Calculation Policy

The following Calculation Policy outlines the methods we teach at Oldfield Primary School for the four main areas of calculation: addition, subtraction, multiplication and division. The policy demonstrates a clear progression of skills from EYFS through to Year 6, therefore there is some overlap in consecutive year groups as skills are revised and built upon. In **all** year groups, the Concrete Pictorial Abstract (CPA) approach is followed – please see below.

Concrete: Handling physical objects

Pictorial: Looking at pictures and models

Abstract: Using only numbers and symbols

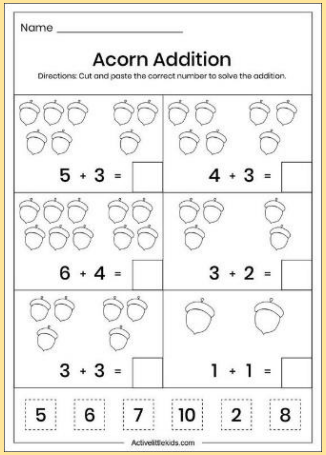
In class, children are regularly given opportunities to then apply these calculation skills to a range of age-appropriate mathematical problems and varying contexts (these are not included in the policy).

This calculation policy has been developed by the maths coordinators, agreed by all teachers at Oldfield and shared with support staff, governors and parents.

EYFS

Counting, number recognition and ordering is taught before to allow children to access the learning and understanding of calculations. Techniques such as touch, count and move must be taught beforehand.

Addition

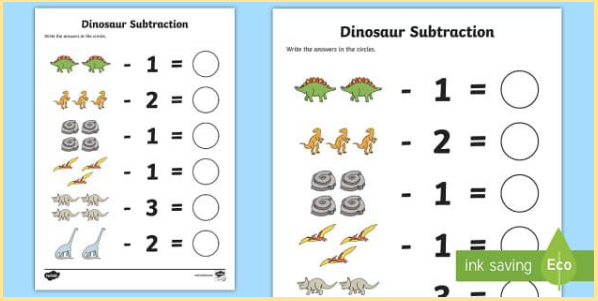


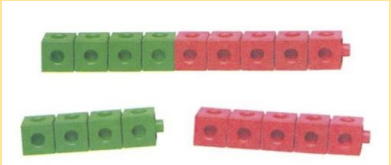
- Numicon to support addition
- Learning of number bonds to 5 then 10
- Multilink cubes – combing 2 groups to find the total
- Say a number sentence orally, then move onto written number sentences

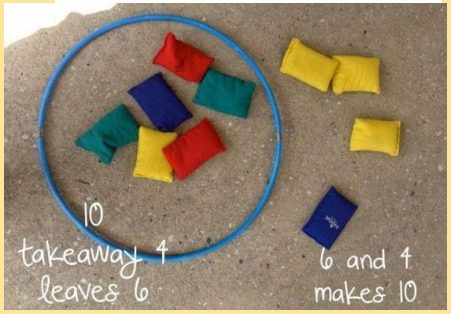
- Opportunities for problem solving independently
- Using the touch, count and move technique for addition
- Board games for addition – moving counters along a board
- Pegs on a hanger for addition
- Simple addition worksheets with pictorial support

Subtraction

- Say a number sentence orally, then move onto written number sentences
- Board games for subtraction – moving counters along a board
- Breaking towers of cubes into smaller groups
- Using the touch, count and move technique for subtraction

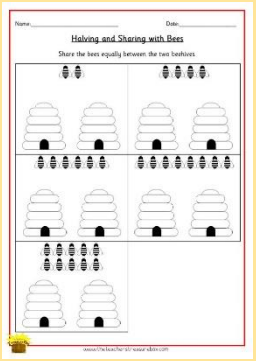




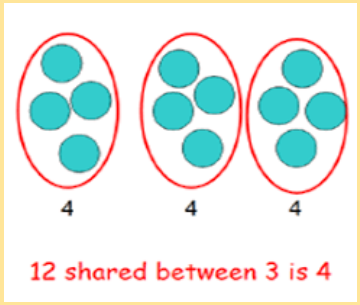


- Pegs on a hanger for subtraction
- Using tactile objects for hands on maths
- Simple worksheets with pictures to support

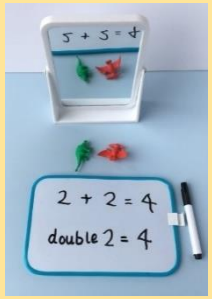
Division (referred to as sharing in EYFS)



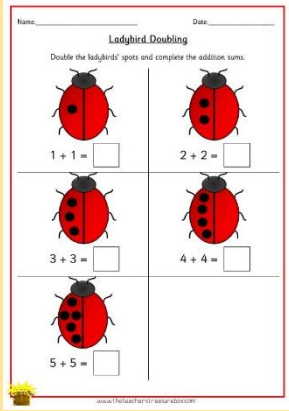
- Splitting cubes or counters into groups to see how a whole number can be shared equally. Discussing the problem orally and in small groups
- Using simple worksheets with pictures to support



Multiplication (referred to as grouping in EYFS)



- Learning number doubles to 10
- Counting in 2's, 5's and 10's
- Putting socks into pairs and counting
- Using a mirror to double objects
- Counting 2p coins



Addition Year 1

<u>+ - = signs and missing numbers</u>

Calculations should be written either side of the sign so that it is not just interpreted as 'the answer'.

2= 1 + 1

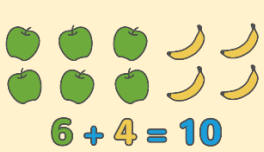
2 + 3 = 4 + 1

Missing numbers need to be placed in a all possible places.

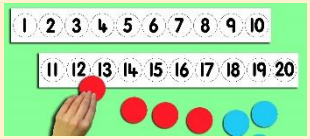
3 + 4 = … … = 3 + 4

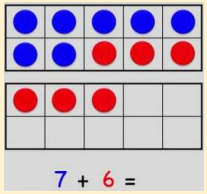
3 + …= 7 7 = … + 4

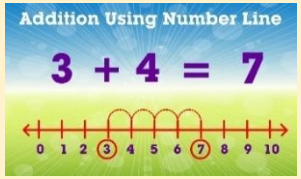
<u>Adding sets of objects and numbers with Numicon, counters and pictures, including number bonds.</u>



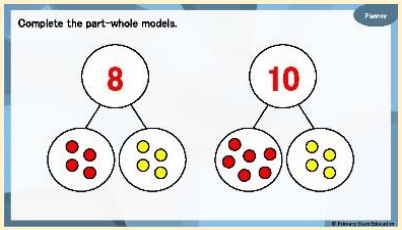
<u>Counting on with a number track, tens frame and number line</u>.







Introduction to the part-whole model



Addition Year 2

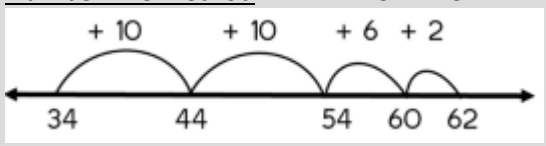
<u>Missing number problems</u>

14 + 5 = … 32 + … + … = 100 35= 1 + … + 5

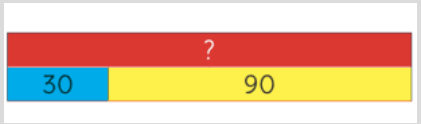
<u>Addition to 100</u>

Counting on using a number line, counters, Numicon, bar models and other visual representations.

<u>Number line method</u> ….. = 34 + 28

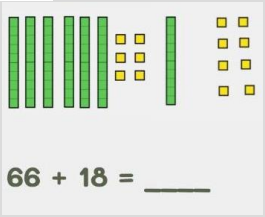


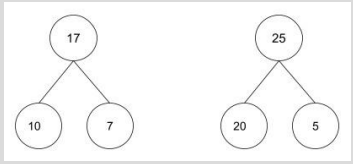
<u>Bar model</u> 30 + 90 =



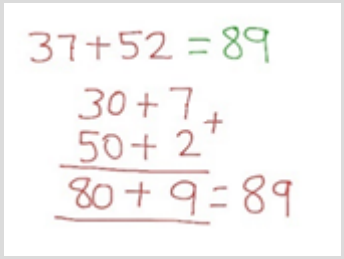
<u>Partitioning for addition</u>

Using dienes and part-whole model to partition 2-digit numbers. Add the tens and ones together and then recombine.





<u>Introduction to the expanded written method</u>

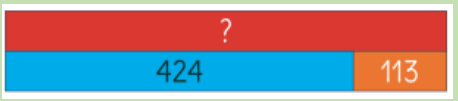


Addition Year 3

<u>Missing number problems</u>

More complex missing number problems, with increasingly large numbers e.g. 25 + … + 95 = 137

<u>Bar model</u>



<u>Mental strategies</u>

Including partitioning, number lines and jumping to the next multiple of 10.

<u>Partitioning for addition (up to 1000)</u>

Partition both numbers and recombine (see Year2)

Count on by partitioning the 2nd number only e.g.

247 + 125 = 247 + 100 + 20 + 5

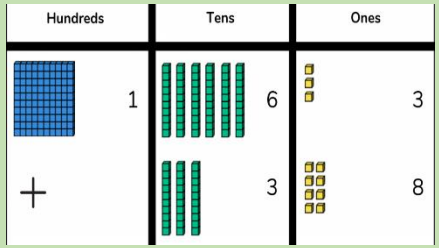
= 347 + 25

= 372

(Children need to be secure adding multiples of 10 and 100 to any 3 digit number e.g. 457 + 100)

<u>Expanded column addition</u>

Modelled with various representations including place value counters and dienes.



100+60+3

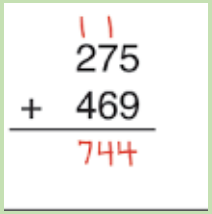
+30+8

100+90+11 = 201

Leading to children having a secure understanding the exchange between tens and ones.

<u>Formal column addition</u>

Working with numbers up to 1000.



Subtraction Year 1

Missing numbers problems

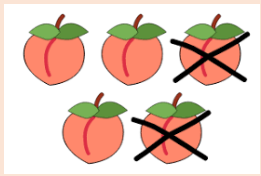
Missing number is in different positions e.g.

7= 9 - … 15 – 9 = …

20 - … = 9 … - … = 11 (multiple solutions)

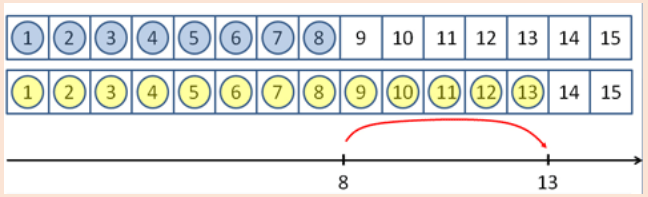
Understanding subtraction as take away

Pictorial methods, Numicon, counters, multi-link, number track/line etc.

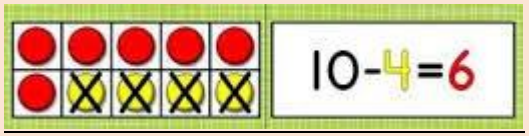


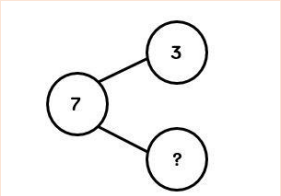
Understanding subtraction as finding the difference

Counting on to find the difference as well as counting backwards.



Tens frame to show subtraction up to 10 and 20.





Part-whole model

Beginning to explore the inverse link between addition and subtraction.

Subtraction Year 2

Missing number problems

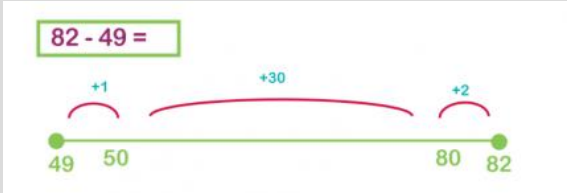
Including numbers up to and beyond 100 e.g.

52 – 8 = … …- 20 = 25 22 = … - 21 6 + … + 3 = 11

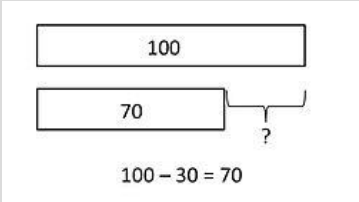
Continue to use and range of different representations for subtraction (see Y1)

Use number lines to model take-away and difference.

Number line method

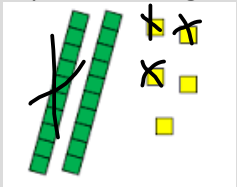


Bar models

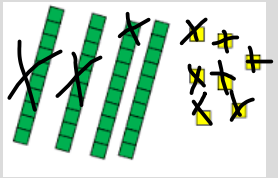


Dienes

Using dienes to subtract tens and ones. Beginning to explore exchange when crossing tens.



25 – 13 = 12



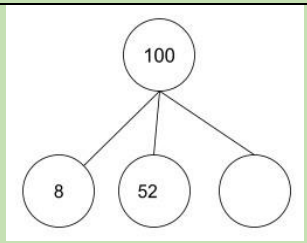
47 – 28 = 19

Understanding the inverse relationship between addition and subtraction.

Subtraction Year 3

Missing number problems

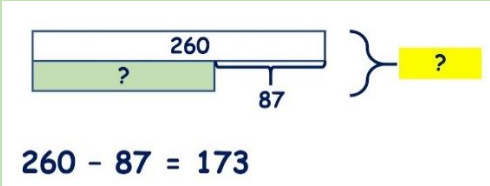
More complex missing number problems, with increasingly large numbers. Represented using the part-whole model (right).



Mental methods

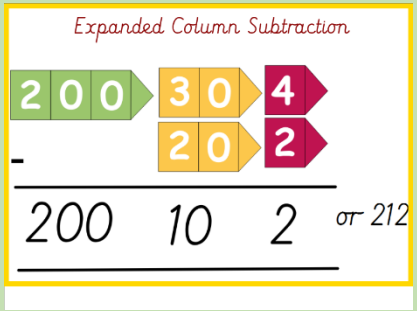
Supported by a range of models, including using the inverse to add when the numbers are closer together.

Bar model

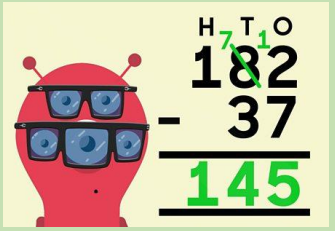


Expanded column subtraction

Modelled with various representations including place value counters, partition cards (see right) and dienes.



Leading to children having a secure understanding the exchange between tens and ones.



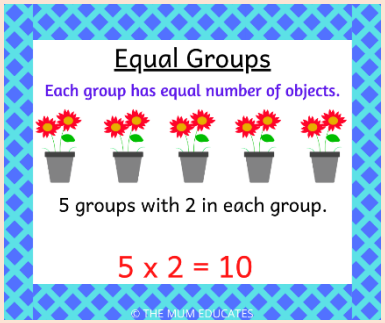
Formal column subtraction

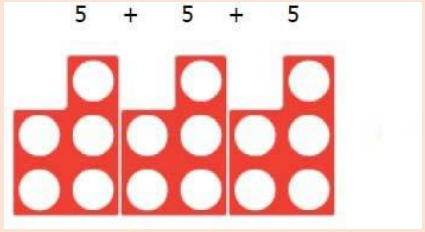
Working with numbers up to 1000

Multiplication Year 1

Understand that multiplication is related to doubling and finding 'groups of' the same number (repeated addition.)

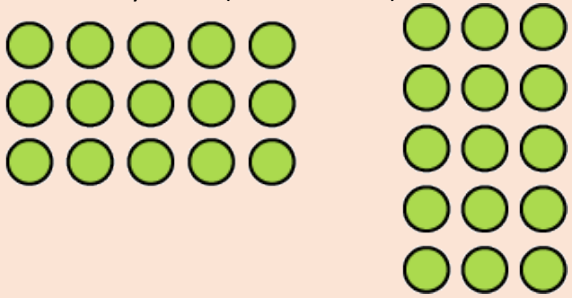
Practical resources for counting groups. Concrete objects: Numicon, counters, Unifix cubes and pictures.





3 x 5 =
5 + 5 + 5 = 15

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



3 rows of 5
3 x 5 = 15

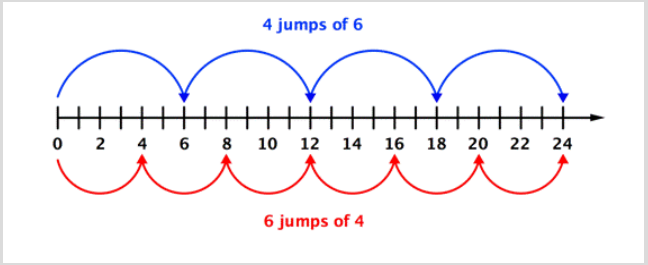
5 rows of 3
5 x 3 = 15

Multiplication Year 2

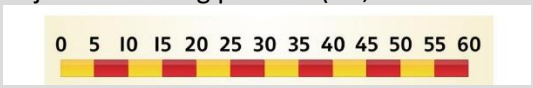
Expressing multiplication as a number sentence using x

Continue to use grouping, multiplication arrays and number lines to understand that multiplication is repeated addition and that it can be done in any order (also see Y1). Include multiplications beyond 2,5, and 10 times tables.

4 x 6 = 6 x 4



Children develop their times table fluency by skip counting using a counting stick, counting concrete objects and using pictures (2's, 5's 10's and 3's).

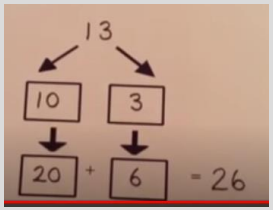


Understanding the inverse and solve missing number problems (missing numbers in different positions).

7 x 2 = ... = 7 x 2
7 x ... = 14 14 = 7 x ....
... x 2 = 14 14 = ... x 2

Begin to understand multiplication as scaling e.g. 3 times bigger/taller/as many.

Understand that doubling = x2 and be able to partition to double 2 digit numbers.



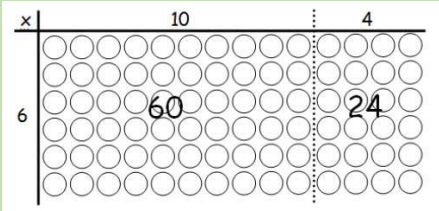
Multiplication Year 3

Continue to use previous methods for multiplying numbers up to 12 (see y1/Y2), including more complex missing number problems.

Mental methods
Doubling 2-digit numbers using partitioning.
Increasing fluency in all times tables up to 12 x 12.

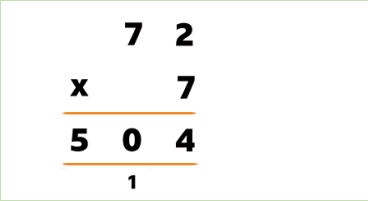
Demonstrating multiplication on a number line jumping in larger groups
13 x 4 = 10 groups 4 + 3 groups of 4

Written methods (progressing to 1 digit x 2 digit)
Developing written methods first using visual images.



Developing onto grid method.

Leading to short multiplication.



Division Year 1

Children must have secure counting skills – being able to confidently count in 2's, 5's and 10's.

Group AND share small quantities

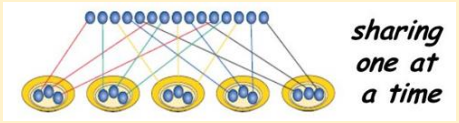
Understanding the difference between the two concepts.

Develops importance of one-to-one correspondence.

15 ÷ 5 = 3

15 shared between 5

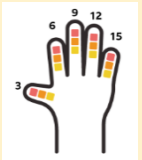
Children should be taught to share using concrete apparatus.

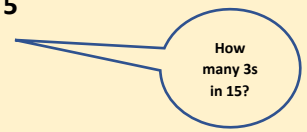


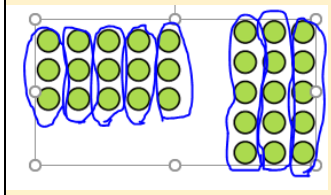
Grouping

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

15 ÷3 = 5







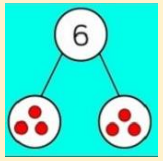
Use of arrays as a pictorial representation for division.

15 ÷ 3 = 5 There are 5 groups of 3.

15 ÷ 5 = 3 There are 3 groups of 5.

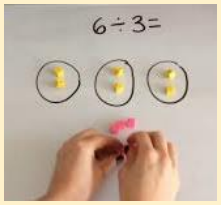
Children should be able to find ½ and ¼ and simple fractions of objects, numbers and quantities.

Introduction to the part-whole model.



Half of 6

6 ÷2=3



6 ÷ 3 = 2

Division Year 2

÷ = signs and missing numbers

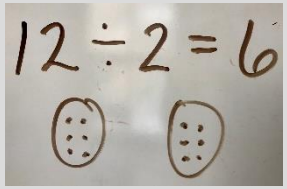
6 ÷ 2 = ☐ ☐ = 6 ÷ 2

6 ÷ ☐ = 3 3 = 6 ÷ ☐

☐ ÷ 2 = 3 3 = ☐ ÷ 2

☐ ÷ △ = 3 3 = ☐ ÷ △

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

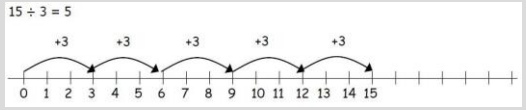


Children should continue to use grouping and sharing for division using practical apparatus, arrays and pictorial representations like sharing circles.

Grouping using pictures and a number line

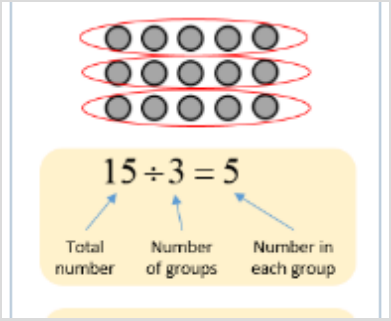
Group from zero in jumps of the divisor to find out 'How many groups of 3 are there in 15?'.

15 ÷ 3 = 5



Arrays

Continue work on arrays. Support children to begin to understand how multiplication and division are inverse.



Children begin to make the link between ½ as dividing by 2 and ¼ as dividing by 4.

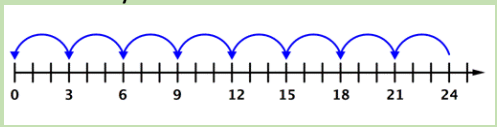
Division Year 3

÷ = signs and missing numbers

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

Grouping

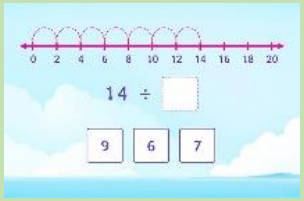
How many 3's are in 24? 24 ÷ 3 can be modelled as:

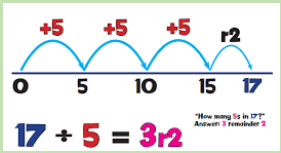


Becoming more efficient using a number line.

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

14 ÷ **2 =7** 7 groups of 2





Remainders

17 ÷ 5 = 3 r2 3 groups of 5 and 2 left

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

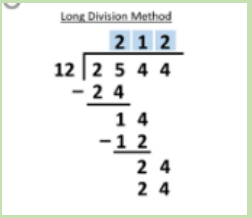
60 ÷ 10 =

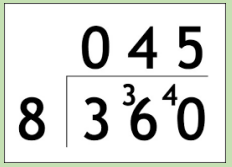
How many groups of 10 in 60?

600 ÷ 100 = How many groups of 100 in 600?

Formal written method

Short division (bus stop method)





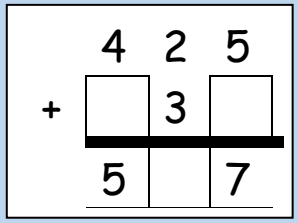
Long division (extension)

Children secure understanding of link between fractions and division.

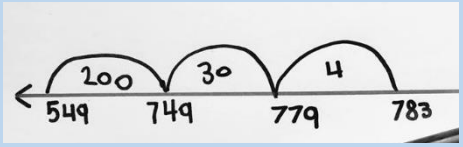
Addition Year 4

Missing number/digit problems

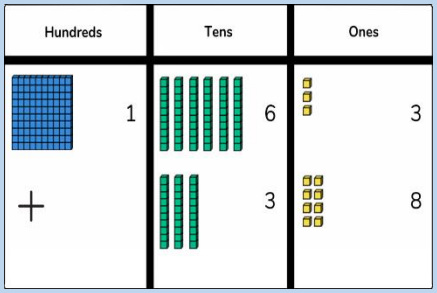
Including within column method (see right).



Mental methods should continue to develop, supported by a range of models and images, including the number line and 100 square.



Expanded column addition modelled with place value counters and dienes (see Y3 also).

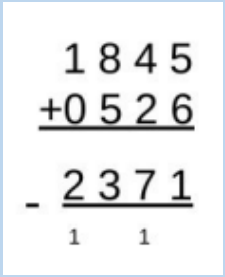


Partitioning

100+60+3
+30+8
100+90+11 = 201

Formal column addition including regrouping where required

Once the expanded method is secure, children move on the formal column addition method.



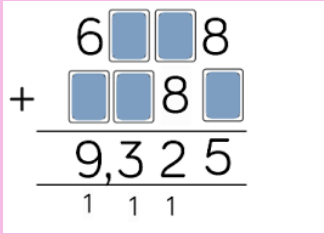
Children need to understand 0 as place holder and develop confidence working with 4 digit numbers.

Addition Year 5

Missing number/digit problems

Whole numbers up to 1 million and decimal numbers.

Missing digits problems within the column method, including where there are multiple possible solutions.



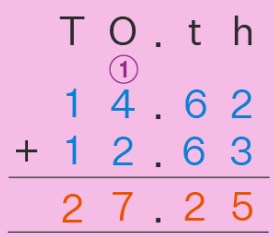
Mental methods

Should continue to develop and become more fluent with increasingly large numbers. (See previous years for supporting models).

12 462 + 2 300 = (12000 + 2000) + (462+ 300) = 14 762

Written methods

Formal column addition



Securing confidence in working with numbers up to 1 000 000 and applying the same method to add decimal numbers.

(Place value counters and dienes may continue to be used alongside the column method to support those less confident.)

Problem solving

Addition (and subtraction) is applied to a range of multi-step problems in varying contexts. A range of concrete objects and visual representations are used to secure understanding.

Addition Year 6

Missing number/digit problems

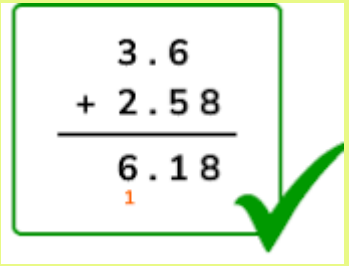
Whole numbers up to 1 million and decimal numbers.

Mental methods

Should continue to develop, supported by a range of models and images including, the number line (see Y4/5).

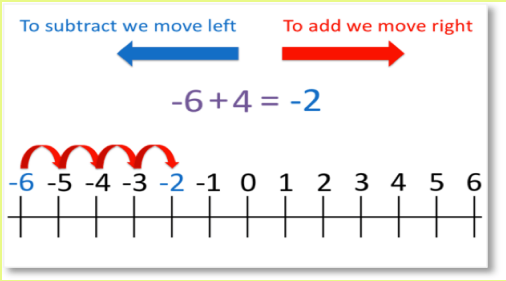
Written methods

As Year 4/5, progressing to larger numbers, aiming for both conceptual understanding and procedural fluency with columnar method to be secured. Continue with calculating with decimals, including those with a different number of decimal places.



Problem solving

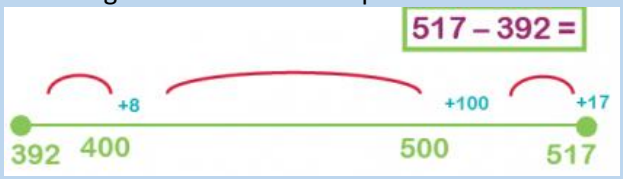
Addition (and subtraction) is applied to a range of multi-step problems in varying contexts, including negative numbers, decimals and mixed numbers. A range of concrete objects and visual representations are used to secure understanding.



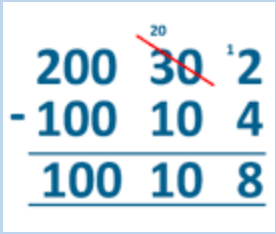
Subtraction Year 4

Range of missing number/digit problems e.g.
456 + … = 710 60 +99 + … = 340
225- …. = 150 … - 25 = 67 … - 2000 = 900

Mental strategies including understanding the inverse - it can be more efficient to 'add on' to solve subtractions. Supported by empty number line. Rounding to the nearest multiple of 10.



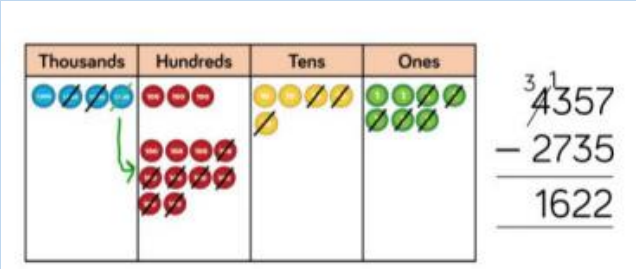
Written methods



Expanded column subtraction (also see Year 3)
Progressing to calculations with 4-digit numbers.

Formal column subtraction

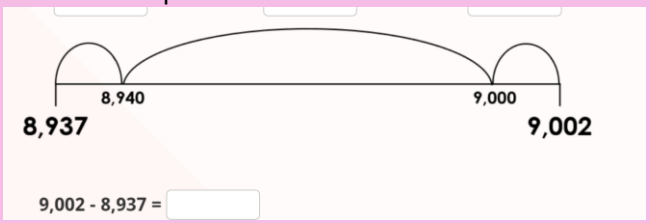
Column subtraction modelled with place value counters to support understanding. Children should be confident working with 4-digit numbers by the end of Year 4.



Subtraction Year 5

Missing number/digit problems
Whole numbers up to 1 million and decimal numbers.
1 000 000 – ……. = 999 009 6.45 = 6 + 0.4 + …..
600 000 + ……. + 1000= 671 000

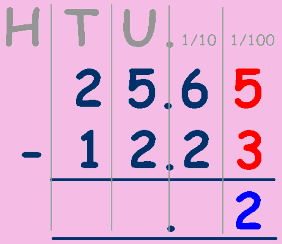
Mental strategies
Supported by empty number line. Rounding to the nearest multiple of 10.



Adjusting e.g.
34 600 – 2 490 = (round to 2 500)
34 600 – 2 500 = 32 100
32 100 + 10 = 32 110 (adjust back by adding 10)

Written methods
Formal column subtraction

Increasing confidence in working with numbers up to 1 000 000 and applying the same method to decimal numbers.



(Place value counters and dienes may continue to be used alongside the column method to support those less confident.)

Problem solving
Subtraction is applied to a range of multi-step problems in varying contexts.

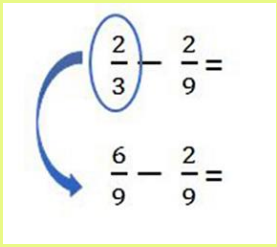
Subtraction Year 6

Missing number/digit problems
Whole numbers up to 1 million and decimal numbers. Problems represented in different ways e.g. number pyramids.

Mental strategies
Should continue to develop, supported by a range of models and images including, the number line (see Y4/5).

Written methods
As Year 4/5 (see models), progressing to larger numbers, aiming for both conceptual understanding and procedural fluency with columnar method to be secured. Continue with calculating with decimals (including those with a different number of decimal places e.g. 3.45 - 9.496).

Problem solving



Subtraction is applied to a range of multi-step problems in varying contexts, including negative numbers, decimals, fractions and mixed numbers.

Multiplication Year 4

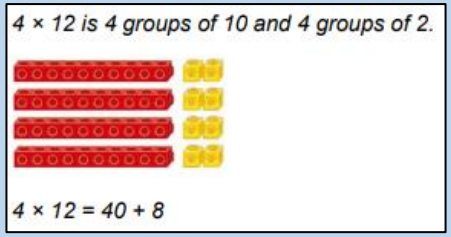
Pupils should be able to recall multiplication and division facts for multiplication tables up to 12 × 12

Mental methods

Counting in multiples of 6, 7, 9, 25 and 1000, and steps of 1/100. recognise and use factor pairs and commutativity in mental calculations

use place value, known and derived facts to multiply and divide mentally, including:

multiplying by 0 and 1; dividing by 1; multiplying together three numbers.



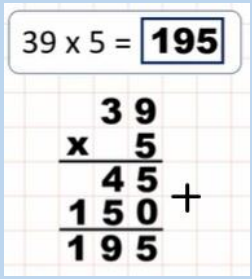
Concrete – Partitioning to make multiples

Written methods (progressing to 3 digit x 2 digit)

multiply two-digit and three-digit numbers by a one-digit number.

Grid Method used as in Y3.

Expanded Long multiplication (Column method) is used to multiply place value which are then added together to find the final total.



Division is used as an inverse operation to check answers.

Confident learners are able to use short multiplication methods.

Multiplication Year 5

Pupils are familiar with short multiplication and develop their use of Long multiplication to solve 3 digit and four digits by a 2 digit number.

Short multiplication

24 × 6 becomes

$$\begin{array}{r} 24 \\ \times\ 6 \\ \hline 144 \\ \scriptstyle 2 \end{array}$$

Answer: 144

342 × 7 becomes

$$\begin{array}{r} 342 \\ \times\ 7 \\ \hline 2394 \\ \scriptstyle 21 \end{array}$$

Answer: 2394

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

Long multiplication

24 × 16 becomes

$$\begin{array}{r} \scriptstyle 2 \\ 24 \\ \times\ 16 \\ \hline 240 \\ 144 \\ \hline 384 \end{array}$$

Answer: 384

Multiplication Year 6

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

2741 × 6 becomes

$$\begin{array}{r} 2741 \\ \times\ 6 \\ \hline 16446 \\ \scriptstyle 42 \end{array}$$

Answer: 16 446

124 × 26 becomes

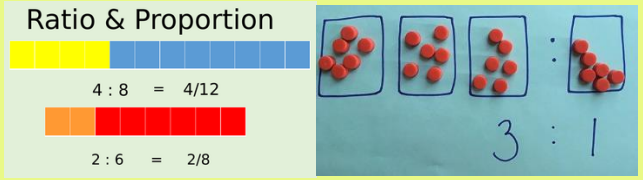
$$\begin{array}{r} \scriptstyle 12 \\ 124 \\ \times\ 26 \\ \hline 744 \\ 2480 \\ \hline 3224 \\ \scriptstyle 11 \end{array}$$

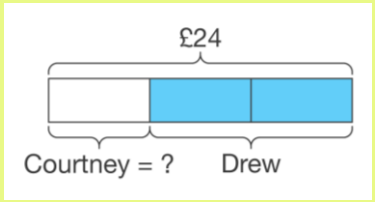
Answer: 3224

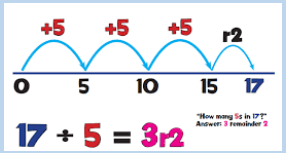
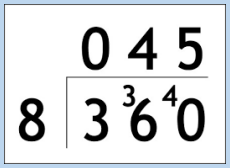
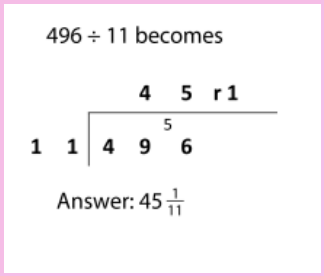
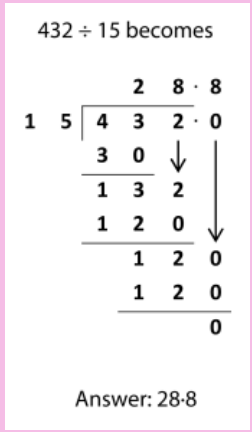
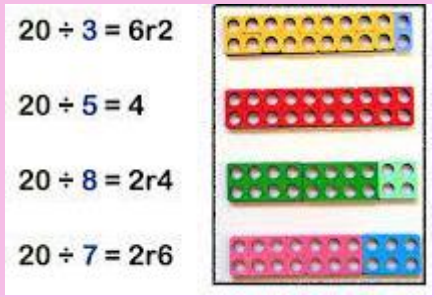
Ratio and proportion

Solve problems involving the relative sizes of two quantities where missing values

can be found by using integer multiplication and division facts. A range of concrete objects and pictorial models are used to apply these to problems.





Division Year 4	Division Year 5	Division Year 6
÷ = signs and missing numbers Sharing, Grouping and using a number line and/or chunking. Children will continue to explore division as sharing and grouping, and to represent calculations on a number line or through chunking until they have a secure understanding.  Both the number line and the chunking methods 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) Written method for short multiplication continued from Year 3 with appropriate numbers.  Decimal numbers are introduced to understand fractions and their place value. Pupils explore the relationship of decimals and can divide by 10 and 100 into decimal numbers.	÷ = signs and missing numbers Sharing, Grouping and using a number line and/or chunking.   Concrete and pictorial methods continue to be used throughout UKS2 to represent division, including using remainders and converting these to fractions and decimals.  	÷ = 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 and /or chunking as appropriate. <u>Written methods:</u> Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long and short division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context.