Grove Vale Primary School

Calculation Policy

Addition

Date: June 2020

Review: June 2022

J. Ahearn

Addition

EYFS

National Curriculum:

Pupils should be taught to:

- Know one more than a number
- Using quantities and objects, they add two single-digit numbers and count onto find the answer.

Adding One More Than a Number

Use of concrete objects, cubes, fingers and counters to find one more than any given number to 5, 10 and then 20 starting with the biggest number.

9 blocks + 1 more block equals 10 blocks

Use of pictorial representations to count one more than a number (using 5 frame).

Ask children to add one more, using a 5 frame and a number track underneath, pointing to the new number (part whole):

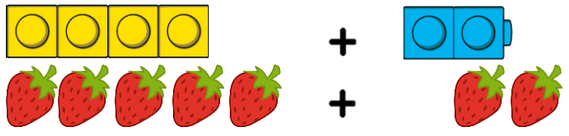
Use of a number track to count on or jump one more than a number. Use counters or fingers to show jumping forwards one

Begin to count on one from a number between 1 and 9 mentally.

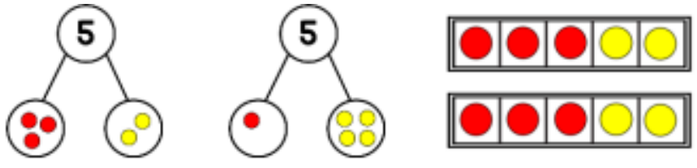
8….9 through simple songs and nursery rhymes.

Add Two Single-Digit Numbers

Use a range of concrete objects and pictorial representations (including drawing own pictures) counting on from one, progressing to counting on from the biggest number using number track. Re-enforced through real life role play, games, songs, playful practical indoor and outdoor math activities focusing on use of mathematical language like 'altogether'. Encourage discussion while solving practical problems to discuss ideas and processes



Number bonds to 5 progressing to number bonds to 10 pictorially (part whole) progressing to show this as an abstract calculation.



Year 1

National Curriculum:

Pupils should be taught to:

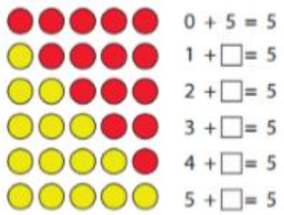
- Read, write and interpret mathematical statements involving addition
- Represent and use all number bonds within 20
- Add one-digit and two-digit numbers to 20, including 0
- Solve one-step problems that involve addition using concrete objects and pictorial representations, and missing number problems

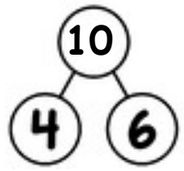
Number Bonds

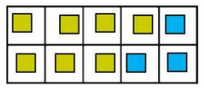
Use of concrete objects (hands, washing line, cubes, counters etc) and pictorial representations to establish number bonds for 5, 10 progressing to 20, using part-part-whole, developing as a mental method.

9 and 1 equal 10

8 and 2 equal 10





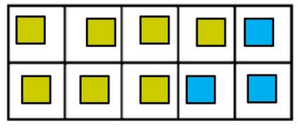


Adding One and Two-Digit Numbers (Up to 20)

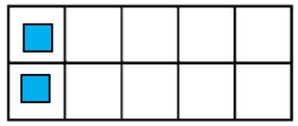
Use a range of concrete objects (Using cubes to show part=part-whole, counters, real life objects) to add one and two-digits up to 20.. Then, progress this as a pictorial representation, starting with the biggest number and adding on the smaller number. Finally progress to showing this abstractly as a calculation or using number bond circles to show part-part-whole while beginning to count on mentally from the larger number. Progress to number line if confident (see year 2).

Children should then apply this skill to **missing number problems** by counting on from the first number. First using concrete objects (washing lines) then to pictorial (circle number on number line, count on) to abstract use of number bonds to partition when counting on to find the missing number.

Regrouping to Make 10



Use a 10 frame concretely then pictorially to regroup by partitioning the smaller number to make 10 and then counting on the left-over amount.



Start with the biggest number (7) then partition that number to make 10 (5 = 3 + 2). Then place the remaining amount.

Year 2

National Curriculum:

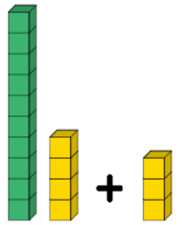
Pupils should be taught to:

- Solve problems with addition and subtraction: using concrete objects and pictorial representations, including those involving numbers, quantities and measures and applying their increasing knowledge of mental and written methods
- Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100
- Add and subtract numbers using concrete objects, pictorial representations, and mentally, including: a two-digit number and 1s; a two-digit number and 10s; 2 two-digit numbers and adding 3 one-digit numbers
- Show that addition of 2 numbers can be done in any order (commutative) and subtraction can't.
- Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems

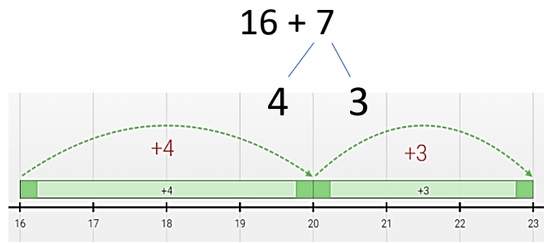
Adding a Two Digit and Ones

Use of concrete objects such as numicon, beads, or dienes etc to add on ones. Progress this to using part-part-whole concept to enable children to use knowledge of number binds to partition to support adding. Mentally secure number facts to 20/100

Concrete (14 + 3)



Abstract (16 + 7)

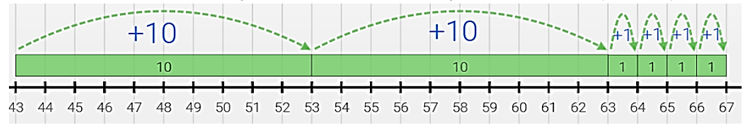


Adding Ten to a Number

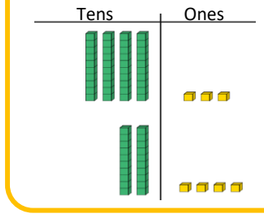
Start showing this concretely using dienes and a hundred square to jump a multiple of ten. Progress this to showing pictorially using dienes how adding a ten changes the place value. Encourage children to notice the pattern that the tens column increases by one each time.

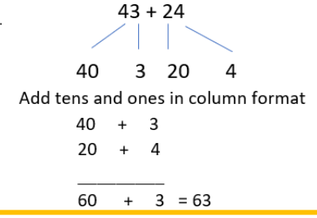
Adding Two Two-Digit Numbers

Use of **number line** initially to add tens individually and then ones: (43 + 24)



When children are confident, move to groups of jumps i.e. +20 rather than +10 +10. Progress to **partitioning** numbers into tens and ones and adding them individually using concrete and pictorial representations moving onto doing this abstractly and mentally **as well as using bar model to show the inverse to check answers.**





Add tens and ones in column format

$$\begin{array}{r} 40 + 3 \\ 20 + 4 \\ \hline 60 + 3 = 63 \end{array}$$

Adding Three Single Digit Numbers

Make sure two of the numbers add to ten. (3 + 5 + 7) Then encourage children to find the number bonds to ten first. (3 + 7 = 10) Then, make a new calculation adding the remaining number (10 + 5 = 15). Use blocks concretely to show this in relation to part-part-whole. Then move to doing this pictorially, progressing to abstract.

Addition

Year 3

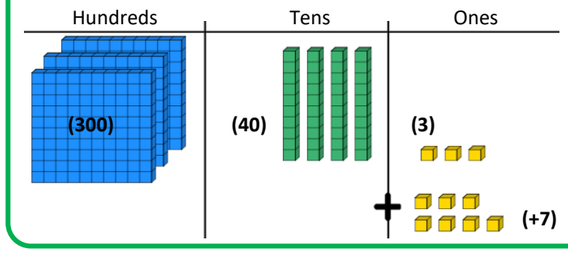
National Curriculum:

Pupils should be taught to:

- Add numbers mentally, including: a three-digit number and 1s, a three-digit number and 10s, a three-digit number and 100s
- Add numbers with up to 3 digits, using formal written methods of columnar addition

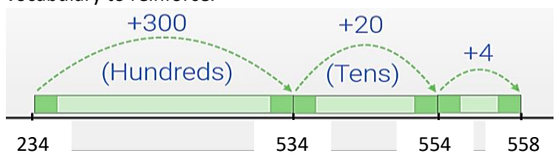
Adding Mentally

Use place value knowledge when adding ones, tens or hundreds to a three-digit number, initially using dienes concretely and pictorially to show that you only need to increase the column that is being added to. (Example: 343+7)



Adding Three-Digit Numbers

Then, use the **number line** to add three-digit numbers, in place value steps) using concrete and pictorial representations to assist understanding, using place value vocabulary to reinforce.



Further develop **partitioning** strategy with calculations beyond a 100, partitioning and adding the groups of hundreds, tens and ones using columns where possible.

234 + 324

200 + 30 + 4 + 300 + 20 + 4

200 + 300 = 500 *(Add hundreds)*
30 + 20 = 50 *(Add tens)*
4 + 4 = 8 *(Add ones)*

Follow this strategy with the **expanded column method**, adding ones, tens and hundreds individually, then adding those totals up to get the final answer. Develop this to bridge a barrier in preparation for the **formal written method** using relevant vocabulary to reinforce.

```
  234
+ 422
    8   Add Ones (4+3)
+  50   Add Tens (30+50)
  600   Add Hundreds (200+300)
  658   Then, add all the groups for the final answer
```

ATTEMPT ADDING DECIMALS MAKING IT EXPLICIT THAT IT IS TENTHS AND THE DECIMAL PLACE STAYS ROOTED.

If children are confident and ready to move on, they can begin to introduce the formal written method (see year 4).

Year 4

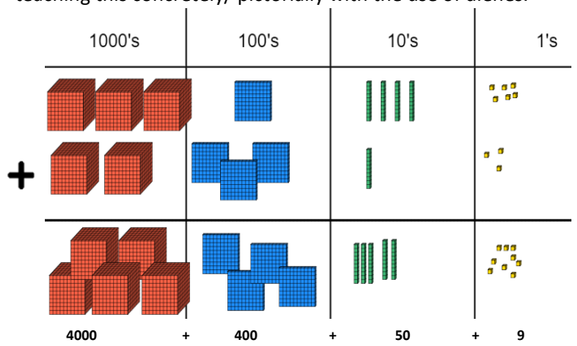
National Curriculum:

Pupils should be taught to:

- Add numbers with up to 4 digits using the formal written methods of columnar addition

Adding Four-Digit Numbers (no re-grouping)

Following recapping of **expanded method**, teach this method for all **without re-grouping** to ensure understanding, initially teaching this concretely/ pictorially with the use of dienes.



Then, show abstractly, adding each column and placing the answer directly underneath in that place value column. Ensure use of mathematical vocabulary i.e altogether there are 4 hundreds.

```
 7436
+2162
 9588
```

Adding Four-Digit Numbers (with re-grouping)

Importantly, model the process of re-grouping with a large place value display and concrete or pictorial dienes to show how the number bridge from one column to the other. I.e. 10 ones make a ten, 10 tens make a hundred so we have to re-group them into the right column. Start with re-grouping one column and as children become more confident, progress to more complex re-grouping, in particular if there are zero's involved and how re-grouping works then.

7349	7349	7349	7349
+6785	+6785	+6785	+6785
4	34	134	14134
1	1 1	1 1 1	1 1 1

Column Addition with Decimals

Include real life math elements here, using money and measurements where possible as the context. When adding decimals make it explicit that it is tenths and the decimal place stays rooted. When re-grouping, make it clear 10 tenths make a one using dienes to show this concretely/ pictorially.

7349	7349	7349	7349
+6785	+6785	+6785	+6785
.4	.34	.134	.14134
1	1 1	1 1 1	1 1 1

Year 5

National Curriculum:

Pupils should be taught to:

- Add whole numbers with more than 4 digits, including using formal written methods (columnar addition)
- Continue to revisit mental strategies of years 3 and 4
- Continue to solve missing number problems

Adding More Than Four Digit Numbers

85683	85683	85683	85683	85683
+45978	+45978	+45978	+45978	+45978
1	61	661	1661	131661
1	1 1	1 1 1	1 1 1 1	1 1 1 1

Children should use the column method with re-grouping to add two numbers in the tens and hundreds of thousands (five and six-digit numbers). Continue to use concrete/ pictorial methods to reinforce re-grouping.

Children should also use the column method to more than two values.

```
 48216
+37452
 11367
 97035
 1 1 1 1
```

Column Addition with Decimals

Childrens place value knowledge is key here when adding decimals, recognising they are adding tenths and hundredths and understanding this is a part of a whole. So, 21.01 + 210.6 = becomes:

```
 210.60
+ 21.01
 231.61
```

```
 210.60
+ 21.01
 231.61
```

It is also important to add then, that 210.6 is actually 210.60 when putting it in to the column method and zero is added as a place value. (Again, it is important children understand that six tenths is equal to sixty hundredths.

Children should be familiar in using the column method to add more than two decimal values while also applying in real life maths like time, money and measurements.

44.1cm + 22.25cm + 2.05cm

```
 44.10cm
 22.25cm
+ 2.05cm
 68.40cm
```

34.2ml + 12.65ml + 0.2ml

```
 34.20ml
 12.65ml
+ 0.20ml
 47.05
 1
```

£19.01 + £3.65 + 70p

```
 £19.01
 £ 3.65
+  0.70p
 £23.36
 1 1
```

Year 6

National Curriculum:

In year six children continue to practise column method for addition for bigger numbers and decimal numbers up to three decimal places

Addition of Numbers to One Million

Children should be confident in adding several numbers together with an increasing level of complexity. The numbers should be a combination of thousands, tens of thousands and hundreds of thousands. **(Children should have a secure understanding of the place value involved)**

```
  81059          423721
   3668           47890
  15301           31133
+ 20551         + 413214
 120579          915958
 1 1 1 1         1 1 1 1
```

Children should be efficient in their use of vocabulary to explain their process when calculating.

Column Addition with Decimals

Children should be taught to add decimals of a range of values up to 3 decimal places. Embedded in a range of real-life contexts (money, time, measurements etc see year 5), using their place value knowledge ensure the digits and decimal point are correctly aligned. Children use the column method to add several numbers with different numbers of decimal places

```
 5.400
 3.060
+12.421
 9.900
30.781
```

Zero **(0)** should be used as a place holder to ensure that the numbers are to the same decimal place. Zero is added to show there is no value to add. **(Children should have a sound understanding of the values and how many tenths, hundredths and thousandths make up a whole one)**

Useful Pictorial Resources:

Dienes Generator
(used to make the illustrations in this policy)
https://mathsbot.com/manipulatives/blocks

Number Line Generator
(used to make the illustrations in this policy)
https://apps.mathlearningcenter.org/number-line/

Maths Frame Online Interactive Addition Games
https://mathsframe.co.uk/en/resources/category/9/addition-and-subtraction

White Rose Reasoning and Problem Solving
https://whiterosemaths.com/resources/schemes-of-learning/primary-sols/

Grove Vale Primary School

Calculation Policy

Subtraction

Date: June 2020

Review: June 2022

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Subtraction

EYFS

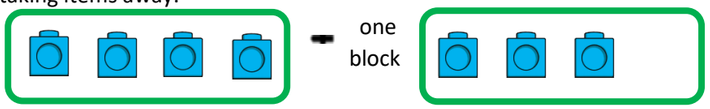
National Curriculum:

Pupils should be able to:

- Know one less than a number
- Using quantities and objects, they subtract two single-digit numbers and count back to find the answer

Finding One Less Than a Number

Use of concrete resources (everyday objects, cubes, beads, counters, toys etc) to show that the quantity of a group (5, 10 and then 20) can be changed by taking items away.



4 blocks take away 1 block leaves 3 blocks. Discuss it is one less.

Also, use pictorial representations to cross objects off to show one less.

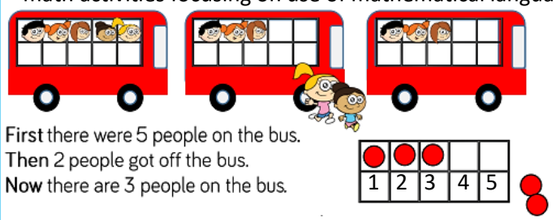
Ask children to cross one out, using a 5 frame and a number track underneath, pointing to the new number (part whole):

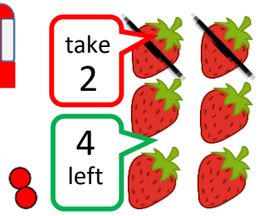
Use of a number track to count or jump backwards one number from different single digits. Use counters or fingers to show jumping forwards one.

Begin to count on one backwards from a number between 1 and 9 mentally. 9….8 through simple songs, actions and nursery rhymes.

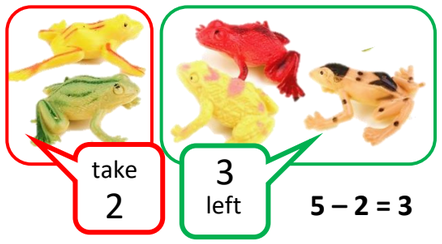
Subtracting Two Single Digit Number

Use a range of concrete objects and pictorial representations (including drawing own pictures) counting back from 5, progressing to counting on from the bigger numbers using number track. Re-enforced through real life role play, games, songs, stories, role play and playful practical indoor and outdoor math activities focusing on use of mathematical language like take away.

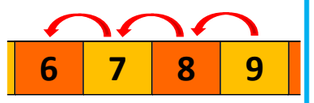




6 – 2 = 4



5 – 2 = 3



9 – 3 = 6

Year 1

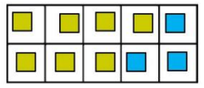
National Curriculum:

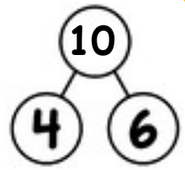
Pupils should be able to:

- Read, write and interpret mathematical statements involving subtraction
- Represent and use all number bonds within 20
- Subtract one-digit and two-digit within 20, including 0
- Solve one-step problems that involve subtraction using concrete objects and pictorial representations, and missing number problems

Subtracting One and Two-Digit Numbers (within 20)

Use of concrete objects, in particular, cubes to represent bar model and part-part whole model – making links with number bonds.



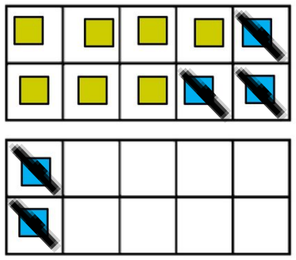


10 – 2 = 8

Use a number track to show this by counting back from the largest number from 10 progressing to showing this on a number from 20. (See year 2)

Once subtracting two-digits within 20, move to solving missing number problems using a number line practically to count backwards.

Regrouping to Make 10



Use a 10 frame concretely then pictorially to regroup by subtracting to make ten first and then subtracting the left over amount.

12 – 5 =

12 – 2 = 10

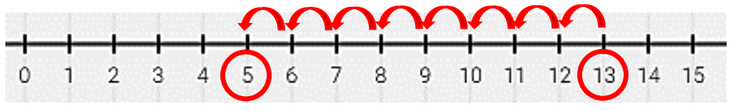
10 – 3 = 7

Missing Number Problems

Following on from children using concrete objects to count back, do this with missing number problems by starting with the biggest number and then counting back.

13 – 8 = 5 **8 missing beads** **Count back until 5**

Children can then use the support of a number line to support counting back to find missing numbers, as well as trying this mentally counting back if secure.



Count back to 5 (8 jumps)

Year 2

National Curriculum:

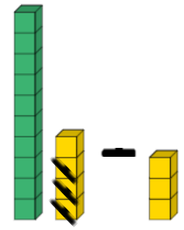
Pupils should be able to:

- Solve problems with subtraction: using concrete objects and pictorial representations, including those involving numbers, quantities and measures Applying their increasing knowledge of mental and written methods
- Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100 subtract numbers using concrete objects, pictorial representations, and mentally, including: a two-digit number and 1s, a two-digit number and 10s, 2 two-digit numbers
- Show that subtraction is not commutative as addition is
- Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems

Subtracting a Two Digit Number and Ones

Use of concrete objects such as numicon, beads, or dienes etc to take away ones. Progress this to using part-part-whole concept to enable children to use knowledge of number bonds to partition to support subtracting on a number line in chunks. **Also, become secure in number facts of 20 and 100 to aid subtraction.**

Concrete (14 - 3) Abstract (14 - 7)

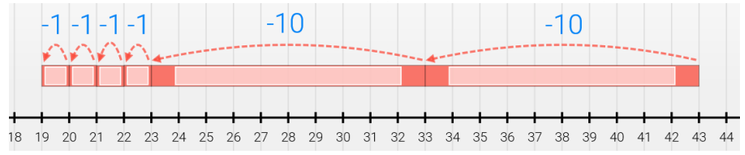


Subtracting 10 from a Number

Start showing this concretely using dienes and a hundred square to jump backwards a multiple of ten. Progress this to showing pictorially using dienes how subtracting a ten changes the place value. Encourage children to notice the pattern that the tens column decreases by one each time a multiple of ten is taken.

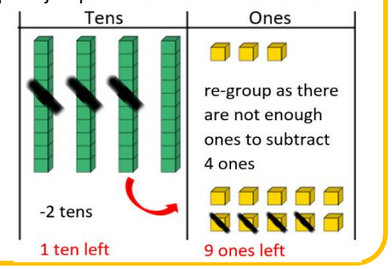
Subtracting Two Two-Digit Numbers

Use of **number line** to take tens individually and then ones: (43 - 24)



When children are confident, move to groups of jumps i.e. -20 rather than -10 -10.

Progress to **partitioning** numbers into tens and ones and subtract tens then ones, re-grouping if not enough ones using concrete and pictorial representations (see below) moving onto doing this abstractly and mentally **as well as using bar model to show the inverse to check answers combined with addition.**



Inverse Operation Use bar model/ part-part-whole to demonstrate the inverse relationship between addition and subtraction to then further help with problems i.e. missing number.

43 – 24 = 19
19 + 24 = 43
43 – 19 = 24
24 + 19 = 43

Subtraction

Year 3

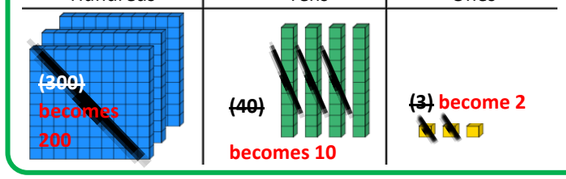
National Curriculum:

Pupils should be taught to:

- Subtract numbers mentally, including: a three-digit number and 1s, a three-digit number and 10s, a three-digit number and 100s
- Subtract numbers with up to 3 digits, using formal written methods of columnar subtraction
- Estimate, Inverse and solve problems involving subtract

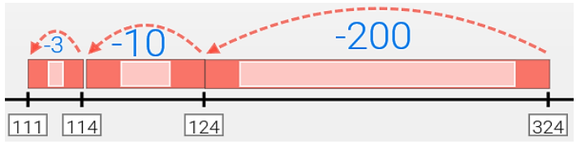
Subtracting Mentally

Use place value knowledge when adding ones, tens or hundreds to a three-digit number, initially using dienes concretely and pictorially to show that you only need to increase the column that is being added to. **(E.g. 343 - 131)**

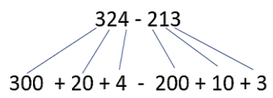


Subtract 3 Digit Numbers

Then, use the **number line** to subtract three-digit numbers, in place value steps) using concrete (like above) and pictorial representations to assist understanding, using place value vocabulary to reinforce. **E.g. 324 - 213**



Apply this when solving problems and use bar model/ part-part whole to re-enforce inverse relationship. (See year 2)



300 – 200 = 100 ***(Subtract hundreds)***
20 – 10 = 10 ***(Subtract tens)***
4 – 3 = 1 ***(Subtract ones)***

Further develop **partitioning** strategy with calculations, partitioning and subtracting the groups of hundreds, tens and ones using columns where possible.

Follow this strategy with the **expanded column method**, subtracting ones, tens and hundreds individually, then subtracting those totals up to get the final answer. Develop this to bridge a barrier in preparation for the **formal written method** using relevant vocabulary to reinforce. Use dienes or other concrete resources to reinforce. Move on to doing this with re-grouping (see year 4)

300 – 200 = 100 ***(Subtract hundreds)***
20 – 10 = 10 ***(Subtract tens)***
4 – 3 = 1 ***(Subtract ones)***

Then add what is left 100 + 10 + 1 = 111

ATTEMPT SUBTRACTING DECIMALS MAKING IT EXPLICIT THAT IT IS TENTHS AND THE DECIMAL PLACE STAYS ROOTED.

If children are confident and ready to move on, they can begin to introduce the formal written method (see year 4).

Year 4

National Curriculum:

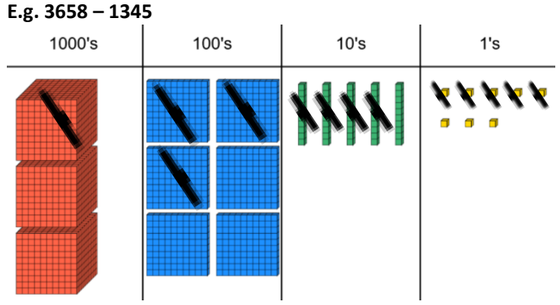
Pupils should be taught to:

- Subtract numbers with up to 4 digits, using formal written methods of columnar subtraction

Subtracting Four Digit Numbers (without re-grouping)

Following recapping of **expanded method**, teach this method for all **without re-grouping** to ensure understanding, initially teaching this concretely/ pictorially with the use of dienes.

E.g. 3658 – 1345



3000 - 1000 **600 – 300** **50 – 40** **8 – 5**

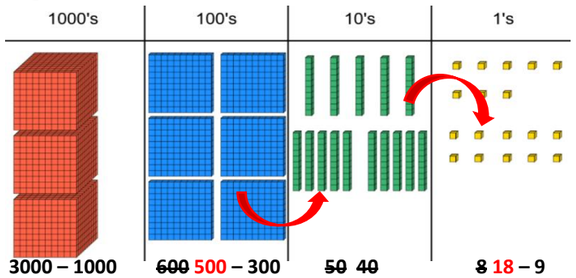
Then, show abstractly, subtracting each column and placing the answer directly underneath in that place value column. Ensure use of mathematical vocabulary i.e take away/ difference.

3658
- 1345
2313

Subtract Four-Digit Numbers (with re-grouping)

Importantly, model the process of re-grouping with a large place value display and heavy use of concrete or pictorial dienes to show if there isn't enough in that column to subtract then they re-group so they can do the calculation.

E.g. 3658 – 1369



3000 – 1000 ~~600~~ 500 **– 300** ~~50~~ ~~40~~ 140 **– 60** ~~8~~ 18 **– 9**

Then, once secure, focus on abstract method: Expose children to a range of problems to solve, reason and apply calculation knowledge for both – and +

5 14 1
3 6 5 8
- 1 3 6 9
2 2 8 9

Subtracting Decimals Include real life math (money and measurements) as the context. When adding decimals make it explicit that it is tenths and the decimal place stays rooted. When re-grouping, make it clear 10 tenths make a one using dienes to show this concretely/ pictorially. **E.g. 365.8 – 136.9**

5 14 1
3 6 5.8
- 1 3 6.9
2 2 8.9

Year 5

National Curriculum:

Pupils should be taught to:

- Subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition)
- Continue to revisit mental strategies of years 3 and 4
- Continue to solve missing number problems

Subtracting More Than Four Digit Numbers

Children should use the column method with re-grouping to add two numbers in the tens and hundreds of thousands (five and six-digit numbers). Continue to use concrete/ pictorial methods to reinforce re-grouping as it becomes more challenging (especially if there are 0's or multiple re-groupings needed). Children should also use the column method to subtract more than two values.

5 14 1
3 3 6 5 8
- 4 1 3 6 9
9 2 2 8 9

Column Addition with Decimals

Childrens place value knowledge is key here when adding decimals, recognising they are adding tenths and hundredths and understanding this is a part of a whole.

So, 658.8 – 369.02 = becomes:

5 14 1
6 5 8.8
- 3 6 9.0 2
2 8 9.8 2

It is also important to add then, that 658.8 is actually 658.80 when putting it in to the column method and zero is added as a place value. (Again, it is important children understand that eight tenths is equal to eighty hundredths.

5 14 1
6 5 8.8 0
- 3 6 9.0 2
2 8 9.8 2

Children should be familiar in using the column method to add more than two decimal values while also applying in real life maths like time, money and measurements.

How much change would I get from £10 if I bought a bag of apples costing £4.27?

Year 6

National Curriculum:

In year six children continue to practise column method for subtraction for bigger numbers and decimal numbers up to three decimal places

Subtraction of Larger Numbers

Children should be confident in subtracting several numbers with an increasing level of complexity. The numbers should be a combination of thousands, tens of thousands and hundreds of thousands. **(Children should have a secure understanding of the place value involved)**

3 1 5 14 1
4 3 3 6 5 8
- 2 4 1 3 6 9
1 9 2 2 8 9

Children should be efficient in their use of vocabulary to explain their process when calculating.

Column Subtraction with Decimals

Children should be taught to subtract decimals of a range of values up to 3 decimal places. Embedded in a range of real-life contexts (money, time, measurements etc), using their place value knowledge ensure the digits and decimal point are correctly aligned. Children use the column method to subtract several numbers with different numbers of decimal places

5 14 1
3 6 5 8.8 0
- 1 3 6 9.0 2
2 2 8 9.8 2

Zero **(0)** should be used as a place holder to ensure that the numbers are to the same decimal place. Zero is added to show there is no value to subtract. **(Children should have a sound understanding of the values and how many tenths, hundredths and thousandths make up a whole one)**

Useful Pictorial Resources:

Dienes Generator
(used to make the illustrations in this policy)
https://mathsbot.com/manipulatives/blocks

Number Line Generator
(used to make the illustrations in this policy)
https://apps.mathlearningcenter.org/number-line/

Maths Frame Online Interactive Subtraction Games
https://mathsframe.co.uk/en/resources/category/9/addition-and-subtraction

White Rose Reasoning and Problem Solving
https://whiterosemaths.com/resources/schemes-of-learning/primary-sols/

Grove Vale Primary School

Calculation Policy

Multiplication

Date: June 2020

Review: June 2022

J. Ahearn

Multiplication

EYFS

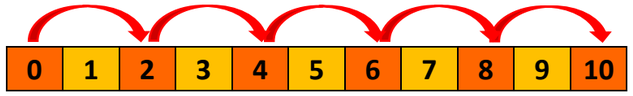
National Curriculum:

Pupils should be able to:

- Can solve problems involving doubling

Counting On

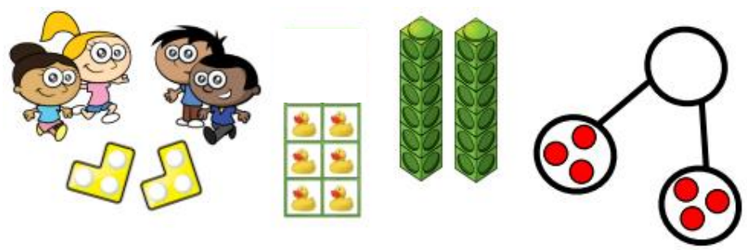
Provide opportunities for children to count beginning with emphasising on multiples of two progressing to counting in twos and tens using a range of concrete resources embedded in a real life context (indoors and outdoors).



Progress to counting on sets of two objects.

Doubling

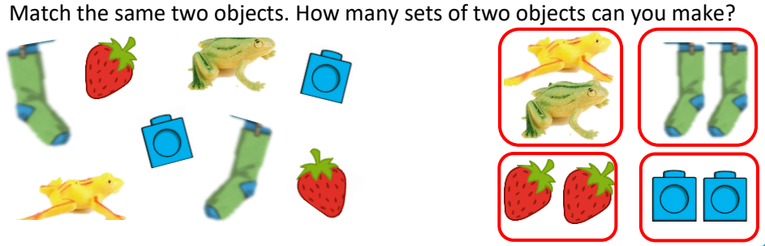
Children should learn that double means twice as many, having access to an array of real-life objects and mathematical equipment to build doubles progressing to numbers up to ten. Children should have access to mirrors to double the items they build understanding each side is equal or the same.



Making Equal Groups

Children will have access to a range of concrete and pictorial versions of real life objects to begin to make sets of objects by counting the objects in a set and making more sets. For example, this could be the pairing of socks. How many groups of two have you made?

Match the same two objects. How many sets of two objects can you make?



Year 1

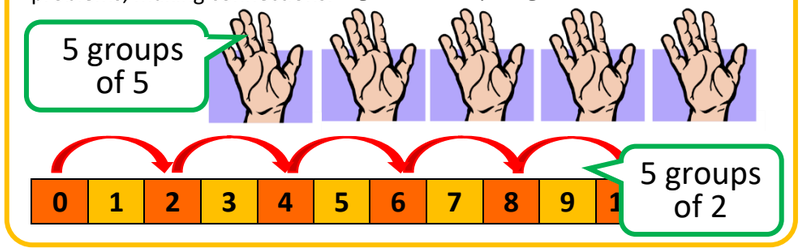
National Curriculum:

Pupils should be able to:

- Solve one-step problems involving multiplication by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher
- Recall doubles and count on/ back in multiples of 1, 2, 5 and 10

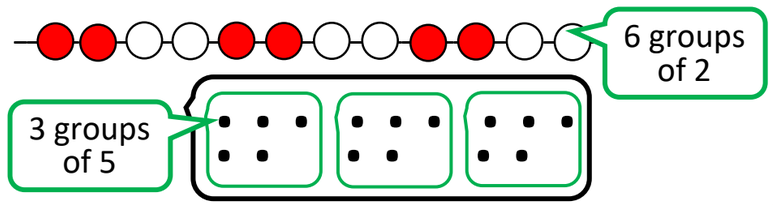
Counting in Multiples

Children should use a range of concrete and pictorial representations of every day/ real life object, used to count how many groups of 2, 5 or 10 there are. This should progress to children being able to count on independently in 1, 2, 5 and 10 while understanding multiplication link and applying to simple problems, making connections.



Grouping/ Repeated Addition

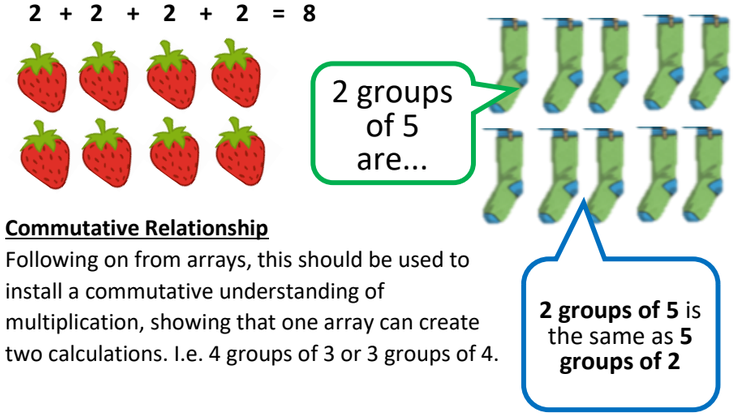
Use concrete resources/ everyday objects as well as pictorial representation on whiteboards to show the visuals of making groups/multiples of 2, 5 or 10 while solving simple 1 step problems.



Arrays

Use of array in maths, arranging objects, numbers or pictures in columns or rows. The purpose of an array is to help children understand and identify groups and reinforce multiplication is grouping and repeated addition.

2 + 2 + 2 + 2 = 8



Commutative Relationship

Following on from arrays, this should be used to install a commutative understanding of multiplication, showing that one array can create two calculations. I.e. 4 groups of 3 or 3 groups of 4.

Year 2

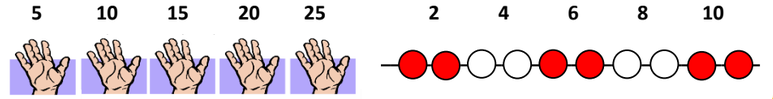
National Curriculum:

Pupils should be able to:

- Recall and use multiplication facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers
- Calculate mathematical statements for multiplication within the multiplication tables and write them using the multiplication (×) and equals (=) signs
- Show that multiplication of two numbers can be done in any order (commutative)
- Solve problems involving multiplication, using materials, arrays, repeated addition, mental methods, and multiplication facts, including problems in contexts

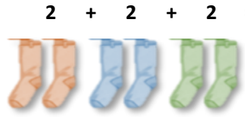
Counting in Multiples (Timetables)

Use practical concrete real-life objects, as well as pictorial representation to count in 2, 5, 10 and beginning 3. Practical methods should reinforce the connection between multiplication and timetables. Children should be progress to doing this mentally.



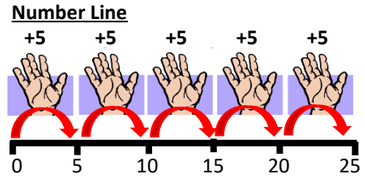
Repeated Addition

Children should use the above concrete and pictorial methods to understand multiplication as repeated addition.



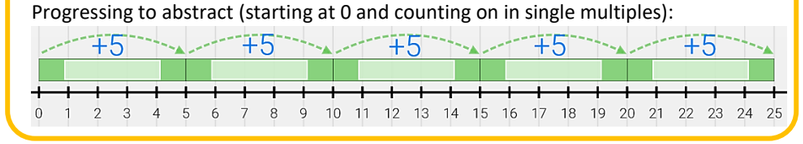
2 x 6 = 8 (2 groups of 6)

Number Line



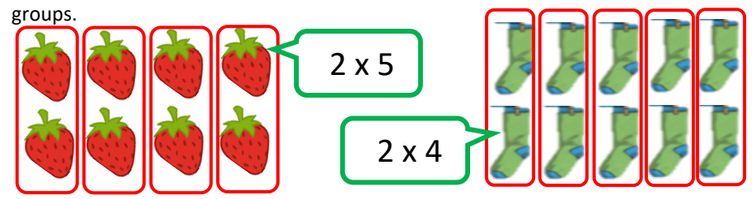
Once secure this can then be shown above a number line, progress to combination of pictorial and abstract use of number line to multiply by repeatedly adding the groups.

Progressing to abstract (starting at 0 and counting on in single multiples):



Arrays

Begin with use of objects and pictures within arrays in columns and rows by recognising equal groups and counting the multiple/ groups. Then, progress to use of pictorial representation of arrays enabling count the total amount of multiples/ groups.



Commutative Relationship and Inverse

Following on from arrays, this should be used to install a commutative understanding of multiplication, showing that one array can create two calculations. I.e. 2 groups of 5 is the same as 5 groups of 2. Further this understanding by teaching the inverse operation and the 2 multiplication and 2 division calculations that can be made from one array. **USE THE BAR MODEL TO DEMONSTRATE THIS.**

Multiplication

Year 3

National Curriculum:

Pupils should be taught to:

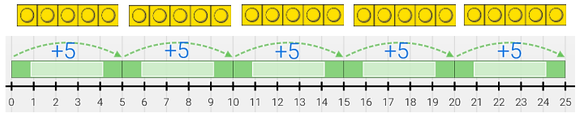
- Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables
- Write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods
- Solve problems, including missing number problems

Counting in Multiples

See year 2 for methods to explicitly teach to reinforce timetable knowledge of 2, 5 and 10. Build on this to secure 3, 4 and 8. Use concrete resources to aid fluent mental recall.

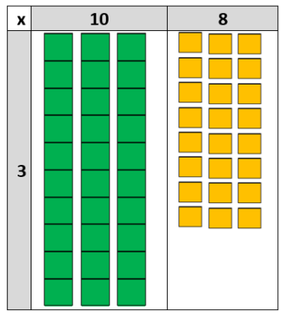
Number Line

Use a number line to multiply by through repeated addition, reinforce this by teaching with use of concrete objects.



Partitioning and Grid Method

Ensure place value understanding is secure so children are competent in portioning a 2-digit number into its T and O.
Chn will first practise this method concretely and pictorially using dienes.
Then, count what is there.



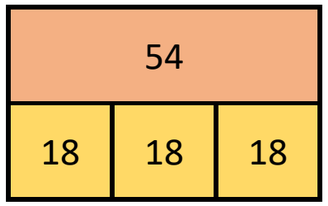
x	10	8
3	30	24

Then add the values 30 + 24 = 54

This will progress to using the grid method abstractly, and then adding the two values to get the answer. Children should be confident drawing these independently.

Problem Solving (Bar Model/ Inverse)

Use the bar model to reinforce understanding, reinforce inverse operation knowledge as well as to assist with problem solving when multiplying.



Inverse:
54 ÷ 18 = 3
54 ÷ 3 = 18
3 x 18 = 54
18 x 3 = 54

Year 4

National Curriculum:

Pupils should be taught to:

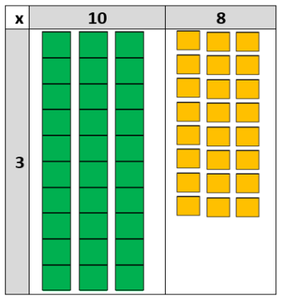
- Recall and use multiplication and division facts for multiplication tables up to 12
- Multiply two-digit and three-digit numbers by a one-digit number using formal written layout

Timetables

Timetables should be embedded within mental math sessions, with regular explicitly timetable teaching – refer to counting in multiple methods if needed.

Grid Method

Ensure place value understanding is secure so children are competent in partitioning a 3-digit number into its T and O.
Chn will first practise this method concretely and pictorially using dienes.
Then, count what is there.



x	10	8
3	30	24

Then add the values 30 + 24 = 54

This will progress to using the grid method abstractly, and then adding the two values to get the answer. Children should be confident drawing these independently.

Expanded Column Method

Column method of addition should be taught initially using the expanded method with the use of concrete and pictorial dienes to reinforce relational understanding.

	H	T	O
		3	6
X			4
		2	4
	1	2	0
	1	4	4

(4 X 6) Digits are multiplied, starting
(4 X 30) with the lowest value digit.
(24 + 120) The new columns are added, starting with the digit of least value.

Short Column Method

The expanded method facilitates a good practical understanding of the process of short column multiplication. When initially teaching short method, show without regrouping. Then, once understanding is secure, progress to teaching it with regrouping, ensuring explicit teaching using dienes to enable a concrete understanding of regrouping.

	T	O
	3	6
X		4
	1	4
	2	4

BAR MODEL SHOULD STILL BE USED TO REENFORCE INVERSE UNDERSTANDING AND ASSIST PROBLEM SOLVING (SEE YEAR 3)

Year 5

National Curriculum:

Pupils should be taught to:

- multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers
- Continue to revisit mental strategies, timetables and bar modelling during problem solving

Short Column Method

The expanded method facilitates a good practical understanding of the process of short column multiplication. When initially teaching short method, show without regrouping. Then, once understanding is secure, progress to teaching it with regrouping, ensuring explicit teaching using dienes to enable a concrete understanding of regrouping.

	T	O
	3	6
X		4
	1	4
	2	4

Expanded Long Multiplication/ Grid Method

	T	H	T	O	
			3	6	
X			7	4	
			2	4	(4 X 6)
		1	2	0	(4 X 30)
		4	2	0	(70 x 6)
	2	1	0	0	(70 x 30)
	2	6	6	4	

Initially model the Grid Method for long multiplication to demonstrate practically how the expanded method works. Use the same process as in Y4, just add another row.

Then, move on to using the expanded long multiplication method to teach multiplying up to 4 digits by a 2-digit number. Initially, use dienes concretely or pictorially to enable a more relational understanding of the method.

Long Multiplication (Column Method)

Once secure with the expanded method, ensure children are secure by the end of the year in using the compact long method with regrouping including the use of decimals. This should be applied within problems that focus on real life maths particular measurement decimals. Begin with 2 digit by 2 digit progressing to 3 or 4 digit by 2 digit.

	H	T	O
		2	4
X		1	6
	1	4	4
	2	4	0
	3	8	4

Multiplying Decimals

As well as multiplying up to 4 digit whole numbers by a 2 digit number, children should be exposed to similar calculations involving decimals, ensuring place value knowledge is secure and decimal stays rooted.

	T	O	.	t	
	3		.	6	
X	4				
	2		.	4	(4 X 0.6)
1	2		.	0	(4 X 3)
1	4		.	4	(2.4 + 12)

Year 6

National Curriculum:

Pupils should be taught to:

- Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication

Short Column Method

Children should be efficient in the use of the short method for multiplying up to 4 digits by 1 digit including decimals from a range of real-life contexts.

342 × 7 becomes

	3	4	2
×			7
2	3	9	4
	2	1	

Answer: 2394

2741 × 6 becomes

	2	7	4	1
×				6
1	6	4	4	6
	4	2		

Answer: 16 446

Ensure that children are using pictorial methods as shown in previous year groups to support their continued and more complex understanding. If secure, use larger numbers.

Long Column Method

Children should consolidate long multiplication by being exposed to more complex calculation up to 4 digits by 2 digits. Including decimals from a range of real-life contexts.

	3	2	4
X	4	6	
	1	9	4
+	1	2	9	6	0
	1	4	9	0	4

Problem Solving

Access to regular problem solving and reasoning where children can apply these methods is essential. Use of bar model is still required as it should be a familiar aid being embedded across the school.

Useful Pictorial Resources:

Dienes Generator
(used to make the illustrations in this policy)
https://mathsbot.com/manipulatives/blocks

Number Line Generator
(used to make the illustrations in this policy)
https://apps.mathlearningcenter.org/number-line/

Maths Frame Online Interactive Subtraction Games
https://mathsframe.co.uk/en/resources/category/7/multiplication-and-division

White Rose Reasoning and Problem Solving
https://whiterosemaths.com/resources/schemes-of-learning/primary-sols/

Grove Vale Primary School

Calculation Policy

Division

Date: June 2020

Review: June 2022

J. Ahearn

Division

EYFS

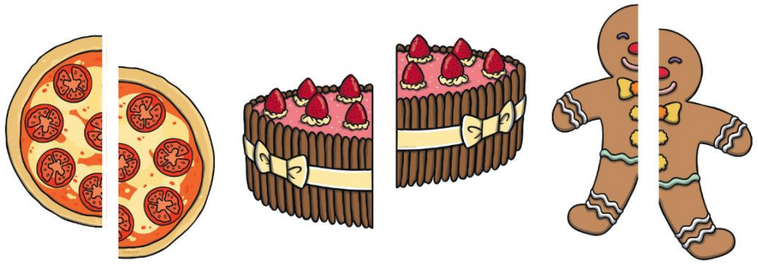
National Curriculum:

Pupils should be able to:

- Understanding the concept of a fair share

Halving

Children should be encouraged to use a range of everyday objects in the classroom and outdoor environments to share fairly. Children should start to understand the concept that halving is sharing equally and fairly between two people, both having the same amount. Use language half for you, half for me.

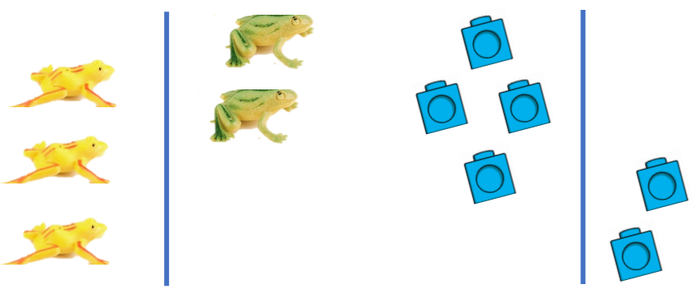


Also, demonstrate when something is not shared equally and discuss why:

Fair Sharing

Children will have access to a range of concrete and pictorial versions of real-life objects and also engage in a variety of songs and rhymes to share quantities of objects equally between two people. If confident, begin to explore sharing between three and four. Use language half, sharing equally and fairly.

Also, demonstrate when something is not shared equally and discuss why:



Year 1

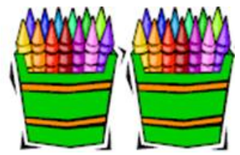
National Curriculum:

Pupils should be able to:

- Solve one-step problems involving division by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher
- Recall doubles and count on/ back in multiples of 1, 2, 5 and 10

Fair Sharing

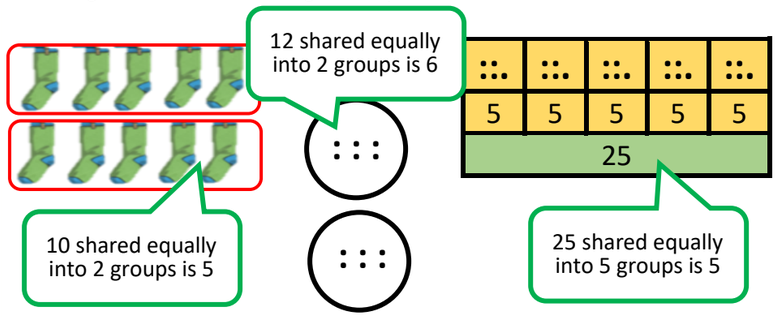
Children will start with practical sharing using a range of concrete resources and everyday objects. They will share objects in to equal groups in a variety of real-life situations. Encourage use of vocabulary (share, equally, fair) associated with division in practical, real-life contexts.



'Share 20 crayons between 2 pots.'

'How many crayons are in each pot?'

Children can then move on to representing pictorial in books either them drawing themselves or sharing circles provided on a worksheet.

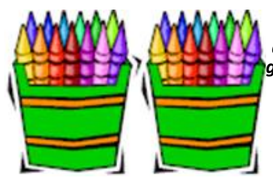


If children are ready, they could be pushed on to solve more abstractly through use of a bar model. Or provided with a bar and show their representations. (See above)

Grouping

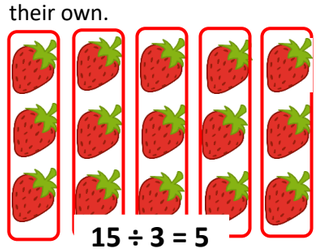
Children will move from sharing to grouping in a practical, real-life context.

Children should experience grouping objects into groups of the multiple. E.g. placing objects into groups of 5 and seeing how many groups there are through use of arrays. Rather than children drawing arrays in their books, they may be provided pictorially with an array, circling to group. If children are ready they can draw their own.

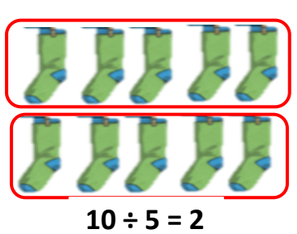


'Put 20 crayons into groups of 10.'

'How many pots do we need?'



15 ÷ 3 = 5



10 ÷ 5 = 2

Year 2

National Curriculum:

Pupils should be able to:

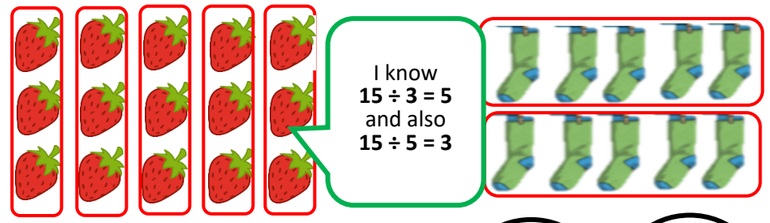
- Recall and use division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers
- Calculate mathematical statements for division within the multiplication tables and write them using the division (÷) and equals (=) signs
- Show that division of one number by another cannot
- Solve problems involving division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.

Division Facts/ Inverse Operation

Children should be encouraged to count in multiples as seen in the multiplication policy; using their timetable knowledge to make division fact links (link to inverse). As seen in multiplication, the inverse operation link between ÷ / x should constantly be referred to throughout.

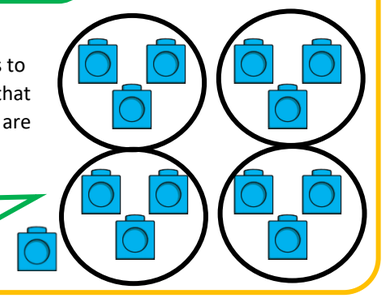
Fair Sharing and Grouping

Children will continue with embedding understanding of sharing and grouping with concrete objects and pictorial arrays (see year 1). This should progress to enable children to see the two division relationships. This should be done to share between 2, 5 and 10 equally.



Sharing with Remainders

While using concrete and pictorial resources to share, children should begin to understand that sometimes there isn't a fair share and there are objects remaining called remainders.

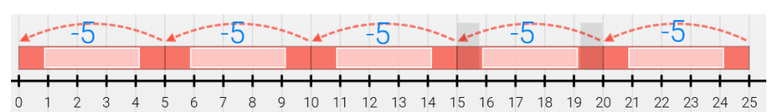


Number Line (Repeated Addition)

Children should start mental and formal division methods by using the number line method learnt in multiplication, counting on in groups to reach the total then logging the number of groups. E.g. 25 ÷ 5 = How many groups of 5 do we count to make 25? See multiplication for pictorial representation.

Number Line (Repeated Subtraction)

Following on from counting in multiples of 2, 5 and 10, use this timetable knowledge to make the same steps backwards. You could use a meter stick or beads to reinforce this concretely. This would be further on in the year and greater depth children could even use this to incorporate remainders. (2,5 and 10 multiples)



E.g. 25 ÷ 5 = 5 Start at 25, jump backwards in groups of 5 until you reach 0. If confident, children could begin to chunk the groups to make less jumps (se year 3).

BAR MODEL SHOULD CONTINUE TO BE USED FOR PROBLEM SOLVING (see year 1)

Division

Year 3

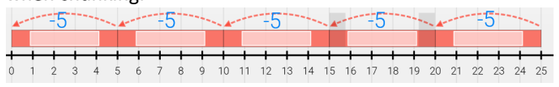
National Curriculum:

Pupils should be taught to:

- Recall and use division facts for the 3, 4 and 8 multiplication tables
- Write and calculate mathematical statements for division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods

Repeated Subtraction

Children use previous methods learned in year 2, but focus on aspect of repeated subtraction to prepare for subtracting when chunking.



Formal Layout

Introduce the formal division layout using multiplication/ division facts that the children know to prepare them for formal division methods.

24 ÷ 3 = 8

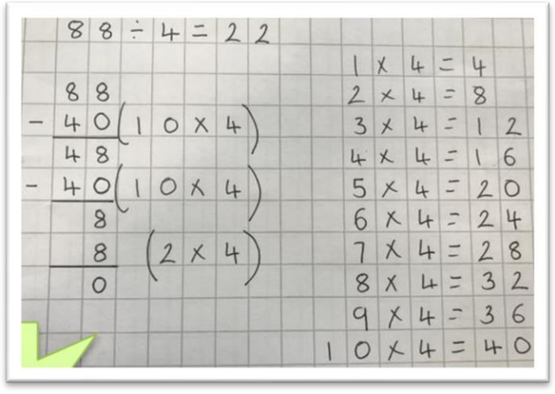
This can also be recorded as...

$$3\overline{)24}\quad 8$$

Chunking

Begin by showing chunking on a number line, rather than using repeated subtraction, jumping back in chunks of groups. Children should be encouraged to write down the related time tables facts to support them with the formal method of chunking. **Use concrete resources to reinforce.**

Then, begin to use chunking vertically to demonstrate conceptual understanding of short division (subtracting chunks of the divisor rather than individual jumps). Children need to recognise that chunking is inefficient if too many subtractions have to be carried out. Encourage them to reduce the number of steps and move them on quickly to finding the largest possible multiples.



If confident move to dividing with remainders using this method, progressing to short method without remainders.

Year 4

National Curriculum:

Pupils should be taught to:

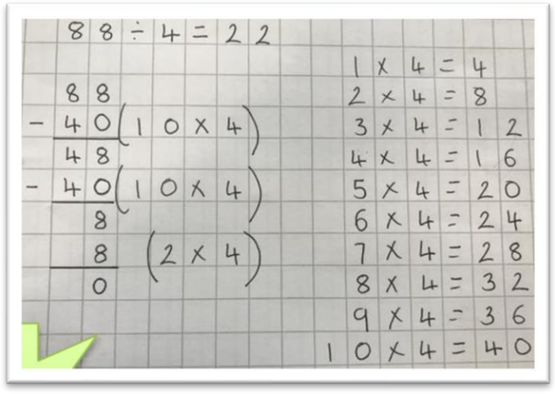
- Recall multiplication and division facts for multiplication tables up to 12 × 12
- Use place value, known and derived facts to divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together 3 numbers
- Recognise and use factor pairs and commutativity in mental calculations Multiply two-digit and three-digit numbers by a one-digit number using formal written layout

Division Facts

Consolidation of timetables and recall of related division facts should be incorporated into mental maths regularly to support division. Concrete resources can be used to reinforce.

Chunking (with and without remainders)

Like in year 3, children will begin chunking vertically to demonstrate conceptual understanding of short division (subtracting chunks of the divisor rather than individual



jumps). Children need to recognise that chunking is inefficient if too many subtractions have to be carried out. Encourage them to reduce the number of steps and move them on quickly to finding the largest possible multiples.
If confident move to dividing with remainders using this method, once consolidated, children should progress to short method without remainders. Reinforce with concrete resources like dienes.

Short Column Division (no remainders)

Continue to use the formal division layout using multiplication/ division facts that the children know to prepare them for formal division methods. This could progress to remainders within timetable division facts.

25 ÷ 3 = 8 r1

$$3\overline{)25}\quad 8\text{ r }1$$

National Curriculum:

Pupils should be taught to:

- Divide numbers mentally, drawing upon known facts
- Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context
- Divide whole numbers and those involving decimals by 10, 100 and 1,000
- Solve problems involving division, as well as a combination of all 4 calculations and understanding the meaning of the equals sign

Short Column Method

When children are secure with division, they are taught the compact column method, starting from the left and regrouping each remainder. Progress to more complex numbers with more complex regrouping.

$$4\overline{)3\,{}^{3}5\,{}^{3}3}\quad 088\text{ R }1$$

Children should revisit chunking as a class reinforce short method as well as aiding children to make an informed estimation or to check their answers.

Dividing Decimals

As well as dividing up to 4 digit whole numbers by a 1 digit number, children should be exposed to similar calculations involving decimals, ensuring place value knowledge is secure and decimal stays rooted.

$$4\overline{)3\,{}^{3}5\,{}^{3}3}\quad 088\text{ R }1$$

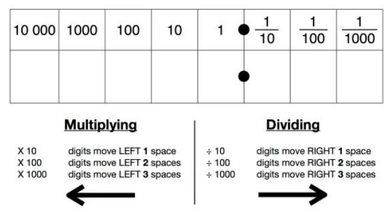
Remainders

$$4\overline{)3\,{}^{3}5\,{}^{3}3}\quad 088\text{ R }1$$

Pupils will begin to be taught how to calculate the remainder as a fraction or decimal, relating to how far they are in that area of maths. **The remainder becomes ¼ then children will use their conversion knowledge that the answer will be 88 ¼ or 88.25**.

Dividing/ Multiplying by 10, 100 and 1000

Place value knowledge should be secure so children are aware the decimal stays rooted and the place value moves to the right or left depending on the operation.



National Curriculum:

Pupils should be taught to:

- Divide numbers up to 4-digits by a two-digit whole number using the formal written method of short division
- Where appropriate for the context divide numbers up to 4 digits by a two digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- Solve problems involving division
- Use written division methods in cases where the answer has up to two decimal places

Short Division

$$4\overline{)3\,{}^{3}5\,{}^{3}3}\quad 088\text{ R }1$$

Same applies as year 5, children should have access to problems in a wide range of real-life contexts, and should be dividing more complex 4 to 5-digit numbers (inc decimals).

Remainders

$$4\overline{)3\,{}^{3}5\,{}^{3}3}\quad 088\text{ R }1$$

Pupils will be taught how to calculate the remainder as a fraction or decimal, understanding the remainder as a fraction of a group left over.. **The remainder becomes ¼ then children will use their conversion knowledge that the answer will be 88 ¼ or 88.25**.

Long Division

Children are taught initially to divide up to 4 digit numbers by a 2 digit number subtracting large chunks, this will consolidate understanding ready to progress to formal long division method.

$$15\overline{)432}\quad 28\text{ r}12$$

300 (20 x 15)
132
120 (8 x 15)
12 (remainder)

Multiples of the divisor (15) have been subtracted from the dividend (432)

'20 (chunks of 15) + 8 (chunks of 15) = 28
12/15 is the remainder

Then, teach the formal long method ONLY when children are completely secure with the prior method and have a relational understanding of the method. Dienes could be used to reinforce.

432 ÷ 15 = 28·8

$$15\overline{)432\cdot0}\quad 28\cdot8$$

300
132
120
120
0