Norris Bank Primary School

Maths Calculation Policy

B20

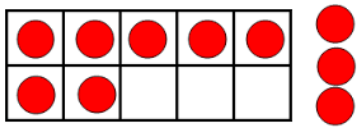
Autumn 2016

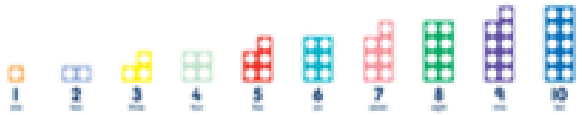
Reception Addition

Maths for young children should be meaningful. Where possible, concepts should be taught in the context of real life.

Visual representation (numicon, tens frames, arrays etc.) of numbers are introduced straight away and can be used to :

- Identify 1more/less
- Combine pieces to add
- Find number bonds
- Add without counting





The chn will record this is a variety of different ways

Chd begin to combine groups of objects using concrete apparatus

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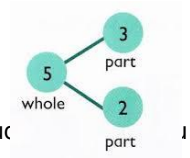


Construct number sentences verbally and or using cards to go with a range of practical activities (inclu ations).

Chn are encouraged to read number sentences aloud exploring mathematical vocabulary, 'three and two equals/ makes five' 5 is the same as / equal to three and two' etc.

Solve problems using their fingers

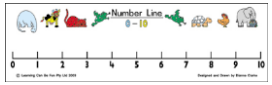
Number lines are introduced to count up 

one more/ less than

What is 1 more than?

Number lines are used alongside practical apparatus to solve addition and subtraction problems

The chn need opportunities to look at and talk about different models and images as they move between representations



Games and songs will be used throughout.

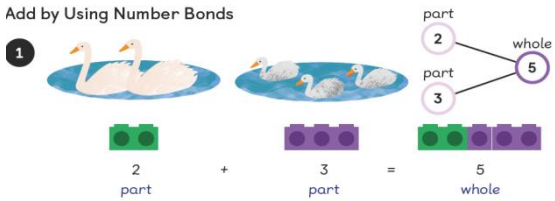
Vocabulary – add, more, and make, sum, total, altogether, score, double, one more, two more, ten more …, how many more to make?, how many more is … than …

Year 1 Addition

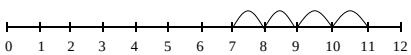
Counting and Combining sets of Objects to 20

Combining two sets of objects e.g. blocks, Numicon, bundles of straws, Dienes apparatus, multi-link cubes, bead strings, ten frames, etc which will progress onto adding on to a set.

Understanding of counting using knowledge of number bonds



Understanding of counting on (supported by models and images), number line, empty number line, putting (larger) number in the head and counting on



To begin to bridge 10

7+ 4 = 7+3 = 10

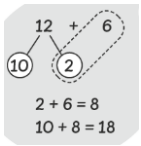
10+ 1= 11

Partitioning to add

Children should be able to separate 2 digit numbers to add the ones then add the tens.

Using known number bonds

The chn should be able to recognise Known number bonds within a 2 digit 1 digit calculation, and apply knowledge.



+ = 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 5+ [ ] = 7

2 + 3 = 4 + 1 7= [ ] + 2

Year 2 Addition

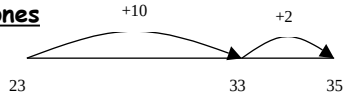
It is valuable to use a range of representations (also see Y1). Continue to use objects , number lines and ten frames to develop understanding of commutative law and of:

Counting on in tens and ones

23 + 12 = 23 + 10 + 2

= 33 + 2

= 35

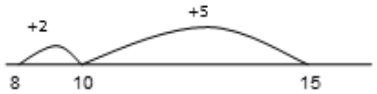


Partitioning and bridging through 10.

The steps in addition often bridge through a multiple of 10

e.g. Children should be able to partition the 7 to relate adding the 2 and then the 5.

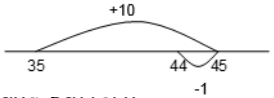
8 + 7 = 15



Adding 9 or 11 by adding 10 and adjusting by 1

e.g. Add 9 by adding 10 and adjusting by 1

35 + 9 = 44



Use knowledge of numbers

7 +3 =10

So 17+3= 20, 27+3= etc, 70+30= 100, 700+30= 1, 000

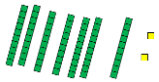
Towards a Written Method

Partitioning in different ways and recombine to 100

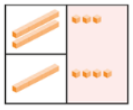
47+25

Leading to exchanging:

72



Towards standard column method:



23	25	25
+ 14	+ 16	+ 16
7	11	41
30	30	1
37	41	

Missing number problems e.g 14 + 5 = 10 + □ 32

+ □ + □ = 100 35 = 1 + □ + 5

Year 3 Addition

Partition into tens and ones

Partition both numbers and recombine.

Count on by partitioning the second number only e.g.

247 + 125 = 247 + 100 + 20+ 5

= 347 + 20 + 5

= 367 + 5

= 372

Children need to be secure adding multiples of 100 and 10 to any three-digit number including those that are not multiples of 10.

Towards a Written Method to 1000

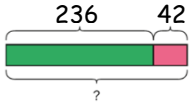
Standard column addition can be modelled with place value counters, objects and pictorial representations.

	h	t	o
			8
+	2	3	6
		1	4
		3	0
+	2	0	0
	2	4	4

Leading to children understanding the renaming between tens and ones (carrying/exchanging).

	h	t	o
	2	3	6
+	3	4	5
	5	8	1
		1	

Introduce the Bar Method.

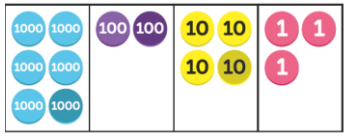


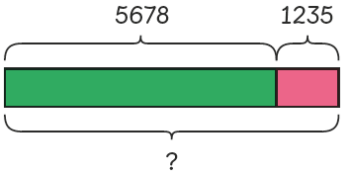
Missing number problems using a range of equations as in Year 1 and 2 but with appropriate, larger numbers.

Year 4 Addition

Mental methods (within 10,000) should continue to develop, supported by a range of models and images, including the number line.

Written methods (progressing to 4-digits & 1dp)
Continue to model column addition modelled with place value counters, objects, pictorial representations and the Bar Method





Extend to numbers with at least four digits, including renaming between various columns (carrying).

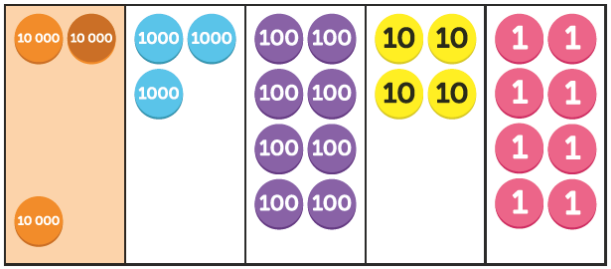
```
  4 2 5 6
+ 1 9 8 7
---------
  6 2 4 3
  1 1 1
```

Select and use different methods to solve word problems, involving two step problems in context.

Year 5 Addition

Mental methods (within 1,000,000) should continue to develop, supported by a range of models and images, including place value counters. Children should practise with increasingly large numbers to aid fluency
e.g. 12462 + 2300 = 14762

Written methods (progressing to more than 4-digits & 2dp)
As in Year 4, continue to explore column addition modelled with place value counters, objects, pictorial representations and the Bar Method (See Appendix 1)



Children will move on to the formal columnar method for whole numbers and decimal numbers as an efficient written method.

```
  1 6  6 0 3
+ 1 7  2 4 5
-----------
  3 3  8 4 8
  1
```

Select and use different methods to solve word problems, involving two step problems in context.

Year 6 Addition

Mental methods should continue to develop, supported by a range of models and images, including the number line.

Written methods
As in Year 5, progressing to larger numbers, aiming for both conceptual understanding and procedural fluency with columnar method to be secured. Continue to model with place value counters, objects, pictorial representations and the Bar Method (See Appendix 1)

Continue calculating with decimals, including those with different numbers of decimal places, and develop procedural fluency with renaming (carrying) to be secured.

```
  6 . 5 9
+ 0 . 7 2
---------
  7 . 3 2
    1
```

Problem Solving
Teachers should ensure that pupils have the opportunity to apply their knowledge in a variety of contexts and problems (exploring cross curricular links) to deepen their understanding.

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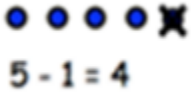
Reception Subtraction

Maths for young children should be meaningful. Where possible, concepts should be taught in the context of real life.

Children begin with mostly concrete objects used to relate subtraction to taking away and counting how many are left as well as pictorial representations

The concrete apparatus are used to model the subtraction of 1 object from a set of 5



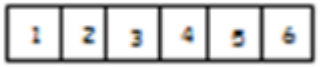
Construct number sentences verbally and or using cards to go along side practical activities.

The chn are encouraged to read number sentences aloud and in different ways ‘Five subtract one leaves four’, ‘four is equal to 5 subtract 1’etc.

Chn to record in objects, pictures, words or symbols the subtraction activities carried out.

To solve simple subtraction number sentences including ‘real life’ problems using their fingers.

Chn will count back from numbers to 20. Number tracks can be introduced to count back and to find the number ‘one less than’



What is 1 less than 9? 1 Less than 20?

Number lines can then be used alongside number tracks and concrete apparatus to solve subtraction calculations and word problems. Chn count back on the number line,

Chn will need opportunities to look at and talk about different models and images as they move between different representations.

Games and songs will be used throughout.

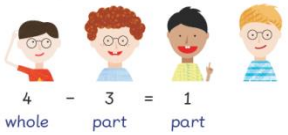
Vocabulary – take (away0, leave, how many are left/ left over, how many have gone, one less, two less … ten less…, how many fewer is … than …? different between, is the same as

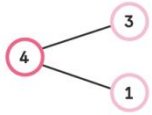
Year 1 Subtraction

Understand subtraction as taking away or crossing out (within 20):

7 – 2 = 5

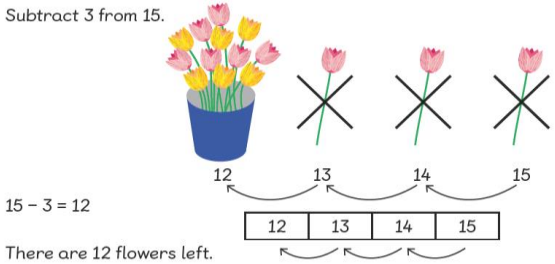
Using knowledge of number bonds (pairs) to subtract (within 20):





Understand subtraction as counting back (within 20):

Use concrete objects and pictorial representations. Progress from using number lines with every number shown to number lines with significant numbers shown.



To use known number bonds

17 – 4 =

7 – 4 = 3

Etc.

To begin to bridge to the ten when subtracting

14 – 6 = X X . . . .

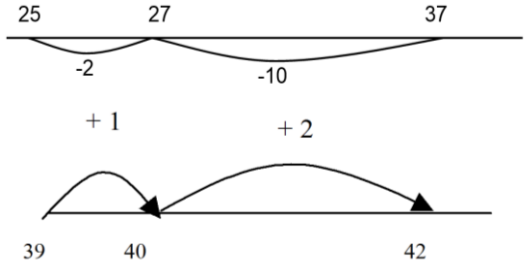
14-4 = 10

10- 2 =8

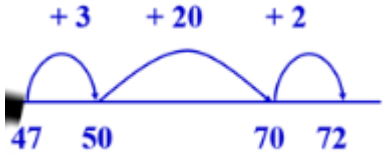
Missing number problems e.g. 7 = □ - 9; 20 - □ = 9; 15 – 9 = □; □ - □ = 11; 16 – 0 = □

Year 2 Subtraction

It is valuable to use a range of representations (also see Y1). Continue to use dienes, number lines, ten frames and objects to model take-away and difference. E.g.



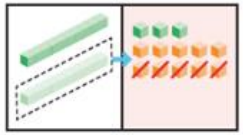
The link between the two may be supported by an image like this, with 47 being taken away from 72, leaving the difference, which is 25.

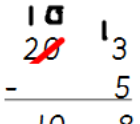


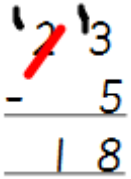
Towards written methods within 100

Record addition and subtraction in columns, the numbers may be represented with objects and pictorial representations. E.g. 23 – 5. Progress to renaming (borrowing).

Regroup 1 ten into 10 ones.
Subtract the ones.
13 ones – 5 ones = 8 ones







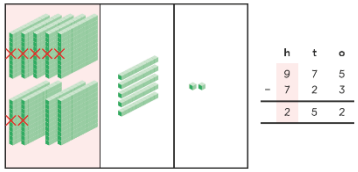
Missing number problems, including use of inverse relationships e.g. 52 – 8 = □; □ – 20 = 25; 22 = □ – 21; 6 + □ + 3 = 11

Year 3 Subtraction

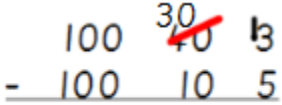
Mental methods should continue to develop, supported by a range of models and images, including the number line Children should make choices about which strategy to use, depending on the numbers involved.

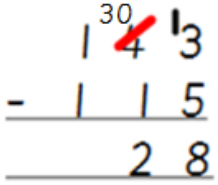
Written methods (progressing to 3-digits)

Continue to model column subtraction with no renaming (borrowing/decomposition), modelled with objects such as place value counters, Numicon and Dienes.

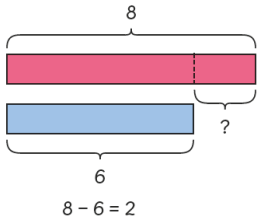


This will lead to renaming (borrowing), modelled using place value counters or Dienes. Explored first through the expanded method.





Introduce the Bar Method (See



8 – 6 = 2

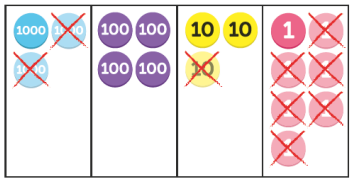
Missing number problems, including use of inverse relationships e.g. □ = 43 – 27; 145 – □ = 138; 274 – 30 = □; 245 – □ = 195; 532 – 200 = □; 364 – 153 = □

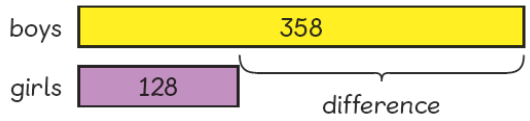
Year 4 Subtraction

Mental methods (within 10,000) should continue to develop, supported by a range of models and images, including partitioning.

Written methods (progressing to 4-digits & 1 dp)

Continue to use column subtraction modelled with place value counters, objects, pictorial representations and the Bar Method (See Appendix 1)

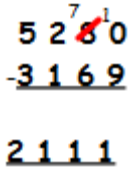




Extend to numbers with at least four digits, including renaming between various columns (borrowing).

	5	2	7 ~~8~~	10 ~~0~~
−	3	1	6	9
	2	1	1	1

Use place value counters to explore compensation method:

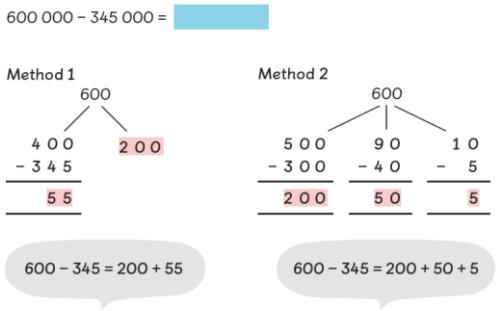


Select and use different methods to solve word problems, involving two step problems in context.

Missing number/digit problems, including use of inverse relationships: 200 – 90 – 80 = □; 225 - □ = 150; □ – 25 = 67; □ - 2000 = 900

Year 5 Subtraction

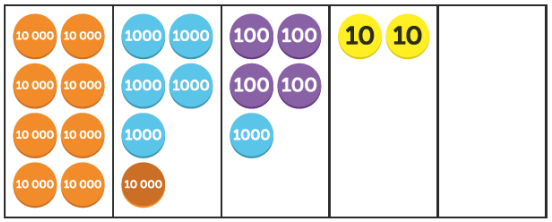
Mental methods (within 1 000 000) should continue to develop, supported by a range of models and images, including partitioning.

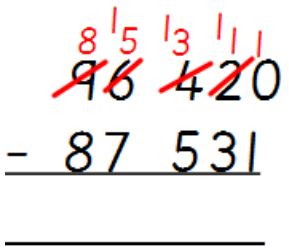


Written methods (progressing to more than 4-digits)

As in Year 4, continue to use place value counters to support understanding of decomposition (renaming/borrowing) in formal written method.

E.g. 96 420 – 87 531 =





Continue to select and use different methods to solve word problems, involving two step problems in context.

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 = □

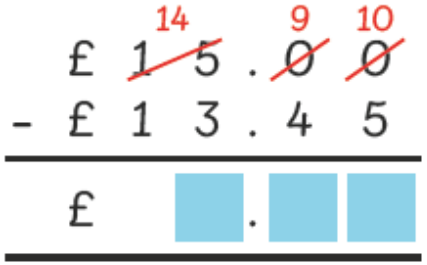
Year 6 Subtraction

Mental methods should continue to develop, supported by a range of models and images,

Written methods

As in Year 5, progressing to larger numbers, aiming for both conceptual understanding and procedural fluency with columnar method to be secured. Continue to model with place value counters, objects, pictorial representations and the Bar Method (See Appendix 1)

Continue calculating with decimals, including those with different numbers of decimal places, and develop procedural fluency with decomposition (borrowing) to be secured.



Problem Solving

Teachers should ensure that pupils have the opportunity to apply their knowledge in a variety of contexts and problems (exploring cross curricular links) to deepen their understanding.

Reception Multiplication

Maths for young children should be meaningful. Where possible, concepts should be taught in the context of real life.

The links between addition and multiplication can be introduced through doubling.

Numicon and other concrete apparatus are used to visualise the repeated adding of the same number. These can then be drawn around or printed as a way of recording.

Children begin with mostly concrete objects used to relate subtraction to taking away and counting how many are left as well as pictorial representations.

How many groups of 2 are there?

Real life contexts and the use of practical equipment to count in repeated groups of the same number/ size

How many wheel are there altogether?

Count in twos, fives, tens both aloud and with

objects.

Chn are given multiplication problems in real life context. Chn are encouraged to use concrete apparatus and/ or visual the problem.

How many fingers on two hands? How many sides on three triangles? How many legs on 4 ducks

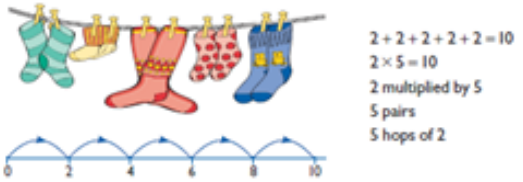
Chn are encouraged to read the number sentences aloud and in different ways, ‘two groups of five makes ten, double five is 10, 5 +5 =10’

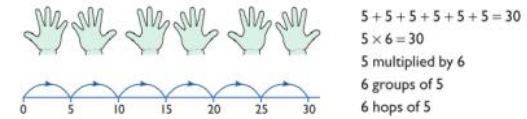
Vocabulary – lots of, groups of, times, multiply, multiplied by, multiple of, once, twice, three times … ten times …, times as (big, long, wide … and so on), repeated addition, double

Year 1 Multiplication

Understand multiplication is related to doubling and combing/counting groups of the same size (repeated addition) for 2, 5, 10.

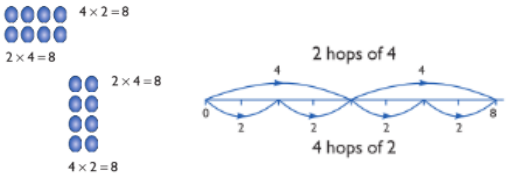
Washing line, and other practical resources for counting. Concrete objects: Dienes, Numicon, bundles of straws, bead strings.





Problem solving with concrete objects grouping – How many groups of …?(including money and measures)

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



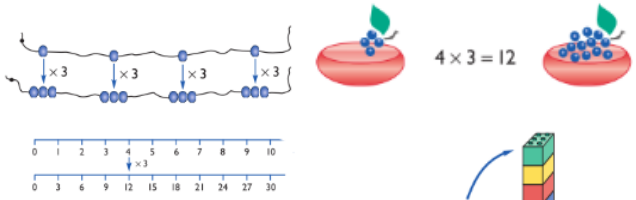
Year 2 Multiplication

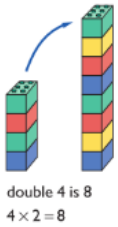
Expressing multiplication as a number sentence using x and explore commutative law of multiplication

Recall and use multiplication facts for the 2, 5 and 10 multiplication tables

Develop understanding of solving multiplication problems using arrays, objects, pictorial representations and number lines (see Year 1).

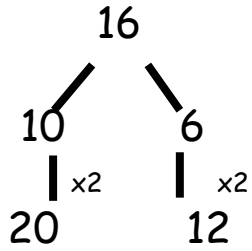
Begin to develop understanding of multiplication as scaling (3 times bigger/taller)





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

Towards written methods
Use arrays and jottings to develop an understanding of doubling two digit numbers.



Use 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 □

Year 3 Multiplication

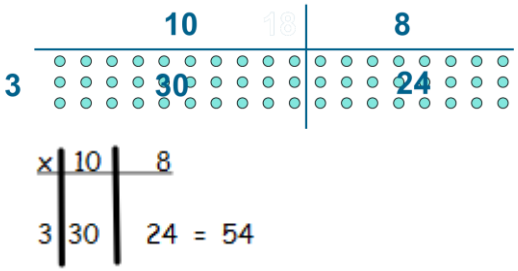
Mental methods
Doubling 2 digit numbers using partitioning

Demonstrating multiplication on a number line – jumping in larger groups of amounts
13 x 4 = 10 groups of 4 then 3 groups of 4

Recall and use multiplication facts for the 3, 4 and 8 multiplication tables

Written methods (progressing to 3digit x 1digit)

Developing written methods using understanding of visual images to group and create equal groups of objects and pictures



Give children opportunities for children to explore this and deepen understanding of commutative law of multiplication using Numicon, Dienes , place value counters and pictorial representations.

Develop understanding of solving multiplication problems using arrays, objects, pictorial representations and number lines (see Year 1).

All within specified tables: 2, 3,4,5,8 and 10

Year 4 Multiplication

Mental methods
Counting in multiples of 6, 7, 9, 25 and 1000, and steps of 1/100.

Recall and use multiplication facts for the 6, 7, 9, 11 and 12 multiplication tables

Use known facts to multiply by multiples of 10

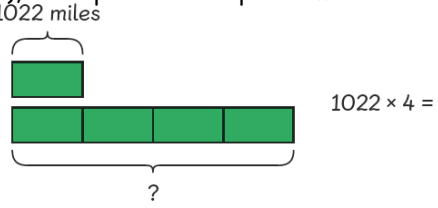
Written methods (progressing to 3digit x 2digit, including 1dp)
Children to embed and deepen their understanding to multiply up to 2d x 2d progressing to 3d x 2d and decimals to 1dp. Ensure this is still linked back to their understanding of arrays.

```
    2  3
×       6
-------
    1  8
+ 1 2  0
-------
  1 3  8
```

Leading to short written method including renaming (carrying):

```
    2 3
X     6
-------
  1 3 8
    1
```

Children to use their knowledge of multiplication tables and inverse, supported by pictorial representations and the Bar Method (See Appendix 1), to help solve word problems in context.



Year 5 Multiplication

Mental methods
X whole numbers and decimals by 10, 100, 1000 using knowledge of place value to move digits

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

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

Identify multiples and factor pairs for numbers

Written methods (progressing to 4d x 2d)
Children to continue to explore long and short methods:

```
  1 1 8
×     3
-------
    2 4  → multiply by ones
    3 0  → multiply by tens
+ 3 0 0  → multiply by hundreds
-------
  3 5 4
```

```
  1 1 4 4
X       8
---------
  9 1 5 2
    1 3 3
```

As in Year 4, children to use their knowledge of multiplication tables and inverse, supported by pictorial representations and the Bar Method (See Appendix 1), to help solve word problems in context.

Year 6 Multiplication

Mental methods
Identifying common factors and multiples of given numbers and prime numbers
X 2d and 3d numbers by 1d mentally or using jottings
Perform mental calculations including mixed operations and large numbers

Written methods
Continue to refine and deepen understanding of written methods including grid method, expanded column and fluency for using column multiplication supported by jottings and the Bar Method (See Appendix 1)

23 × 113 = ☐

Expanded method:

20 × 113 = 2260
3 × 113 = 339
23 × 113 = 2599

Column method:

```
  1 1 4 4
X       8
---------
  9 1 5 2
    1 3 3
```

```
 1144
X  28
-----
 9152
22880
-----
32032
-----
```

Problem Solving
Teachers should ensure that pupils have the opportunity to apply their knowledge in a variety of contexts and problems (exploring cross curricular links) to deepen their understanding.

Reception Division and Fractions

Maths for young children should be meaningful. Where possible, concepts should be taught in the context of real life.

The ELG states that children solve problems, including doubling, halving and sharing

Chn need to see and hear representations of division as bother grouping and sharing.

Division can be introduced through halving.

Chin begin with mostly pictorial representation linked to real life contexts.

Grouping model

Mum has 6 sock. She grouped them into pairs – how many pairs did she make?

Sharing model

I have 10 sweets. I want to share them with my friend. How many will we have each?

Chn have a go at recording the calculation that has been carried out.

Fractions

Although not explicit in the Development Matters documentation, the sharing model is a useful way of introducing young chn to fractions and calculating fractions

Setting the problems in real life contexts and solving them with concrete apparatus will support the chn's understanding.

'I have got 4 bones to share between my 2 dogs. How many bones will they get each?'

Chn have a go at recording the calculation that has been carried out.

2 + 2 = 4

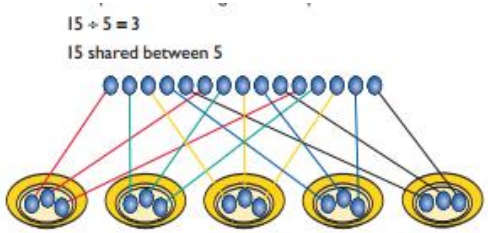
Year 1 Division

Children must have secure counting skills- being able to confidently 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 to 10- understanding the difference between the two concepts.

Sharing

Develops importance of one-to-one correspondence.

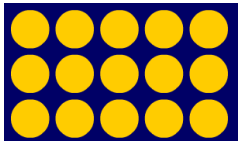


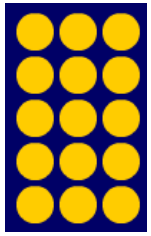
Children should be taught to share using concrete apparatus.

Grouping

Children should apply their counting skills to develop some understanding of grouping.
How many groups of 2 in 6?

Arrays as a pictorial representation can be used for division. 15 ÷ 3 = 5 There are 5 groups of 3. 15 ÷ 5 = 3 There are 3 groups of 5.





Children should be able to find ½ of shapes, objects, numbers and quantities.

Year 2 Division

Know and understand sharing and grouping- introducing children to the ÷ sign.

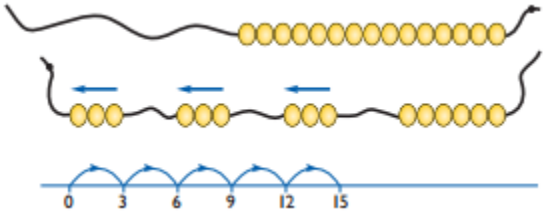
Recall and use division facts for the 2, 5 and 10 multiplication tables

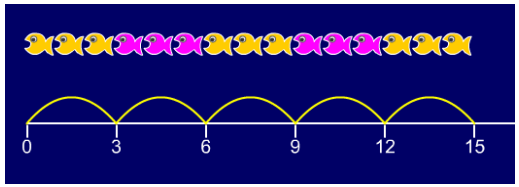
Children should continue to use grouping and sharing for division (dividends below 20) using practical apparatus, arrays and pictorial representations.

Progress to Grouping using a numberline

Group from zero in jumps of the divisor to find out 'how many groups of 3 are there in 15?'.

15 ÷ 3 = 5



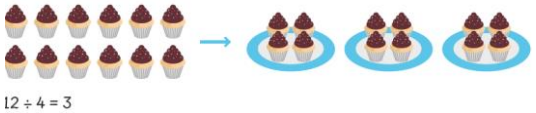


Continue work on arrays. Support children to understand how multiplication and division are inverse. Look at an array – what do you see?
Remainders can be introduced.

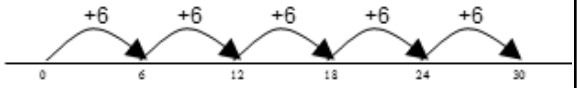
Year 3 Division

Recall and use division facts for the 3, 4 and 8 multiplication tables

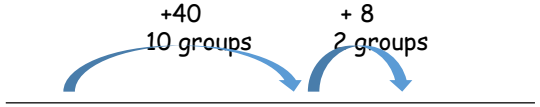
Children should continue to use grouping and sharing for division using practical apparatus, arrays and pictorial representations.



Place value counters, arrays and number lines can be used to support children apply their knowledge of grouping.



Children need to be able to partition the dividend in different ways.
48 ÷ **4** = **12**



÷ = signs and missing numbers
Continue using a range of equations as in year 2 but with appropriate numbers.

93 ÷ **3**

90
- **30** **(10 x3)**
63
- 30 (10 x3)
33
- 30 (10x3)
3

Year 4 Division

Recall division facts for the multiplication tables up to 12 x 12

Sharing, Grouping, Repeated Subtraction and Inverse

Children will continue to explore division as sharing , grouping, repeated subtraction and inverse until they have a secure understanding. Continue to use pictorial representations and Bar Method (See Appendix 1) to solve word problems in context.

Children should progress in their use of written division calculations:

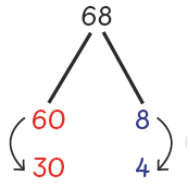
- Using tables facts with which they are fluent
- Experiencing a logical progression in the numbers they use, for example:

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)

Formal Written Methods

Children to use partitioning to divide 2 and 3 digit numbers e.g 68 ÷ 2 = 34



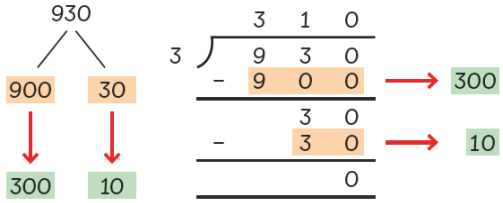
Begin

$$4\overline{)372}$$

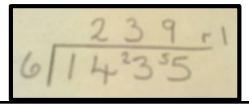
Year 5 Division

Formal Written Methods

Continue to use partitioning, number bonds and place value counters to support the efficient use of a formal long division method



Children begin to practically develop their understanding of how to express the remainder as a decimal or a fraction (only simple conversion fraction to decimal. 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?)



Year 6 Division

Sharing, Grouping, Repeated Subtraction and Inverse

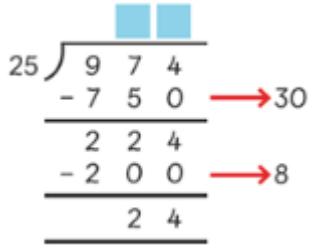
Children will continue to explore division as sharing , grouping, repeated subtraction and inverse and to represent problems using the Bar Method (See Appendix 1) if appropriate.

Quotients (results of division) should be interpreted appropriately for the context as a whole number, remainders, decimal or fraction.

Formal Written Methods – long and short division

Continue to use partitioning, number bonds and place value counters to support the efficient use of long and short division methods including expressing remainder as a fraction or decimal

Coin method 2s, 5s and 10s Only.



$$974 \div 25 = 38\frac{24}{25} = 38\frac{96}{100} = 38.96$$

Problem Solving

Teachers should ensure that pupils have the opportunity to apply their knowledge in a variety of contexts and problems (exploring cross curricular links) to deepen their understanding.