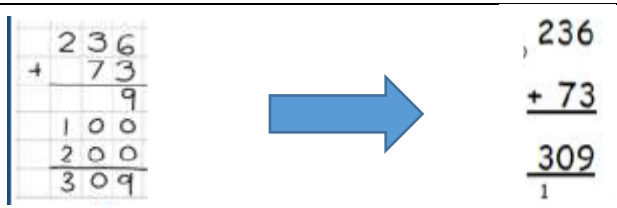
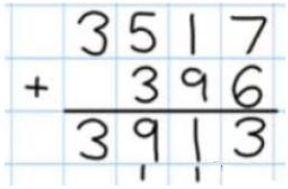
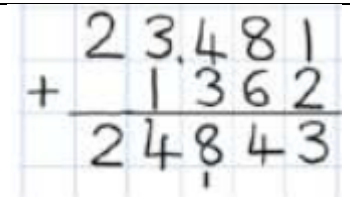
<table>
<tr><th colspan="2">Addition</th></tr>
<tr><td>Y1

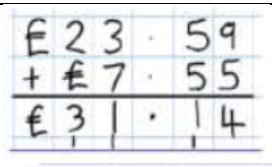
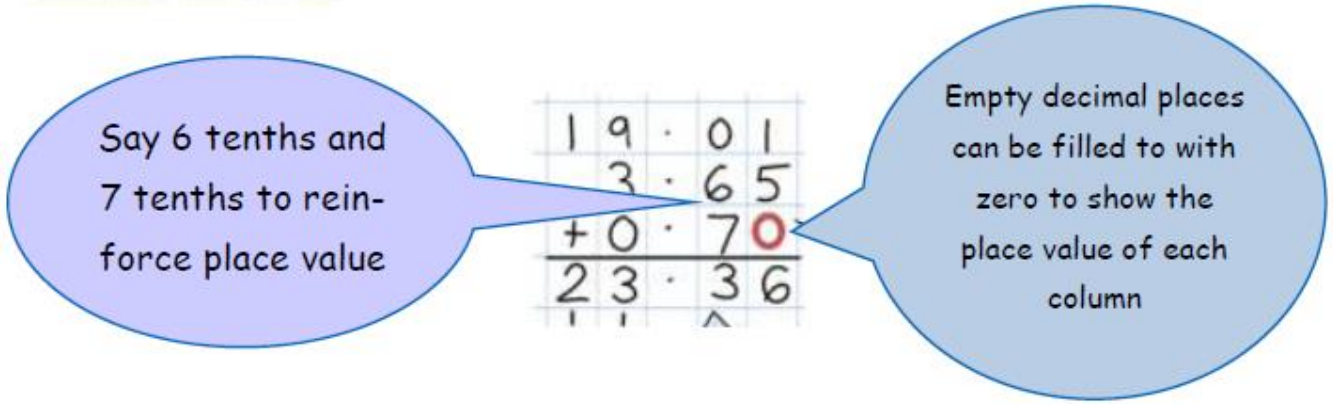
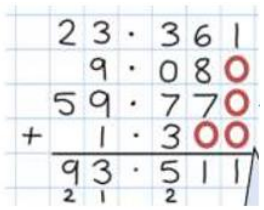
Add numbers up to 20</td><td>6+3=9
 
</td></tr>
<tr><td>Y1/2

Add with 2-digit numbers</td><td> 

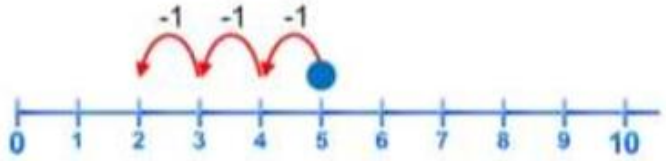
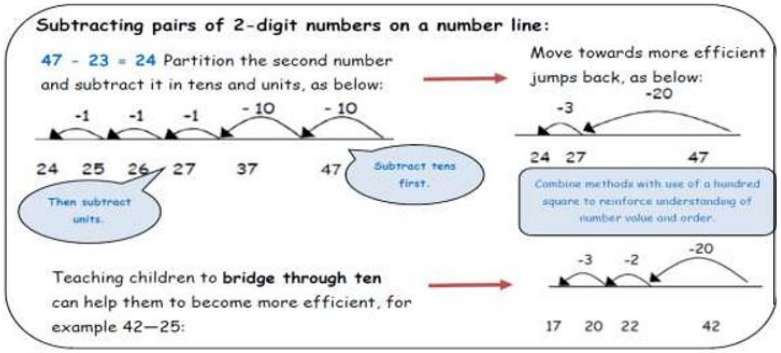
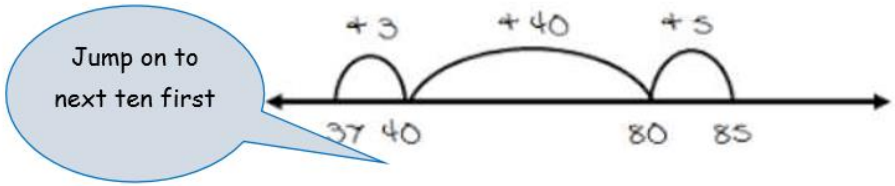

</td></tr>
<tr><td>Y1/2

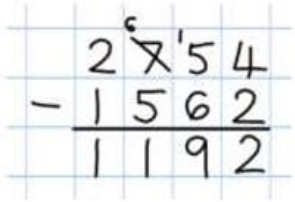
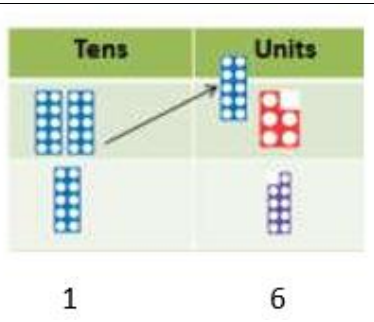
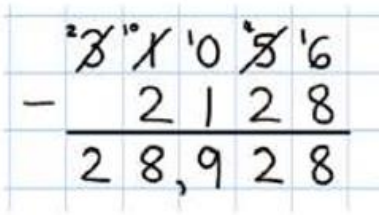
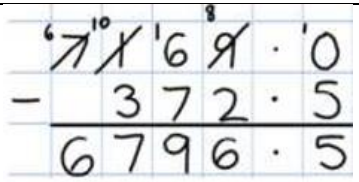
Formal recording using partitioning method</td><td>25 + 47
20 + 5 40 + 7
20 + 40 = 60
5+ 7 =12</td></tr>
</table>

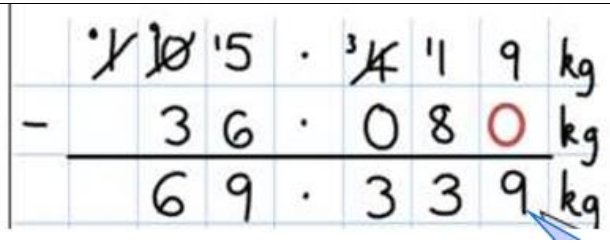
Y2/3 Add numbers to 3 digits	 Remember to carry numbers underneath the bottom line and remind pupils of actual value.
Y3/4 Add numbers with up to 4 digits	 Add the ones first. Remind pupils of actual value (“1 ten add 9 tens”) Can scaffold further if necessary by writing 7+6=13 on the side.
Y4 Use column addition to add 2 or 3 whole numbers	

Y5 Add 2-place decimal number and fill empty columns with zeros	 
Y6 Add several numbers of increasing complexity	 Empty decimal places can be filled with zero to show the place value of each column. Use compact column method to add in the context of money and measures, including decimals with different numbers of decimal places.

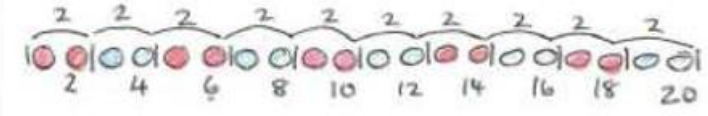
Subtraction

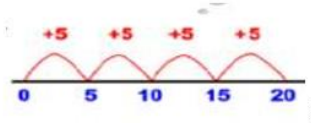
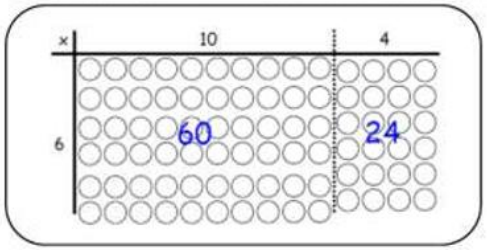
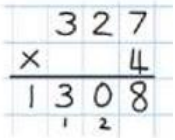
Y1 Subtract from numbers up to 20	 5 - 3 = 2
Y2 Subtracting pairs of 2-digit numbers on a number line	
Y2 Subtract with 2 and 3-digit numbers	

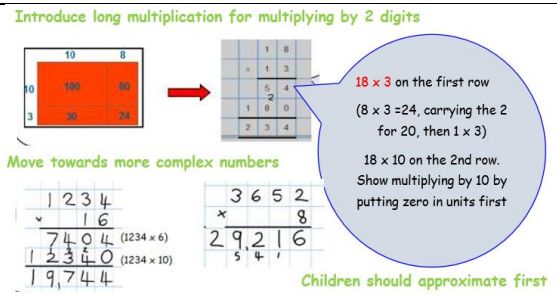
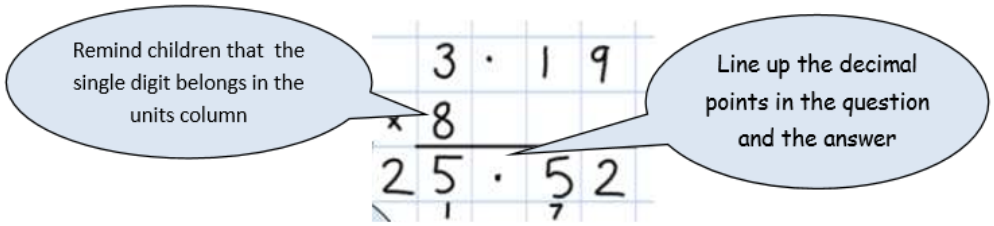
Y3/4 Subtract with up to 4-digit numbers	  Model with Numicon
Y4 Subtract with at least 4-digit numbers	
Y5 Subtract with decimal values, including mixtures of integers and decimals and aligning the decimal point	 Add a zero in any empty decimal place to aid understanding of what to subtract

Y6 Subtracting with increasingly large and more complex numbers and decimal values	

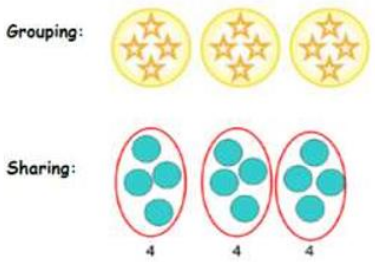
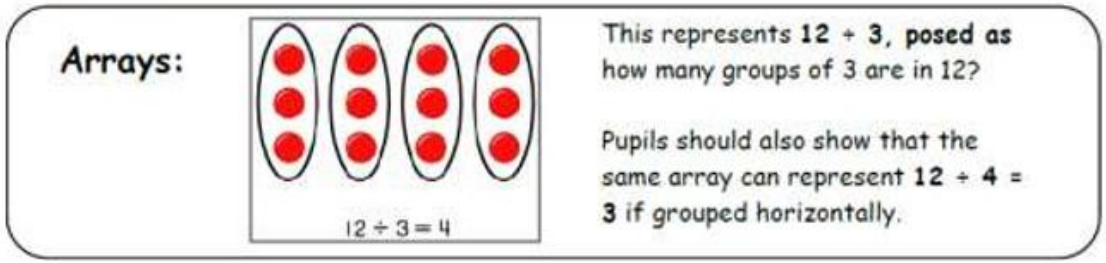
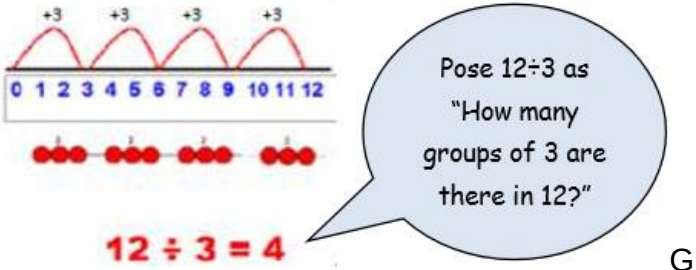
Multiplication

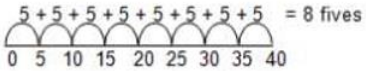
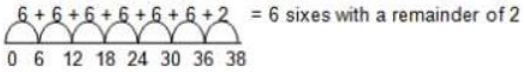
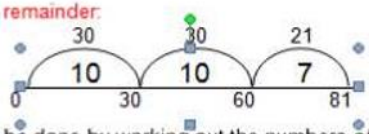
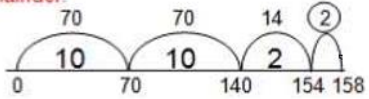
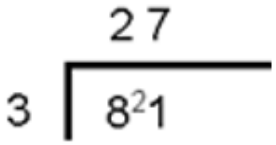
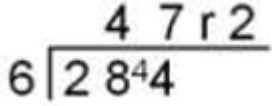
Y2 Multiply with concrete objects, arrays and pictorial representations	 Count in 2s, 5s, 10s   Use Numicon to find doubles to double 6

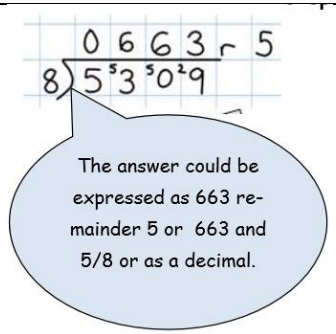
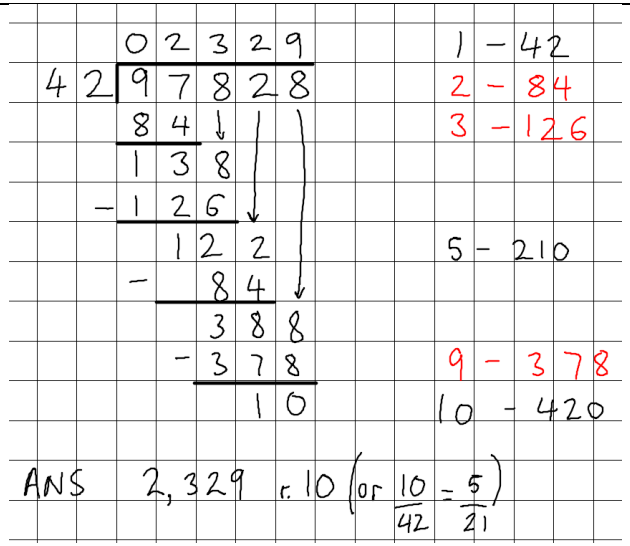
Y2 Multiplication using arrays and repeated addition	Use  re- **4 X 5 = 20** **peated addition on a number line:**  5 x 3 = 15 3 x 5 = 15
Multiply 2-digit numbers by a single digit number	Eg. 23 x 8 = 184 Link the layout of the grid to an array initially: 	X	20	3
---	---	---
8	160	24	  160 + 24 = 184 Demonstrate how the array links to the grid calculation
Y3 Multiply 2 and 3 digits by a single digit	Developing the grid method: Eg. 136 x 5 = 680 	X	100	30	6
---	---	---	---
5	500	150	30	 500 150 + 30 680
Y3/4 Multiply up to 4 digits by 1 or 2 digits		x	300	20	7
---	---	---	---
4	1200	80	28	  

	
Y5/6 Short and long multiplication (see above) with up to 2 decimal places by a single digit	

Division

Y2 Group and share small quantities	 Children should solve a division problem within a context. E.g. 5 children share 15 sweets. How many does each child get? Can they solve this and write a division statement eg. 15 sweets shared between 5 children gives 3 each.
Y2 Group and share using ÷ and = signs	  Grouping using a number line. Group from zero in equal jumps to find "how many groups of __ in __ ?

Y2/3 Divide 2-digit numbers by a single digit	Example without remainder: 40 ÷ 5 Ask "How many 5s in 40?"  Example with remainder: 38 ÷ 6  For larger numbers, when it becomes inefficient to count in single multiples, bigger jumps can be recorded using known facts. Example without remainder: 81 ÷ 3  This could either be done by working out the numbers of threes in each jump as you go along (10 threes are 30, another 10 threes makes 60, and another 7 threes makes 81. That's 27 threes altogether) or by counting in jumps of known multiples of 3 to reach 81 (30 + 30 + 21) then working out the number of threes in each jump. Example with remainder: 158 ÷ 7 
Y3/4 Divide up to 3-digit numbers by a single digit	 

Divide up to 4-digits by a single digit. Division given in real life contexts e.g. money and measures.	
Y6 **Long Division** Divide at least 4-digit numbers by single and 2-digit numbers	 Start with 1x,5x,10x number and work out other multiples as required. Subtract and bring digits down where the arrows are.

Appendix C

Mathematical Language

High expectations of the mathematical language used are essential, with staff only accepting what is correct. Consistency across the school is key:

Correct Terminology	Incorrect Terminology
Ones	units
Is equal to (is the same as)	equals
zero	Oh (the letter o), nothing, naught
exchange exchanging regrouping	stealing borrowing
calculation equation	Generic term of “sum” or “number sentence”
bar model	
known unknown	
whole	
part	

Also see Wolsingham Primary School Progression in Mathematical Language Document 2024-25.