Calculation Policy

The following calculation policy has been devised to meet requirements of the National Curriculum 2014 for the teaching and learning of mathematics, and is also designed to give pupils a consistent and smooth progression of learning in calculations across the school.

Age stage expectations:

The calculation policy is organised according to age stage expectations as set out in the National Curriculum 2014 and the method(s) shown for each year group should be modelled to the vast majority of pupils. However, it is vital that pupils are taught according to the pathway that they are currently working at and are showing to have 'mastered' a pathway before moving on to the next one. Of course, pupils who are showing to be secure in a skill can be challenged to the next pathway as necessary.

Choosing a calculation method:

Before pupils opt for a written method they should first consider these steps:

Can I do it in my head using a mental strategy? → Could I use some jottings to help me? → Should I use a formal written method to work it out?

Year 1

Obj | Gui | Vid | Ex

+ = 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

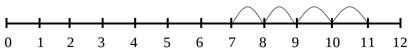
Counting and Combining sets of Objects

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

Understanding of counting on with a numbertrack.

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

7+ 4



Year 2

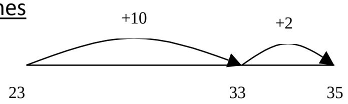
Obj | Gui | Vid | Ex

Missing number problems e.g 14 + 5 = 10 + ☐   32 + ☐ + ☐ = 100   35 = 1 + ☐ + 5

It is valuable to use a range of representations (also see Y1). Continue to use numberlines to develop understanding of:

Counting on in tens and ones

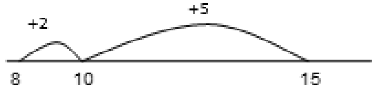
23 + 12 = 23 + 10 + 2
= 33 + 2
= 35



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.

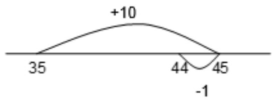
8 + 7 = 15



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

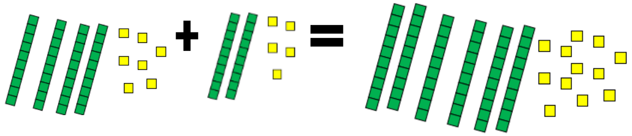


Towards a Written Method

Partitioning in different ways and recombine

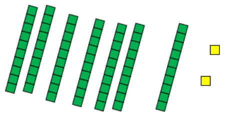
47+25

47   **25**   **60 + 12**



Leading to exchanging:

72



Expanded written method

40 + 7 + 20 + 5 =

40+20 + 7 + 5 =

60 + 12 = 72

40 + 7
+ 20 + 5
60 + 12 = 72

Year 3

Obj | Gui | Vid | Ex

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

Partition into tens and ones

Partition both numbers and recombine.

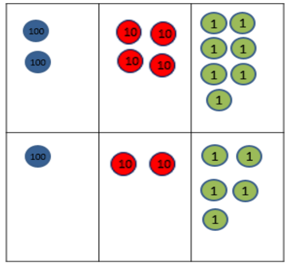
Count on by partitioning the second number only e.g.

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

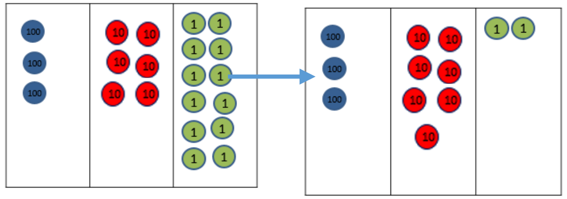
Introduce expanded column addition modelled with place value counters (Dienes could be used for those who need a less abstract representation)



200 + 40 + 7
100 + 20 + 5
300 + 60 +12 = 372

```
  247
 +125
   12
   60
  300
  372
```

Leading to children understanding the exchange between tens and ones.



Some children may begin to use a formal columnar algorithm, initially introduced alongside the expanded method. The formal method should be seen as a more streamlined version of the expanded method, not a new method.

```
  247
 +125
  372
   10
```

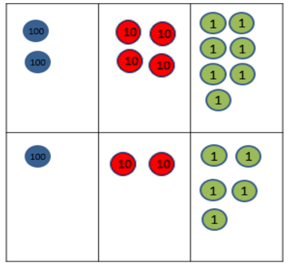
Year 4

Missing number/digit problems:

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

Written methods (progressing to 4-digits)

Expanded column addition modelled with place value counters, progressing to calculations with 4-digit numbers.

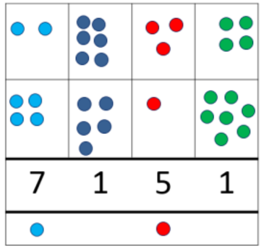


200 + 40 + 7
100 + 20 + 5
300 + 60 +12 = 372

```
 247
+125
  12
  60
 300
 372
```

Compact written method

Extend to numbers with at least four digits.




```
 2634
+4517
 7151
 1 1
```

Children should be able to make the choice of reverting to expanded methods if experiencing any difficulty.

Extend to up to two places of decimals (same number of decimals places) and adding several numbers (with different numbers of digits).

```
  72.8
+ 54.6
 127.4
 1 1
```


Year 5

Missing number/digit problems:

Mental methods should continue to develop, supported by a range of models and images, including the number line. 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. 12462 + 2300 = 14762

Written methods (progressing to more than 4-digits)

As year 4, progressing when understanding of the expanded method is secure, children will move on to the formal columnar method for whole numbers and decimal numbers as an efficient written algorithm.

```
  172.83
+  54.68
  227.51
  1  1 1
```

Place value counters can be used alongside the columnar method to develop understanding of addition with decimal numbers.

Year 6

Missing number/digit problems:

Mental methods should continue to develop, supported by a range of models and images, including the number line. 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 columnar method to be secured. Continue calculating with decimals, including those with different numbers of decimal places

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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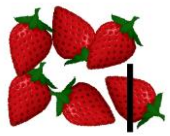
Obj | Gui

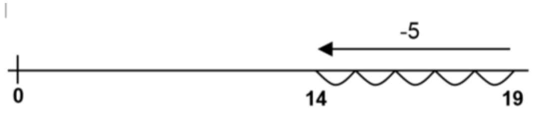
Year 1

Vid | Ex

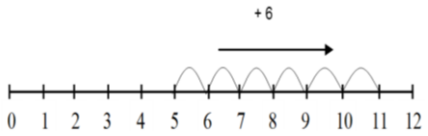
Missing number problems e.g. 7 = □ - 9; 20 - □ = 9; 15 – 9 = □; □ - □ = 11; 16 – 0 = □
Use concrete objects and pictorial representations. If appropriate, progress from using number lines with every number shown to number lines with significant numbers shown.

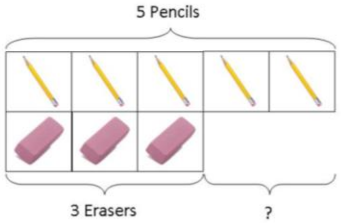
Understand subtraction as take-away:





Understand subtraction as finding the difference:





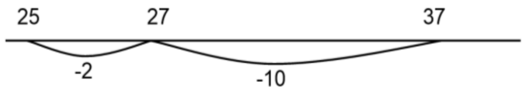
The above model would be introduced with concrete objects which children can move (including cards with pictures) before progressing to pictorial representation.
The use of other images is also valuable for modelling subtraction e.g. Numicon, bundles of straws, Dienes apparatus, multi-link cubes, bead strings

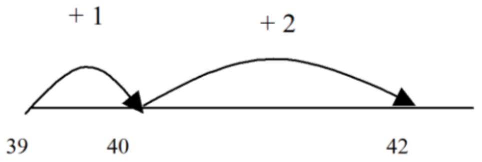
Obj | Gui

Year 2

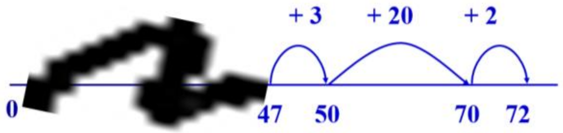
Vid | Ex

Missing number problems e.g. 52 – 8 = □; □ – 20 = 25; 22 = □ – 21; 6 + □ + 3 = 11
It is valuable to use a range of representations (also see Y1).
Continue to use number lines to model take-away and difference. E.g.





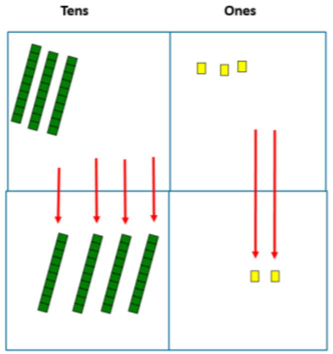
The link between the two may be supported by an image like this, with 47 being taken away from 72, leaving the difference, which is 25.



The bar model should continue to be used, as well as images in the context of **measures**.

Towards written methods

Recording addition and subtraction in expanded columns can support understanding of the quantity aspect of place value and prepare for efficient written methods with larger numbers. The numbers may be represented with Dienes apparatus. E.g. 75 – 42



	70	5
-	40	2
	30	3

Obj | Gui

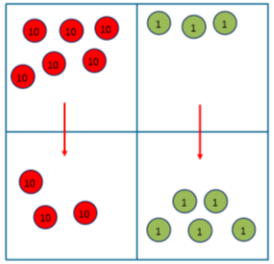
Year 3

Vid | Ex

Missing number problems e.g. □ = 43 – 27; 145 – □ = 138; 274 – 30 = □; 245 – □ = 195; 532 – 200 = □; 364 – 153 = □
Mental methods should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving (see Y1 and Y2).
Children should make choices about whether to use complementary addition or counting back, depending on the numbers involved.

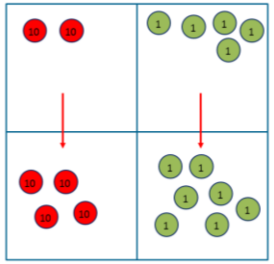
Written methods (progressing to 3-digits)

Introduce expanded column subtraction with no decomposition, modelled with place value counters (Dienes could be used for those who need a less abstract representation)



	90	8
-	30	5
	60	3

For some children this will lead to exchanging, modelled using place value counters (or Dienes).



	~~70~~ 60	12
-	40	7
	20	5

A number line and expanded column method may be compared next to each other.

Some children may begin to use a formal columnar algorithm, initially introduced alongside the expanded method. The formal method should be seen as a more streamlined version of the expanded method, not a new method.

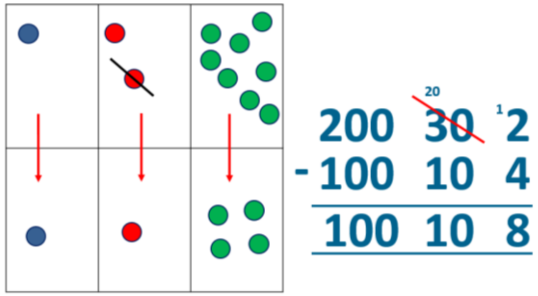
Obj Gui Year 4 Vid Ex

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

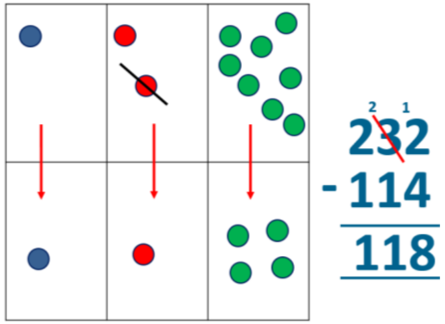
Mental methods should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving.

Written methods (progressing to 4-digits)

Expanded column subtraction with decomposition, modelled with place value counters, progressing to calculations with 4-digit numbers.



If understanding of the expanded method is secure, children will move on to the formal method of decomposition, which again can be initially modelled with place value counters.



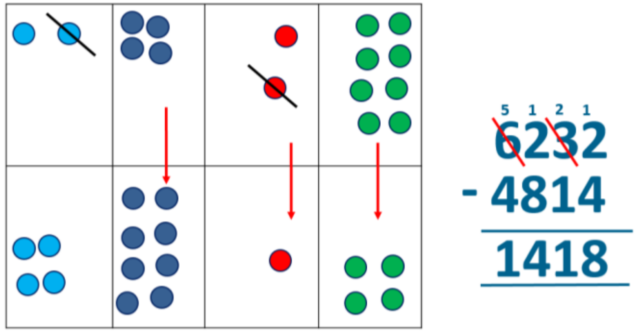
Obj Gui Year 5 Vid Ex

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 = □

Mental methods should continue to develop, supported by a range of models and images, including the number line. 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, children will move on to the formal method of decomposition, which can be initially modelled with place value counters.



Progress to calculating with decimals, including those with different numbers of decimal places.

Obj Gui Year 6 Vid Ex

Missing number/digit problems: □ and # each stand for a different number. # = 34. # + # = □ + □ + #. What is the value of □? What if # = 28? What if # = 21

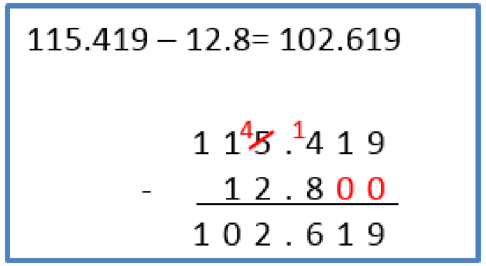
10 000 000 = 9 000 100 + □

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. 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 decomposition to be secured.



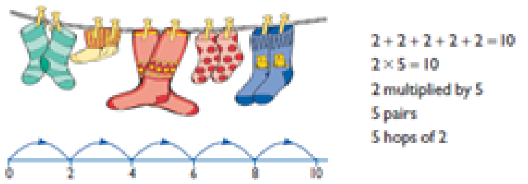
Continue calculating with decimals, including those with different numbers of decimal places.

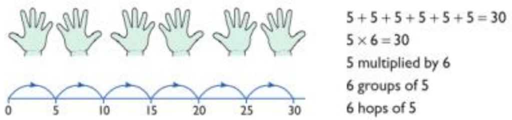
Year 1

Obj | Gui | Ex

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

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

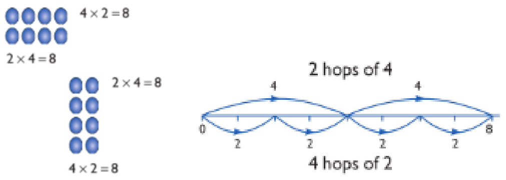




Problem solving with concrete objects (including money and measures)

Use cuissenaire and 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)



Year 2

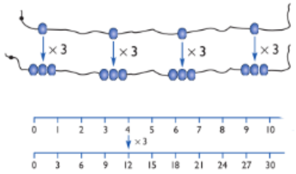
Obj | Gui | Vid | Ex

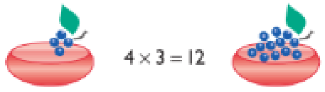
Expressing multiplication as a number sentence using x
Using understanding of the inverse and practical resources to solve missing number problems.

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

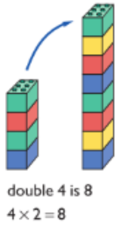
Develop understanding of multiplication using array and number lines (see Year 1). Include multiplications not in the 2, 5 or 10 times tables.

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



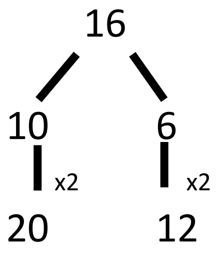


Doubling numbers up to 10 + 10
Link with understanding scaling
Using known doubles to work out double TU numbers
(double 15 = double 10 + double 5)



Towards written methods

Use jottings to develop an understanding of doubling two digit numbers.



Year 3

Obj | Gui | Vid | Ex

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

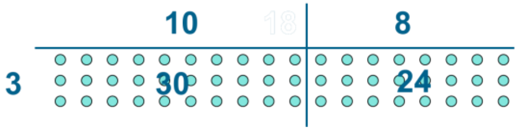
Mental methods
Doubling 2 digit numbers using partitioning

Demonstrating multiplication on a number line – jumping in larger groups of amounts

13 x 4 = 10 groups 4 = 3 groups of 4

Written methods (progressing to TU x U)

Developing written methods using understanding of visual images



Develop onto the grid method

Give children opportunities for children to explore this and deepen understanding using Dienes apparatus , place value counters and Numicon.

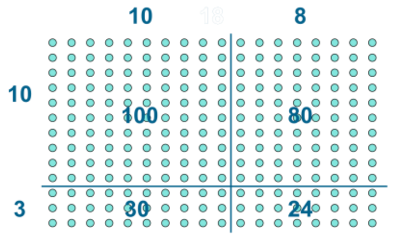
Obj Gui **Year 4** Vid Ex

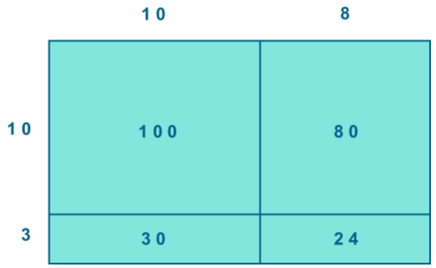
Continue with a range of equations as in Year 2 but with appropriate numbers. Also include equations with missing digits
□2 x 5 = 160

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

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

Written methods (progressing to HTU x TU)
Children to embed and deepen their understanding of the grid method to multiply up 2d x 2d. Ensure this is still linked back to their understanding of arrays and place value counters.





Obj Gui **Year 5** Vid Ex

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 ITP

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)

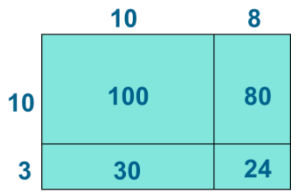
Solving practical problems where children need to scale up. Relate to known number facts.

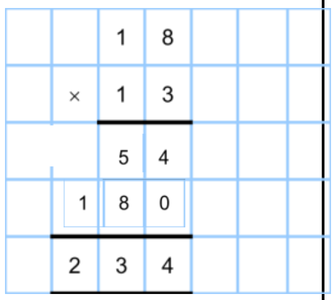
Identify factor pairs for numbers

Written methods (progressing to THHTU x TU)

Long multiplication using place value counters

Children to explore how the grid method supports an understanding of long multiplication (for 2d x 2d)





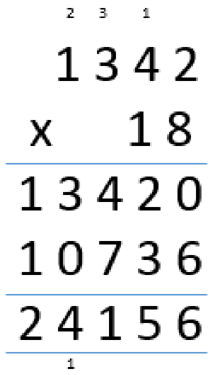
Obj Gui **Year 6** Vid Ex

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. Relate to known number facts.

Written methods
Continue to refine and deepen understanding of written methods including fluency for using long multiplication

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



Obj Gui

Year 1

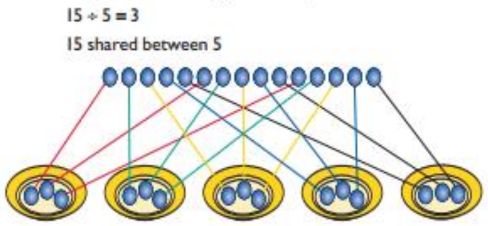
Vid Ex

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- understanding the difference between the two concepts.

Sharing

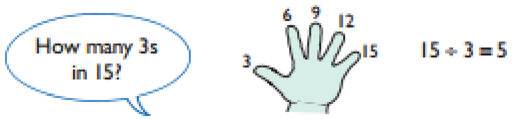
Develops importance of one-to-one correspondence.



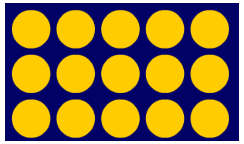
Children should be taught to share using concrete apparatus.

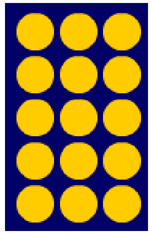
Grouping

Children should apply their counting skills to develop some understanding of grouping.



Use of arrays as a pictorial representation 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 and ¼ and simple fractions of objects, numbers and quantities.

Obj Gui

Year 2

Vid Ex

÷ = signs and missing numbers

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

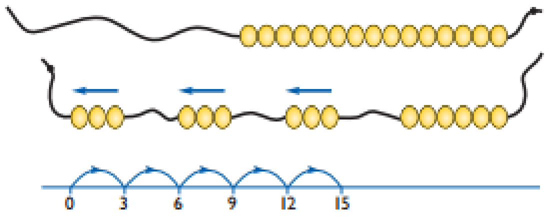
Know and understand sharing and grouping- introducing children to the ÷ sign.

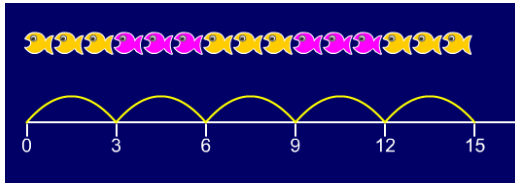
Children should continue to use grouping and sharing for division using practical apparatus, arrays and pictorial representations.

Grouping using a numberline

Group from zero in jumps of the divisor to find our '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?

Obj Gui

Year 3

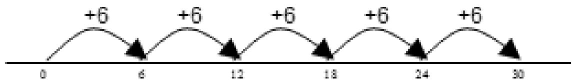
Vid Ex

÷ = signs and missing numbers

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

Grouping

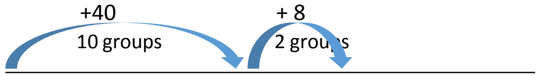
How many 6's are in 30?
30 ÷ 6 can be modelled as:



Becoming more efficient using a numberline

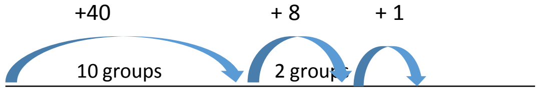
Children need to be able to partition the dividend in different ways.

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?

Obj | Gui | **Year 4** | Vid | Ex

Obj | Gui | **Year 5** | Vid | Ex

Obj | Gui | **Year 6** | Vid | Ex

Year 4

3 2
3 | 9 6

1 8
4 | 7 [3]2

Limit numbers to NO remainders in the answer OR carried (each digit must be a multiple of the divisor).

Limit numbers to NO remainders in the final answer, but with remainders occurring within the calculation.

Year 5

2 1 8
4 | 8 7 [3]2

0 3 7
5 | 1 8 [3]5

Extend to 3-digit number first where the divisor can go into the first number and then progress to when the divisor cannot go into the first number.

Year 5 statutory requirement:
✓ 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

2 7 r 2
8 | 2 [2]1 [5]8

Extend to expressing results in different ways according to the context, including with remainders as fractions, as decimals or by rounding. For example:

- Whole number remainder = 27 r 2
- Fraction remainder = $27\frac{2}{8} = 27\frac{1}{4}$
- Decimal remainder = $27\frac{1}{4} = 27\frac{25}{100} = 27.25$

Year 6

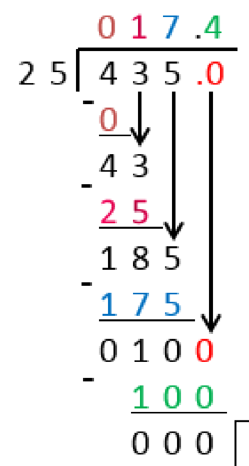
1044 ÷ 16

Children will solve division problems where integers with up to 4 digits are divided by an integer with up to two digits, including answers with remainders.

0 0 6 5 . 2 5
1 6 | 1 [1]0 [10]4 [8]4 . [4]0 [8]0

Children will also be able to solve division calculations by using the long division method.

435 ÷ 25



25
50
75
100
125
150
175
200

It is helpful to write the times table of the divisor down the side of the calculation – even for short division.