Roxeth Primary School
Maths Calculation Policy

Addition Year 1

+ = signs and missing numbers

Children need to understand the concept of equality before using the '=' sign. Calculations should be written either side of the equality sign so that the sign is not just interpreted as 'the answer'.

2 = 1+ 1

2 + 3 = 4 + 1

Missing numbers need to be placed in all possible places.

3 + 4 = □ □ = 3 + 4

3 + □ = 7 7 = □ + 4

Counting and combining sets of Objects

Combining two sets of objects (aggregation) which will progress onto adding on to a set (augmentation)

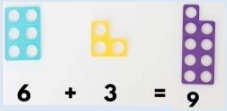
Understanding of counting on with a numbertrack.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Understanding of counting on with a number line (supported by models and images).

7+ 4 = 11

Children will use concrete models e.g **numicon**



And progress to visual bar modelling

9	
6	3

Addition Year 2

Missing number problems:

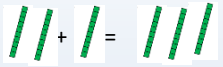
14 + 5 = 10 + □

32 + □ + □ = 100

35 = 1 + □ + 5

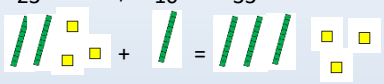
Counting on in tens using dienes

20 + 10 = 30



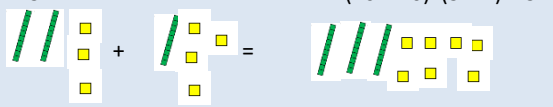
Adding tens and ones using dienes

23 + 10 = 33



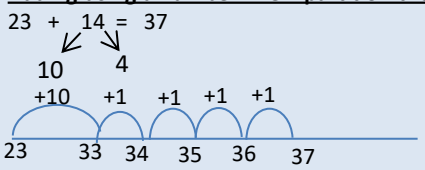
Adding two 2 digit numbers

23 + 14 = (20 + 10) (3 + 4) = 37



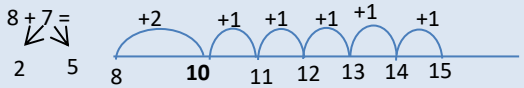
Adding using a number line – partition the second number

23 + 14 = 37



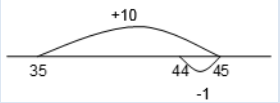
Partitioning and bridging through 10

When adding, you will often need to reach a multiple of 10 e.g. children should be able to partition the 7 to make 2 and 5. You need to add on 2 first to make 10.



Adding 9 or 11 by adding 10 and adding or subtracting 1

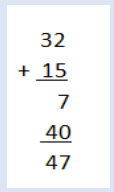
35 + 9 (add 10 and subtract 1)



44	
35	9

Moving towards a written method without decomposition

Once the child is completely secure with partitioning and the number line, they can then begin the first step towards a formal written method.



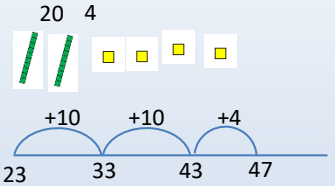
Addition Year 3

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

Adding using a number line

Similar as in Years 1 and 2, however doing larger jumps (not jumps of ones). Partition the second number only.

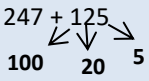
23 + 24



Expanded written method – partition the second number

Children should only move onto written methods once they are completely secure with partitioning and number lines. ***Number lines are used all the way up to Year 6.***

247 + 125



372	
247	125

247 + **100** = 347

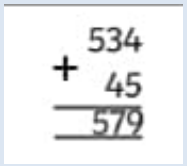
347 + **20** = 367

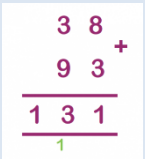
367 + **5** = 372

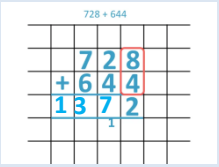
Children need to be secure adding multiples of 100 and 10 to any three-digit number.

Moving towards a written method (up to 3-digits)

Please see Year 2 written method first and become secure with this before moving on. The numbers carried over to the next column, should be written underneath.

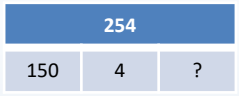






Addition Year 4

Children can solve missing number problems with increasingly large numbers using the **bar model**.



Mental methods should continue to develop, supported by a range of models and images, including the **number line, numicon and dienes**. The **bar model** should continue to be used to help with problem solving.

Written methods (progressing to 4-digits)
Column addition methods progressing up to calculations with 4-digit numbers.

```
 1 9 4 5
+ 1 2 1 5
 3 1 6 0
 1   1
```

Children should be able to make the choice of reverting to Year 2 written method if experiencing any difficulty.

Extend to up to four decimal places and adding several numbers with different numbers of digits.

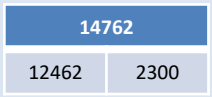
```
  72.8
+ 54.6
 127.4
   1
```

Addition Year 5

Children can solve missing number problems with increasingly large numbers in a variety of contexts such as money or length using the **bar model.**

Mental methods should continue to develop, supported by a range of models and images, including the **number line**, **numicon, dienes** and **bar model** The bar model should continue to be used to help with problem solving. Children should practise with increasingly large numbers to aid fluency

e.g. 12,462 + 2300 = 14,762



Written methods (progressing to more than 4-digits)
When understanding of the **number line and partitioning is** secure, children will move on to using the column method for whole numbers and decimal numbers as an efficient written method.

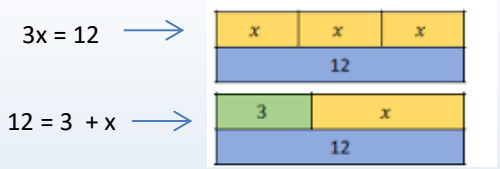
```
 2 9 . 5 5
+ 1 3 . 1 5
 4 2 . 7 0
 1     1
```

When adding using the column method, the numbers carried over to the next column should be written underneath (see numbers in blue).

However, if your child is already confident at column addition, placing the carried numbers elsewhere, they should be allowed to continue to do so.

Addition Year 6

Children can solve missing number problems with increasingly large numbers in a variety of contexts, and represent them algebraically.



Mental methods should continue to develop, supported by a range of models and images, including the **number line, numicon** and **dienes**. The **bar model** should continue to be used to help with problem solving.

Written methods
As year 5, progressing to larger numbers, aiming for both conceptual understanding and procedural fluency with column method to be secured. Continue calculating with decimals, including those with different numbers of decimal places

Physical objects, such as **numicon** or **dienes,** should be used alongside the column method to develop understanding of addition.

Problem Solving
Pupils must have the opportunity to apply their knowledge in a variety of contexts and problems such as maths investigations.

Subtraction Year 1

Missing number problems:

20 - □ = 9

15 – 9 = □

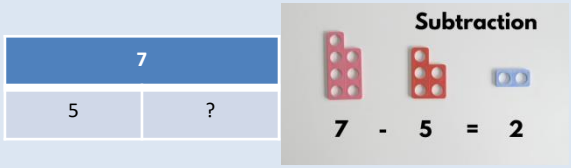
16 – 0 = □

Single digit and 2 digit number subtraction:

Use concrete objects and pictures.

6-1 = 5

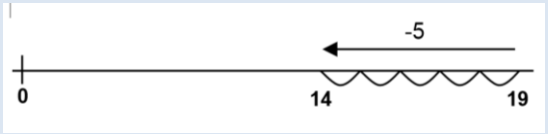
Using manipulatives to subtract: Numicon, dienes, multi-link cubes. Manipulatives are objects that are used to explore maths.



Number lines:

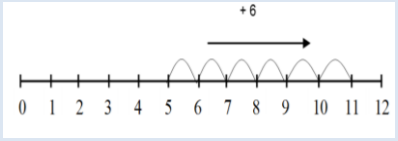
Version 1: Understand subtraction as take-away (counting backwards using a number line):

14 = 19 - 5



Version 2: Understand subtraction as finding the difference: (counting on using a number line):

11 – 5 = 6



Subtraction Year 2

Missing number problems:

52 – 8 = □

□ – 20 = 25

22 = □ – 6

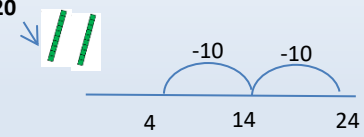
6 + □ + 3 = 11

It is valuable to use a range of representations (also see Y1). 7

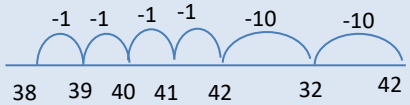
Number lines:

Continue to use number lines to subtract. Refer back to Year 1 version 1 and 2. Partition the second number only.

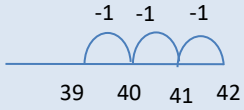
24 - 20



42 – 24

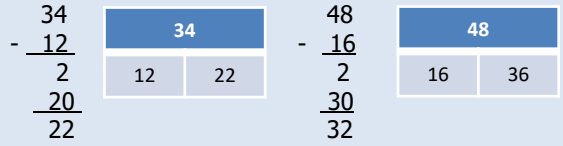


42 - ? = 39



Towards written methods

Children will begin to learn the first step of the column method for subtraction without decomposition only when they are secure with subtracting on a **number line and partitioning.**



The **bar model** should continue to be used to help children to subtract.

Subtraction Year 3

Missing number problems:

□ = 43 – 27

145 – □ = 138

274 – 30 = □

245 – □ = 195

532 – 200 = □

364 – 153 = □

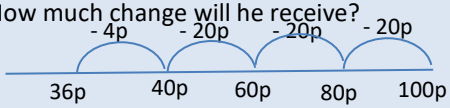
Mental methods :

These should continue to develop, supported by a range of models and images, including **dienes** and **numicon**. The **bar model** should continue to be used to help with problem solving (see Years 1 and 2).

Number line:

Children should make choices about whether they prefer to add on or count back (refer to Year 1 version 1 and 2) for all areas of maths e.g.

Kevin spends buys a pencil for 64p. He pays with £1. How much change will he receive?



Written methods (progressing to 3-digits)

Once children are secure with using the number line and partitioning, only then should they move on to the written methods.

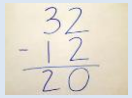
Expanded written method – partition the second number

65 – 12 =

65 – 10 = 55

55 – 2 = 53

Formal written method (up to 3-digits) with and without decomposition



165

- 24

141

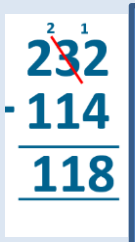
Subtraction Year 4

Missing number/digit problems:
456 + □ = 710
1□7 + 6□ = 200
60 + 99 + □ = 340
200 – 90 – 80 = □
225 - □ = 150
□ – 25 = 67
3450 – 1000 = □
□ - 2000 = 900

Mental methods should continue to develop, supported by a range of models and images, including the **number line., numicon** and **dienes.** The **bar model** should continue to be used to help with problem solving.

Written methods (progressing to 4-digits)
Column subtraction with **decomposition,** progressing to calculations with 4-digit numbers.

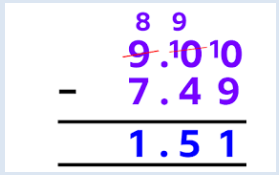
If understanding of the expanded method (please see Year 3) is secure, children will move on to the formal method of column subtraction.



When subtracting using the column method, the numbers being decomposed should be written above the top line as the answer is calculated.

However, if your child is already confident at column subtraction, placing the decomposed numbers elsewhere, they should be allowed to continue to do so.

Progress to subtracting decimals.



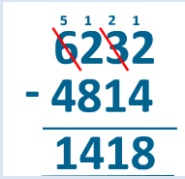
Subtraction Year 5

Missing number/digit problems:
6.45 = 6 + 0.4 + □
119 - □ = 86
1,000,000 - □ = 999,000
600,000 + □ + 1000 = 671,000
12,462 – 2 300 = □

6.45		
6	0.4	?

Mental methods should continue to develop, supported by a range of models and images, including the **number line, numicon** and **dienes.** The **bar model** should continue to be used to help with problem solving.

Written methods (progressing to more than 4-digits)
When understanding of the expanded method is secure (please see Year 3) children will move on to the formal method of decomposition.



When subtracting using the column method, the numbers being decomposed should be written above the top line as the answer is calculated.

However, if your child is already confident at column subtraction, placing the decomposed numbers elsewhere, they should be allowed to continue to do so.

Continue subtracting decimals, including those with different numbers of decimal places e.g.

12 .4 – 3.26 =

9.8 – 6.21 =

3.4 – 2.01 =

Subtraction Year 6

Missing number/digit problems: □ and □ each stand for a different number. □ = 34. □ + □ = □ + □ + □. What is the value of □? What if □ = 28? What if □ = 21?
10,000,000 = 9,000,100 + □
7 – 2 x 3 = □
(7 – 2) x 3 = □
(□ - 2) x 3 = 15

Mental methods should continue to develop, supported by a range of models and images, including the **number line, numicon and dienes.** The **bar model** should continue to be used to help with problem solving.

Written methods
As year 5, but progressing to larger numbers past 1 million (7 digits), aiming for children to work through the stages of decomposition fluently. Continue subtracting with decimals, including those with different numbers of decimal places.

Physical objects, such as **numicon,** should be used alongside the column method to develop understanding of subtraction.

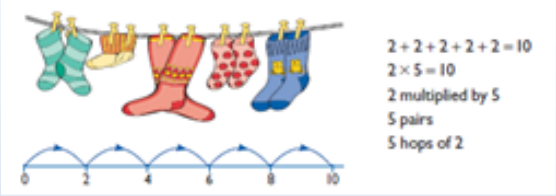
Problem Solving
Pupils have the opportunity to apply their knowledge in a variety of contexts and problems such as maths investigations.

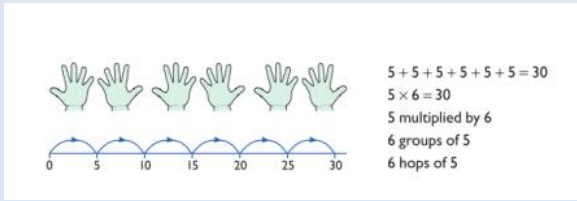
Multiplication Year 1

Children to count in 2s, 5s and 10s.

Doubling and combining

Understand multiplication is related to doubling and combining groups of the same size (repeated addition)



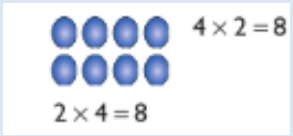


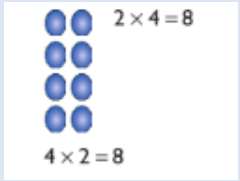
Problem solving Use concrete objects (including money and measures) e.g. 3 friends have 5p each. How much is this altogether?

This can be written as:
5 + 5 + 5 (repeated addition)
Or 5 x 3

Use **numicon** to develop the vocabulary relating to 'times' – Pick up five, 4 times

Use **arrays** to understand multiplication can be done in any order **(commutative)**





Multiplication Year 2

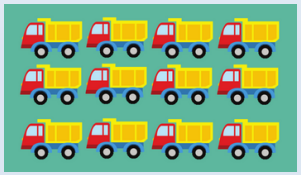
Children to count in 2s, 3s, 5s from zero.
They also need to count in 10s from any number, forwards and backwards e.g. 57, 47, 37, 27

Missing number problems

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

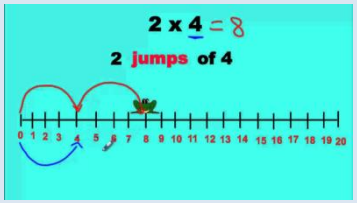
7 x 2 = □ □ = 2 x 7
7 x □ = 14 14 = □ x 7
□ x 2 = 14 14 = 2 x □

Develop understanding of multiplication using **arrays with repeated addition** and **number lines.**

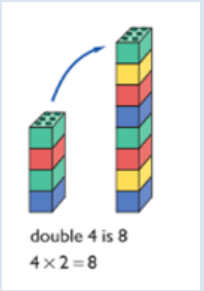


This array can be written in 4 different ways:

- 4 + 4 + 4 = 12
- 3 + 3 + 3 + 3 = 12
- 4 x 3 =12
- 3 x 4 = 12



Begin to develop understanding of multiplication as scaling (3 times bigger/taller):



Doubling numbers up to 10 + 10
Link with understanding scaling
Using known doubles to work out double 2d numbers
(double 15 = double 10 + double 5)

Multiplication Year 3

Children to know the 2s, 3s, 5s and 10s (Year 2).
Recall and use multiplication and division facts for the 3s, 4s and 8s (Year 3).

Missing number problems

Continue with a range of sums s as in Year 2 but with appropriate numbers.

Mental methods

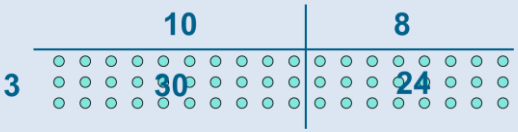
Doubling 2 digit numbers using partitioning e.g. double 24.
Double 20 is 40
Double 4 is 8.
40 + 8 = 48

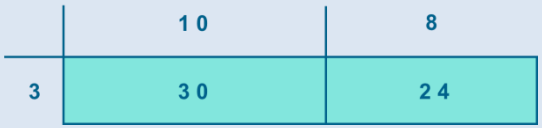
Continue to multiply on a **number line.**

Explore different methods for larger numbers e.g. 13 x 4 = 10 groups of 4 and 3 groups of 4

Written methods – grid method

Developing written methods using understanding of visual images e.g. **18 x 3**





X	10	8	
3	30	24	54

30 + 24 = 54

Give children opportunities for children to explore this method using **dienes** and **numicon.**

Multiplication Year 4

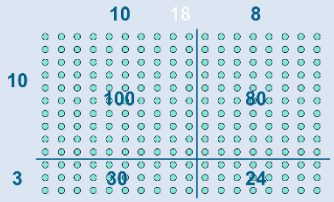
Children to recall all multiplication and division facts up to 12 x 12

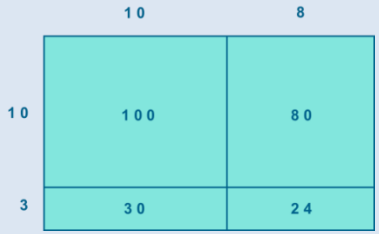
Missing number problems
Continue with a range of equations as in Year 2 but with appropriate numbers.
Also include equations with missing digits e.g.
□2 x 5 = 160

Mental methods
Counting in multiples of 25 and 1000, and steps of 1/100.

Solving practical problems where children need to scale up e.g. how tall would a 25cm sunflower be if it grew 6 times taller?

Written methods – grid method (progressing to 3 digits x 2 digits)
Children to embed and deepen their understanding of the grid method to multiply 2 digits x 2 digits (e.g. 18 x 13), progressing to 3 digits x 2 digits (e.g. 123 x 14). Ensure this is linked back to their understanding of arrays and place value.



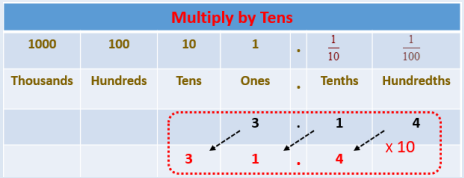


Multiplication Year 5

Children to recall all multiplication and division facts up to 12 x 12 (Year 4)

Missing number problems
Continue with a range of equations as in Year 2 but with appropriate numbers. Also include equations with missing digits.

Mental methods
X by 10, 100, 1000 using moving digits on a place value grid.



Use practical resources and jottings to explore equivalent statements (e.g. 4 x 35 = 2 x 2 x 35)

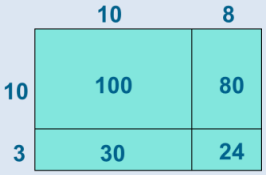
Recall of prime numbers up 19 and identify prime numbers up to 100 (with reasoning)

Solving practical problems where children need to scale up.

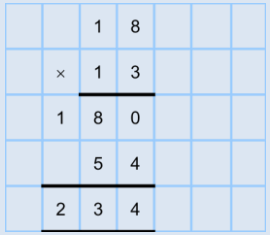
Identify factor pairs for numbers

Written methods (progressing to 4 digits x 2 digits e.g. 1247 x 13)
children to explore how the grid method supports an understanding of the column method.

Grid method:



Column method:



Multiplication Year 6

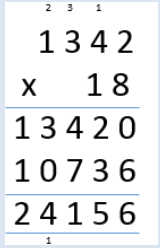
Children to recall all multiplication and division facts up to 12 x 12 (Year 4)

Missing number problems
Continue with a range of equations as in Year 2 but with appropriate numbers. Also include equations with missing digits.

Mental methods
Identifying common factors and multiples of given numbers.

Solving practical problems where children need to scale up.

Written methods (up to 4-digits by 2-digits)
Continue to refine and deepen understanding of written methods including grid method and column method.



Physical objects, such as **numicon,** should be used alongside the column method to develop understanding of multiplication.

Problem Solving
Pupils have the opportunity to apply their knowledge in a variety of contexts and problems such as maths investigations.

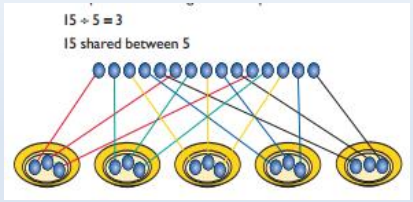
Division Year 1

Children to count in 2s, 5s and 10s.

Children should be given opportunities to reason about what they notice in number patterns.

Group AND **share small quantities- understanding the difference between the two concepts.**

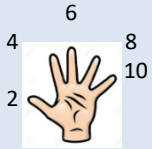
Sharing:

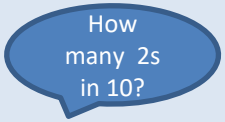


Children should be taught to share using concrete apparatus such as numicon and dienes.

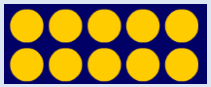
Grouping

Children should apply their counting skills to develop some understanding of grouping. 10 ÷ 2 = 5





Use of arrays as a pictorial representation for division.
10 ÷ 2 = 5 (Reasoning - there are 5 groups of 2).
10 ÷ 5 = 2 (Reasoning - there are 2 groups of 5).



Children should be able to find ½ and ¼ and simple fractions of objects, numbers and quantities by dividing by 2 and 4.

Division Year 2

Children to count in 2s, 3s, 5s from zero.
They also need to count in 10s from any number, forwards and backwards e.g. 57, 47, 37, 27

÷ = signs and missing numbers

6 ÷ 2 = □	□ = 6 ÷ 2
6 ÷ □ = 3	3 = 6 ÷ □
□ ÷ 2 = 3	3 = □ ÷ 2
□ ÷ ∇ = 3	3 = □ ÷ ∇

Know and understand the difference between sharing and grouping.

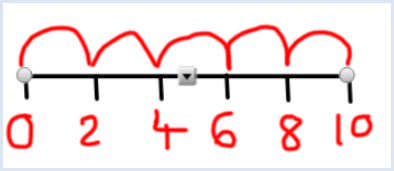
Introduce children to the ÷ sign.

Children should continue to use grouping and sharing for division using **dienes, numicon, arrays** and **pictorial representations** such as **bar modelling**.

Grouping using a number line

Group from zero in jumps of the divisor to find out 'how many groups of 2 are there in 10?'.

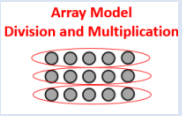
10 ÷ 2 = 5

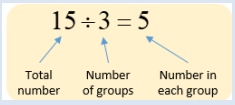


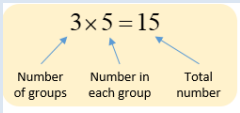
5 groups of 10 equals 10				
2	4	6	8	10

Arrays

Continue work on arrays. Support children to understand how multiplication and division are inverse. Look at an array – what do you see?







Division Year 3

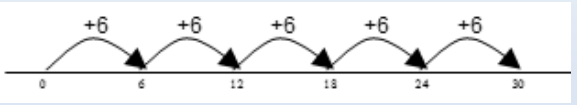
Children to know the 2s, 3s, 5s and 10s (Year 2).
Recall and use multiplication and division facts for the 3s, 4s and 8s (Year 3).

÷ = signs and missing numbers

Continue using a range of equations as in year 2 but with appropriate numbers.

Grouping using a number line

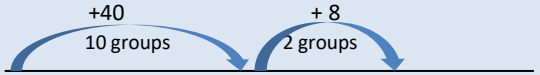
How many 6s are in 30?
30 ÷ 6 can be modelled as:



Becoming more efficient using a number line

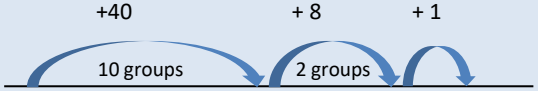
Children need to be able to partition the dividend in different ways.

48 ÷ 4 = 12



Remainders

49 ÷ 4 = 12 r1



Sharing : 49 shared between 4. How many left over?
Grouping : How many 4s make 49. How many are left over?

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

For example:
60 ÷ 10 = How many groups of 10 in 60?
600 ÷ 100 = How many groups of 100 in 600?

Division Year 4

Children to recall all multiplication and division facts up to 12 x 12

÷ = signs and missing numbers

Continue using a range of equations as in year 2 but with appropriate numbers.

Sharing, Grouping and using a number line

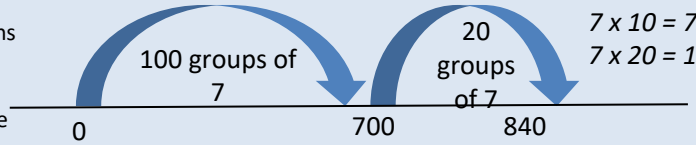
Children will continue to explore division as **sharing and grouping**, and to represent calculations on a **number line** until they have a secure understanding. Children should progress in their use of written division calculations:

- Using tables facts with which they are fluent
- Experiencing a logical progression in the numbers they use, for example:

1. Dividend just over 10x the divisor, e.g. 84 ÷ 7
2. Dividend just over 10x the divisor when the divisor is a teen number, e.g. 173 ÷ 15 (learning sensible strategies for calculations such as 102 ÷ 17)
3. Dividend over 100x the divisor, e.g. 840 ÷ 7
4. Dividend over 20x the divisor, e.g. 168 ÷ 7

All of the above stages should include calculations with remainders as well as without.
Remainders should be interpreted according to the context. (i.e. rounded up or down to relate to the answer to the problem)

e.g. 840 ÷ 7 = 120

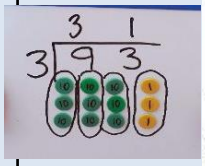


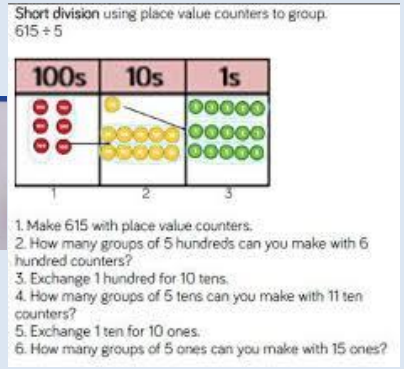
Jottings
7 x 100 = 700
7 x 10 = 70
7 x 20 = 140

Formal Written Methods (Year 4)

Formal short division should only be introduced once children have a good understanding of division, its links with multiplication and the idea of 'chunking up' to find a target number (see use of number lines above).

Short division to be modelled for understanding using place value counters as shown below. Calculations with 2 and 3-digit dividends.



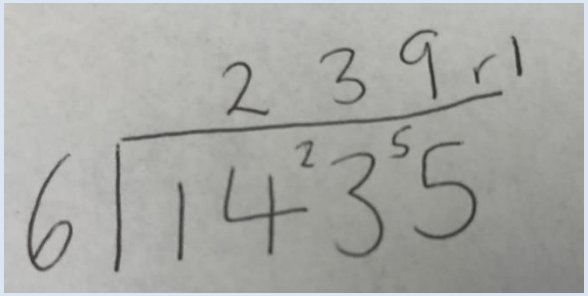


Division Year 5

Formal Written Methods (Year 5)

Continued as shown in Year 4, leading to the efficient use of a formal method. The language of grouping to be used .

E.g. 1435 ÷ 6



Children begin to practically develop their understanding of how to express the remainder as a decimal or a fraction. Ensure practical understanding allows children to work through this (e.g. what could I do with this remaining 1? How could I share this between 6 as well?)

Division Year 6

Children to recall all multiplication and division facts up to 12 x 12

÷ = signs and missing numbers

Continue using a range of equations but with appropriate numbers

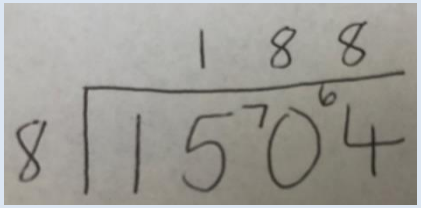
Sharing and Grouping and using a number line

Children will continue to explore division as sharing and grouping, and to represent calculations on a number line as appropriate.

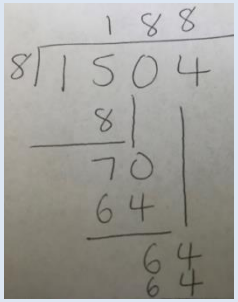
Quotients should be expressed as decimals and fractions

Formal Written Methods – long and short division including decimal remainder.

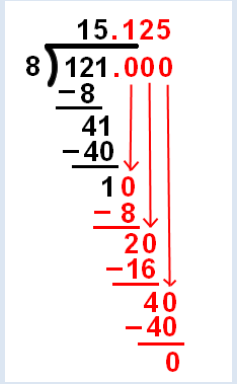
E.g. 1504 ÷ 8 (short)



E.g. 1504 ÷ 8 (long)



E.g. 121 ÷ 8 (long with decimal remainder)



Division continued
ALL YEAR GROUPS

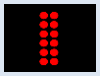
Physical objects, such as **numicon,** should be used alongside the column method to develop understanding of division.

Problem Solving
Teachers should ensure that pupils have the opportunity to apply their knowledge in a variety of contexts and problems such as maths investigations.

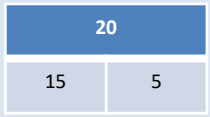
Glossary

Algebra – Maths which uses letters and other symbols to represent numbers and quantities.

Arrays – an orderly arrangement of circles which represent numbers.



Bar modelling – a visual way to organize data for problem solving.



Glossary

Chunking - repeated subtraction of the divisor and multiples of the divisor – in other words, working out how many groups of a number fit into another number.

Commutative – when the operation means the quantities connected give the same result, no matter which order they are put in e.g. 3 + 4 = 7 and 4 + 3 =

Concrete objects/apparatus - physical objects your children can touch and use to represent numbers e.g. cubes, counters, dice etc.

Decomposition – breaking a number apart e.g. 347 = 300+40+7.

Dienes apparatus – blocks which represent 1, 10, 100 and 1000.

Dividend – the number you want to divide up.

Divisor – the number dividing the number you want to divide up.

Equation – a maths statement which expresses 2 equal mathematical expressions, indicated by the = sign.

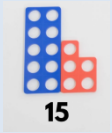
Expanded method – showing working out in division a line at a time.

Factor pairs – any 2 numbers multiplied to give a certain number e.g. 16 = 8 and 2, or 4 and 4 or 16 and 1.

Grid method – a way for children to solve multiplication problems as shown in the Multiplication section from Year 3 up.
Grouping – demonstrating division by putting objects into groups.

Manipulatives - physical objects your children can touch and use to represent numbers e.g. numicon, cubes, counters, dice etc.

Numicon - flat plastic shapes with holes in, with each shape representing a number from 1 to 10. The aim of **Numicon** is to make numbers real for children through them being able to see and touch them.



Partitioning - a way of splitting large numbers into smaller units so they're easier to work with.

Pictorial representation – a picture used to show the numbers being calculated in a sum or problem.

Prime numbers – a number greater than 1 that can only be divided by itself and 1 e.g. 7

Key Mathematical Vocabulary for the 4 operations

Addition:

Add, groups of, more, plus, increase, total, sum, altogether

Subtraction:

Subtract, minus, less, decrease, take away, fewer, difference

Multiplication:

Multiply, times, groups of, repeated addition, product, multiplied by, array

Division:

Divide, divided by, share, divisible by, share equally, group

Place value :

Tens of millions	Millions	Hundreds of thousands	Tens of thousands	Thousands	Hundreds	Tens	Ones	.	Tenths	Hundredths	Thousandths

Websites to support learning

- White Rose Maths
- BBC Bitesize
- NRich
- Oxford Owl
- Top Marks
- Primary Resources
- ICT games
- Maths Frame
- Times Table Rockstars – Children in KS2 have a school subscription