Calculation Policy for Mathematics

Federated Primary Schools

How we teach calculations

March 2015

About our 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. Please note that early learning in number and calculation in Reception follows the 'Development Matters' EYFS document, and this calculation policy is designed to build on progressively from the content and methods established in the Early Years Foundation Stage.

Age stage expectations

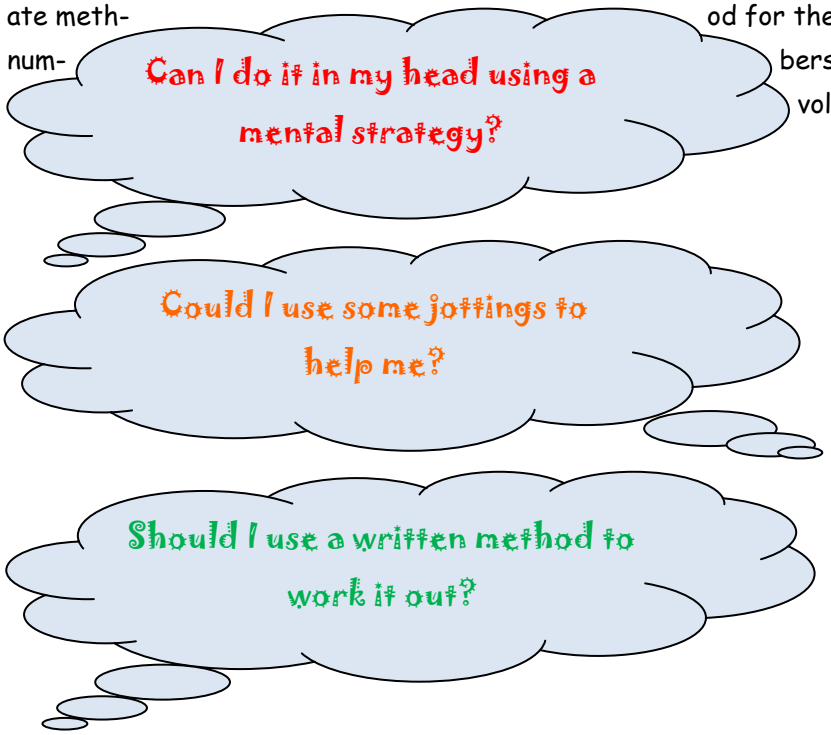
The calculation policy is organised according to age stage expectations as set out in the National Curriculum 2014, **however it is vital that pupils are taught according to the stage that they are currently working at,** being moved onto the next level as soon as they are ready, or working at a lower stage until they are secure enough to move on.

Providing a context for calculation:

It is important that, after any type of calculation has been taught, children are given a range of opportunities to apply these skills in real life meaningful contexts and problem solving activities. (Making purposeful links to other areas of the curriculum where appropriate.) This will help build children's understanding of the purpose of calculation, and to help them recognise when to use certain operations and methods. Children should be able to explain how they have solved the problem/calculation and estimate whether their answer is likely to be correct (reasoning).

Choosing a calculation method:

Children need to be taught and encouraged to use the following processes in deciding what approach they will take to a calculation, to ensure they select the most appropriate method for the numbers involved:



Year 1-6
To work out a tricky calculation:
Approximate.
More formally in + - from year 3.
Calculate.
Check it mate!
Explain whether answer is reasonable and why.

Addition

Reception

Reception addition should be taught through play as much as possible and using practical objects. Any directed teaching should be reinforced through own learning time and the environment should provide opportunities for the children to practice what they have learnt.

- Count objects saying 1 name for each object
- Count the total number of objects
- Count one more using objects
- Count/add objects/pictures that don't move
- Draw their own pictures to solve an addition problem
- Count forwards and backwards on a number track
- Using head and finders-put the largest number in your head and count on using your fingers.

Year 1 Add with numbers up to 20

(When the children are secure counting forwards and backwards using number tracks within the context of games they would then move on to using number lines.)

Use numbered number lines to add, by counting on in ones. Encourage children to start with the **larger** number and count on.

Children should:

- Have access to a wide range of counting equipment, everyday objects, number tracks and number lines, and be shown numbers in different contexts.
- Read and write the addition (+) and equals (=) signs within number sentences.
- Interpret addition number sentences and solve missing box problems, using concrete objects and number line addition

  8 + 3 = ☐ 15 + 4 = ☐ 5 + 3 + 1 = ☐ ☐ + ☐ = 6

This builds on from prior learning of adding by combining two sets of objects into one group (5 cubes and 3 cubes) in Early Years by counting on, as opposed to counting all.

- Number facts to 20

Addition

Year 1

8+5=

Bead strings or bead bars can be used to illustrate addition including bridging through ten by counting on 2 then counting on 3.

The children also need to be introduced to the concepts of

- Reordering numbers

5+9= becomes 9+5=

- Bridging 10

9+5 becomes 9+1+4=

- Compensating

8+9= becomes 8+10-1=

- Near doubles

8+9= becomes 8+8+1=

- Using knowledge of pairs to 10

17+3= becomes 7+3+10=

These concepts need to be revisited and increased in challenge at every stage of calculation.

Key vocabulary: *add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line*

Key skills for addition at Y1:

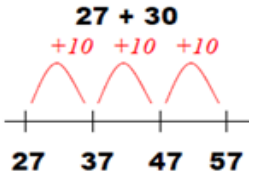
- Read and write numbers to 100 in numerals, incl. 1—20 in words
- Recall bonds to 10 and 20, and addition facts within 20
- Count to and across 100
- Count in multiples of 1 2, 5 and 10
- Solve simple 1-step problems involving addition, using objects, number lines and pictorial representations.

Addition

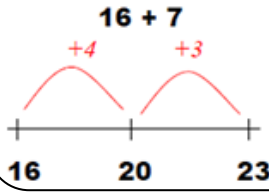
Year 2 Add with 2-digit numbers

Developing mental fluency with addition and place value involving 2-digit numbers, then establish more formal methods.

Add 2-digit numbers and tens:



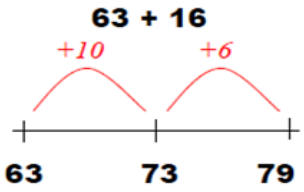
Add 2-digit numbers and units:



Partition the 7 to get to the next multiple of 10 first.

Use empty number lines, concrete equipment, hundred squares etc.

Add pairs of 2-digit numbers, moving to the partitioned column method when secure adding tens and units:



34+23=

30+20=50

4+3=7

50+7=57

STEP 1: Only provide examples that do **NOT** cross the tens boundary until they are secure with the method itself.

STEP 2: Once children can add a multiple of ten to a 2-digit number mentally (e.g. 80+11), they are ready for adding pairs of 2-digit numbers that DO cross the tens boundary (e.g. 58 + 43).

38+26=

30+20=50

8+6=14

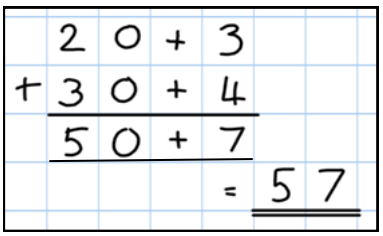
50+10+4=64

Addition

Year 2 Progressing to column methods

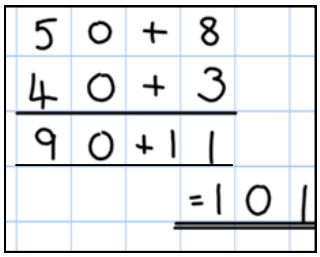
Not crossing 10s boundary

23 + 34:



Crossing 10s boundary

58 + 43:



To support understanding, pupils may physically make and carry out the calculation with Dienes Base 10 apparatus or place value counters, then compare their practical version to the written form, to help them to build an understanding of it.

Key vocabulary:

add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, addition, column, tens boundary

Key skills for addition at Y2:

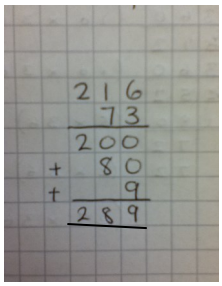
- Add a 2-digit number and ones (e.g. 27 + 6)
- Add a 2-digit number and tens (e.g. 23 + 40)
- Add pairs of 2-digit numbers (e.g. 35 + 47)
- Add three single-digit numbers (e.g. 5 + 9 + 7)
- Show that adding can be done in any order (the commutative law).
- Recall bonds to 20 and bonds of tens to 100 (30 + 70 etc.)
- Count in steps of 2, 3 and 5 and count in tens from any number.
- Understand the place value of 2-digit numbers (tens and ones)
- Compare and order numbers to 100 using < > and = signs.
- Read and write numbers to at least 100 in numerals and words.

Addition

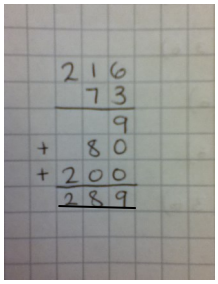
Year 3 Add numbers with up to 3-digits

Introduce the **expanded column addition** method:

A



B



Start with method A, adding with the hundreds numbers first and move rapidly on to method B, adding the units first, in preparation for the compact method.

In order to carry out this method of addition:

- Children need to recognise the value of the hundreds, tens and units without recording the partitioning.
- Pupils need to be able to add in columns.

Move to the compact **column addition** method, with 'carrying':

Add **units** first.

'Carry' numbers **underneath** the bottom line.

```
  236
+  73
  309
   1
```

Children who are very secure and confident with 3-digit expanded column addition should be moved onto the **compact column addition** method, being introduced to 'carrying' for the first time. Compare the expanded method to the compact column method to develop an understanding of the process and the reduced number of steps involved.

Remind pupils the actual value is '**thirty add seventy**', but we say '**three tens add seven tens**'.

Key vocabulary: *add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary,* ***hundreds boundary, increase, vertical, 'carry', expanded, compact***

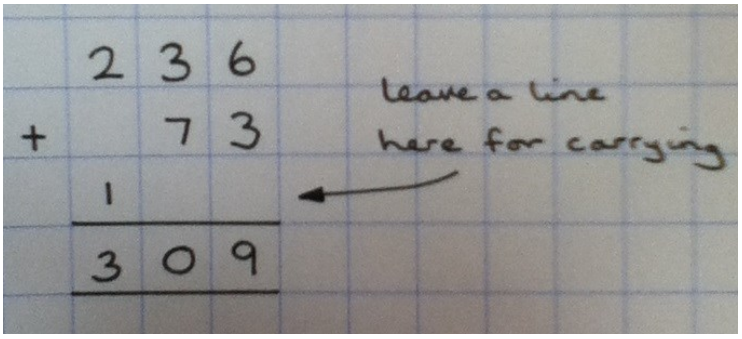
Key skills for addition at Y3:

- Read and write numbers to 1000 in numerals and words.
- Add 2-digit numbers mentally, incl. those exceeding 100.
- **Add a three-digit number and ones mentally (175 + 8)**
- **Add a three-digit number and tens mentally (249 + 50)**
- **Add a three-digit number and hundreds mentally (381 + 400)**
- Estimate answers to calculations, using inverse to check answers.
- Solve problems, including missing number problems, using
- number facts, place value, and more complex addition.
- Recognise place value of each digit in 3-digit numbers (hundreds, tens, ones.)
- Continue to practise a wide range of mental addition strategies, ie. number bonds, adding the nearest multiple of 10, 100, 1000 and adjusting, using near doubles, partitioning and recombining.

Addition

Year 3 Add numbers with up to 3-digits

If a child is forgetting to add the numbers that they have carried, the compact method will be adapted as follows.



The children will need to leave a line underneath the question, So that there is space to store the numbers that have been carried.

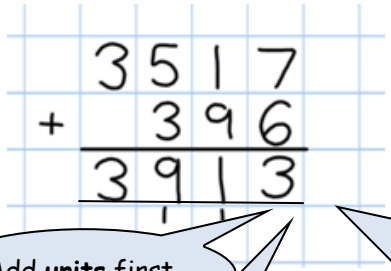
PLEASE NOTE : This method may also be used by children when adding larger numbers or decimal numbers.

Addition

Year 4 Add numbers with up to 4 digits

Continuing with the compact column method, **adding units first**, and 'carrying' numbers **underneath** the calculation.

e.g. 3517 + 396 = 3913



Continue the **compact column addition** method by asking children to add the two given numbers together using the method that they are familiar with (expanded column addition—see Y3).

Add **units** first.

'Carry' numbers **underneath** the bottom line.

Reinforce correct place value by reminding them the actual value is 5 hundreds add 3 hundreds, **not 5 add 3**, for example.

Key vocabulary: *add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary, hundreds boundary, increase, vertical, 'carry', expanded, compact,* ***thousands, hundreds, digits, inverse***

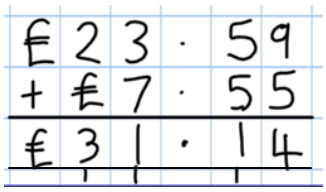
Key skills for addition at Y4:

- Select most appropriate method: mental, jottings or written and explain why.
- Recognise the place value of each digit in a four-digit number.
- Round any number to the nearest 10, 100 or 1000.
- Estimate and use inverse operations to check answers.
- Solve 2-step problems in context, deciding which operations and methods to use and why.
- Find 1000 more or less than a given number.
- Continue to practise a wide range of mental addition strategies, ie. number bonds, add the nearest multiple of 10, 100, 1000 and adjust, use near doubles, partitioning and recombining.
- Add numbers with up to 4 digits using the formal written method of column addition
- Solve 2-step problems in contexts, deciding which operations and methods to use and why.
- Estimate and use inverse operations to check answers to a calculation.

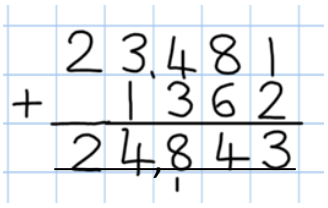
Addition

Year 5 Add numbers with more than 4 digits

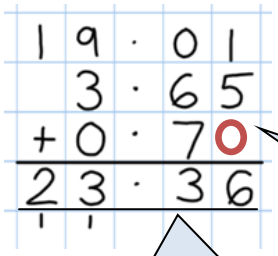
including money, measures and decimals with different numbers of decimal places.



The decimal point should be aligned in the same way as the other place value columns, and must remain in the same column in the answer row.



Numbers should exceed 4 digits.



Pupils should be able to add **more than two values**, carefully aligning place value columns.

Empty decimal places can be filled with zero to show the place value in each column.

Say '6 tenths add 7 tenths' to reinforce place value.

Children should:

- Understand the place value of **tenths and hundredths** and use this to align numbers with different numbers of decimal places.

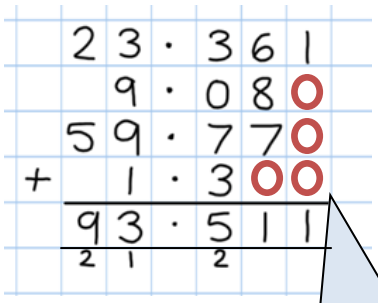
Key vocabulary: *add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary, hundreds boundary, increase, 'carry', expanded, compact, vertical, thousands, hundreds, digits, inverse &* ***decimal places, decimal point, tenths, hundredths, thousandths***

Key skills for addition at Y5:

- Add numbers mentally with increasingly large numbers, using and practising a range of mental strategies ie. add the nearest multiple of 10, 100, 1000 and adjust; use near doubles, inverse, partitioning and re-combining; using number bonds.
- Use rounding to check answers and accuracy.
- Solve multi-step problems in contexts, deciding which operations and methods to use and why.
- Read, write, order and compare numbers to at least 1 million and determine the value of each digit.
- Round any number up to 1, 000, 000 to the nearest 10, 100, 1000, 10,000 and 100,000.
- Add numbers with more than 4 digits using formal written method of columnar addition.

Addition

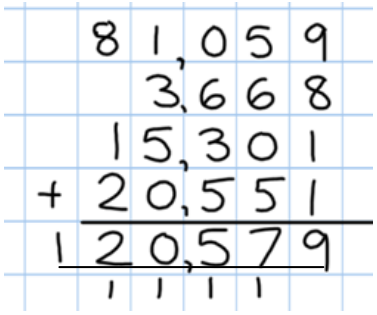
Year 6 Add several numbers of increasing complexity



Empty decimal places should be filled with zero to show the place value in each column.

Adding several numbers with different numbers of decimal places (including money and measures):

- Tenths, hundredths and thousandths should be correctly aligned, with the decimal point lined up vertically including in the answer row.



Adding several numbers with more than 4 digits.

Commas will be used in numbers that have 5 digits or more however children will be familiar with texts and resources that do not have commas.

Key vocabulary: *add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary, hundreds boundary, increase, 'carry', expanded, compact, vertical, thousands, hundreds, digits, inverse, decimal places, decimal point, tenths, hundredths, thousandths*

Key skills for addition at Y6:

- Perform mental calculations, including with mixed operations and large numbers, using and practising a range of mental strategies.
- Solve multi-step problems in context, deciding which operations and methods to use and why.
- Use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy.
- Read, write, order and compare numbers up to 10 million and determine the value of each digit.
- Round any whole number to a required degree of accuracy.
- Pupils understand how to add mentally with larger numbers and calculations of increasing complexity.

Subtraction

Reception

Reception subtraction should be taught through play as much as possible and using practical objects. Any directed teaching should be reinforced through own learning time and the environment should provide opportunities for the children to practice what they have learnt.

- Count objects saying 1 name for each object
- Count one less using objects
- Count out up to 6 objects from a larger group
- Count/add objects/pictures that don't move
- Draw their own pictures to solve an addition problem
- Count forwards and backwards on a number track
- Using head and fingers-put the largest number in your head and count back using your fingers.

Year 1

Subtract from numbers up to 20

Children consolidate understanding of subtraction practically, showing subtraction on bead strings, using cubes etc. and in familiar contexts, and are introduced to more formal recording using number lines as below:

Subtraction

Year 1 Subtract from numbers up to 20

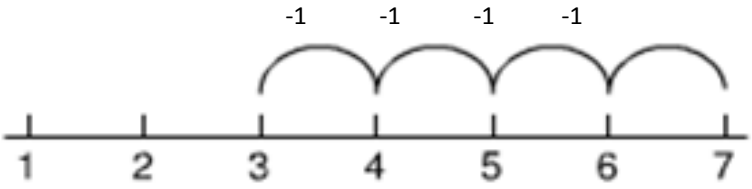
Children consolidate understanding of subtraction practically, showing subtraction on bead strings, using cubes etc. and in familiar contexts, and are introduced to more formal recording using number lines as below:

Read, write and interpret number sen-

Subtract by taking away

Count back in ones on a numbered number line to take away, with numbers up to 20:

Introduce a variety of language of takeaway including difference between.



$7 - 4 = 3$

Model subtraction using hundred squares and numbered number lines/tracks and prac-

Mental subtraction

Children should start recalling subtraction facts up to **and within** 10 and 20, and should be able to subtract zero and recognise links with addition facts.

The children also need to be introduced to the concepts of

- Reordering numbers — 5-9= should be 9-5= and why 5-9 doesn't work
- Bridging 10 — 12-5 becomes 12-2-3=
- Compensating — 18-9= becomes 18-10+1=

These concepts need to be revisited and increased in challenge at every stage of calculation.

Key vocabulary: *equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back , how many left, how much less is_?*

Key skills for subtraction at Y1:

- Given a number, say **one more or one less**.
- Count to and over 100, **forward and back**, from any number.
- Represent and use **subtraction facts to 20 and within 20**.
- Subtract with **one-digit and two-digit** numbers to 20, including zero.
- Solve one-step problems that involve addition and subtraction, using concrete objects (ie bead string, objects, cubes) and pictures, and missing number problems.
- Read and write numbers from 0 to 20 in numerals and words.

Subtraction

Year 2 Subtract with 2-digit numbers

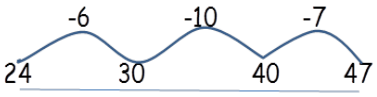
Subtract on a number line by counting back.

This strategy will be used for:

- **2-digit numbers subtract units** (by taking away / counting back) e.g. 36—4Not crossing tens boundary
- **2-digit numbers subtract tens** (by taking away / counting back) e.g. 48—30
- **Subtracting a 2-digit number from a 2 digit number** (see below:)

Subtracting pairs of 2-digit numbers on a number line:

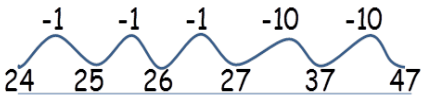
47-23=24



47-23=

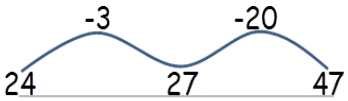
Jump to the nearest 10 then count in 10s.
Subtract the remaining units at the end.

47-23=24



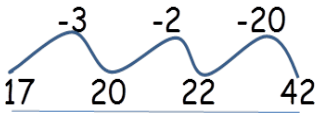
Subtract the 10s first then the units

47-23=24



Move to more efficient jumps, grouping 10s

42-25=17



Begin bridging through 10

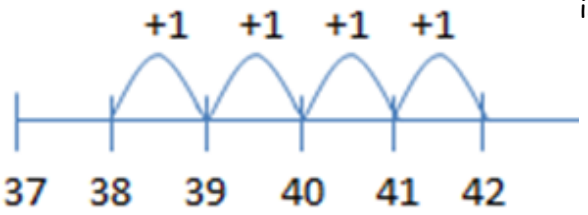
Subtraction

Year 2

Mental strategy - subtract numbers close together by **counting on:**

Many mental strategies are taught. Children are taught to recognise that when numbers are close together, it is more efficient to **count on** the difference. They need to be clear about the relationship between addition and subtraction because 38+4=42.

- $42 - 38 = 4$
- Counting on al r subtraction where number ing up on a number line.



Subtraction of 2 and 3-digit numbers (**introduction of partitioned column subtraction**)

Step 1 A
Partition the tens and units and subtract as a number sentence
89-35=
80-30=50
9-5=4
50+4=54
Only when there is NO bridging 10

Step 1B
Condense this step by subtracting all of the tens from the first number then the units.
89-35=
89-30=59
59-5=54

Step 2
Move towards more standard method. Introduce this method with examples where no exchanging is required.

89 - 35 = 54

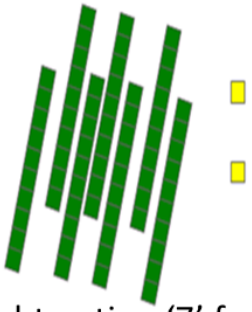
80 + 9
-30 + 5
50 + 4

Subtraction

60 1
~~70~~ + 2
-40 + 7
20 + 5 =
25

Step 3
Introduce 'exchanging' through practical subtraction. Make the larger number with Base 10, then subtract 47 from it.

72 - 47



Before subtracting '7' from the 72 blocks, they will need to exchange a row of 10 for ten units. Then subtract 7, and subtract 4 tens.

When learning to 'exchange', explore 'partitioning in different ways' so that pupils understand that when you exchange, the **VALUE** is the same ie **72** = 70+2 = 60+12 = 50+22 etc. Emphasise that the **value hasn't changed**, we have just partitioned it in a different way. Use lots of practical equipment to ensure good understanding of exchange, including dienes, place value counters, groups of straws, counters etc.

Key vocabulary: *equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back , how many left, how much less is_? **difference, count on, strategy, partition, tens, units***

Key skills for subtraction at Y2:

- Recognise the place value of each digit in a two-digit number.
- Recall and use subtraction facts to 20 fluently, and derive and use related facts up to 100.
- Subtract using concrete objects, pictorial representations, 100 squares and mentally, including: a two-digit number and ones, a two-digit number and tens, and two two-digit numbers.
- Show that subtraction of one number from another cannot be done in any order.
- Recognise and use inverse relationship between addition and subtraction, using this to check calculations and missing number problems.
- Solve simple addition and subtraction problems including measures, using concrete objects, pictorial representation, and also applying their increasing knowledge of mental and written methods.
- Read and write numbers to at least 100 in numerals and in words.

Subtraction

Year 3

Subtracting with 2 and 3-digit numbers with no exchange.

Introduce **partitioned column subtraction** method.

Step 3

Introduce 'exchanging' through practical subtraction. Make the larger number with Base 10, then

72 - 47

$$\begin{array}{r} {}^{60}\cancel{70} + {}^{1}2 \\ -\ 40 + 7 \\ \hline 20 + 5 \quad = \mathbf{25} \end{array}$$

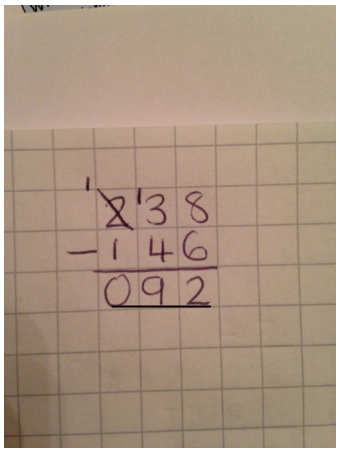
Before subtracting '7' from the 72 blocks, they will need to exchange a row of 10 for ten units. Then subtract 7, and subtract 4 tens.

When learning to 'exchange', explore 'partitioning in different ways' so that pupils understand that when you exchange, the **VALUE** is the same ie **72** = 70+2 = 60+12 = 50+22 etc. Emphasise that the **value hasn't changed**, we have just partitioned it in a different way.

Use lots of practical equipment to ensure good understanding of exchange, including dienes, place value counters, groups of straws, counters etc.

Step 4

Introduce standard method using 3 digit numbers



Approximate,

Calculate,

Check it mate!

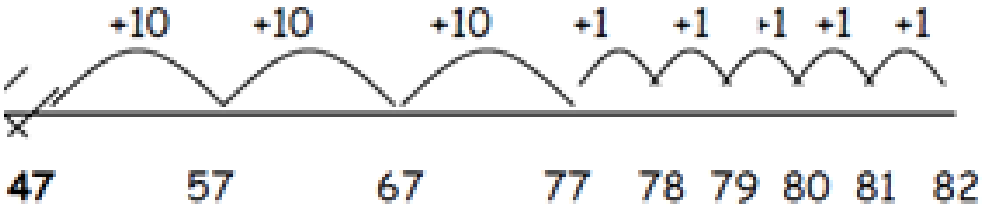
Subtraction

Year 3

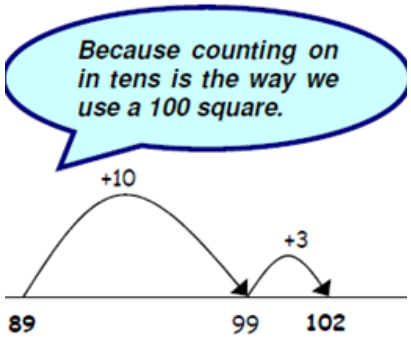
Counting on as a mental strategy

Continue to reinforce counting on as a strategy for close-together numbers and also for numbers that are nearly multiples of 10, 100 and 1000 of £s,

82-47=



102-89=



Key vocabulary: *equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back , how many left, how much less is_? difference, count on, strategy, partition, tens, units* ***exchange, decrease, hundreds, value, digit***

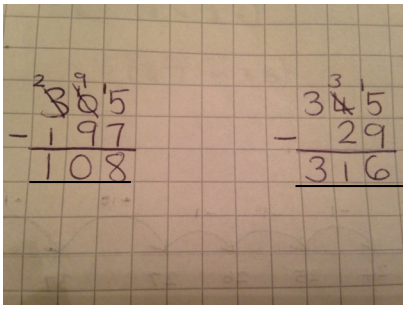
Key skills for subtraction at Y3:

- Subtract mentally a: **3-digit number and ones, 3-digit number and tens, 3-digit number and hundreds** .
- Estimate answers and use inverse operations to check.
- Solve problems, including missing number problems.
- Find 10 or 100 more or less than a given number.
- Recognise the place value of each digit in a 3-digit number .
- Counting up differences as a mental strategy when numbers are close together or near multiples of 10 (see examples above)
- Read and write numbers up to 1000 in numerals and words.
- Practise mental subtraction strategies, such as subtracting near multiples of 10 and adjusting (e.g. subtracting 19 or 21), and select most appropriate methods to subtract, explaining why.

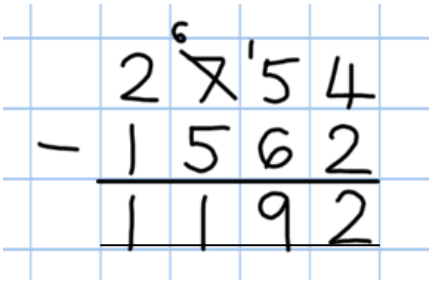
Subtraction

Year 4 Subtract with up to 4-digit numbers

Consolidate subtraction using the standard method using 3 digit numbers and experiment with 0 place holders to ensure understanding.



Introduce 4 digit numbers



Always encourage children to consider the best method for the numbers involved— mental, counting on, counting back or written method.

Mental strategies

A variety of mental strategies must be taught and practised, including counting on to find the difference where numbers are closer together, or where it is easier to count on.

Approximate,
Calculate,
Check it mate!

Key vocabulary: *equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back , how many left, how much less is_? difference, count on, strategy, partition, tens, units exchange, decrease, hundreds, value, digit,* ***inverse***

Key skills for subtraction at Y4:

- Subtract by counting on where numbers are close together or they are near to multiples of 10, 100 etc.
- Children select the most appropriate and efficient methods for given subtraction calculations.
- Estimate and use inverse operations to check answers.
- Solve addition and subtraction 2-step problems, choosing which operations and methods to use and why.
- Solve simple measure and money problems involving fractions and decimals to two decimal places.
- Find 1000 more or less than a given number.
- Count backwards through zero, including negative numbers.
- Recognise place value of each digit in a 4-digit number Round any number to the nearest 10, 100 or 1000
- Solve number and practical problems that involve the above, with increasingly large positive numbers.

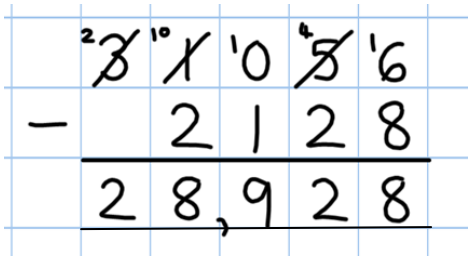
Subtraction

Year 5 Subtract with at least 4-digit numbers

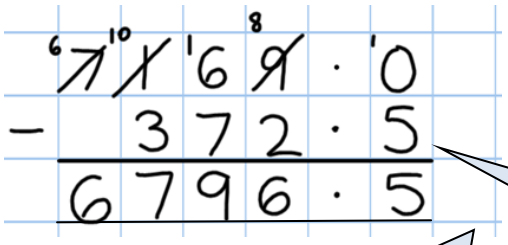
including money, measures, decimals.

Compact column subtraction

(with 'exchanging').



Subtracting with larger integers.



Subtract with decimal values, including mixtures of integers and decimals, aligning the decimal point.

Add a 'zero' in any empty decimal places to aid understanding of what to subtract in that column.

Create lots of opportunities for subtracting and finding differences with money and measures.

Approximate,
Calculate,
Check it mate!

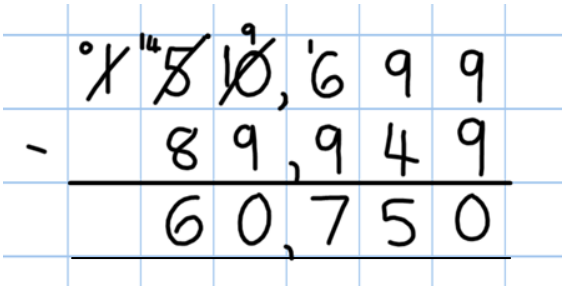
Key vocabulary: *equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back , how many left, how much less is_? difference, count on, strategy, partition, tens, units exchange, decrease, hundreds, value, digit, inverse,* ***tenths, hundredths, decimal point, decimal***

Key skills for subtraction at Y5:

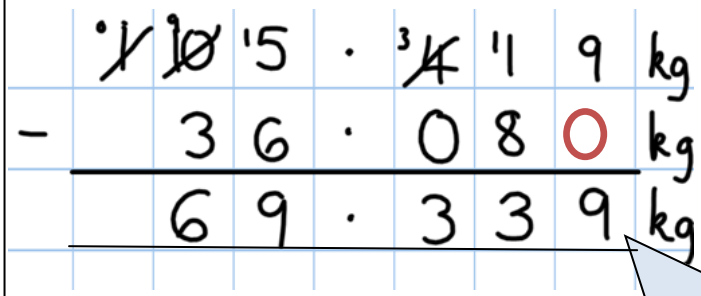
- Subtract numbers mentally with increasingly large numbers .
- Use rounding and estimation to check answers to calculations and determine, in a range of contexts, levels of accuracy .
- Solve addition and subtraction multi-step problems in context, deciding which operations and methods to use and why.
- Read, write, order and compare numbers to at least 1 million and determine the value of each digit.
- Count forwards or backwards in steps of powers of 10 for any given number up to 1 million.
- Interpret negative numbers in context, counting forwards and backwards with positive and negative integers through zero.
- Round any number up to 1 million to the nearest 10, 100, 1000, 10,000 and 100,000.

Subtraction

Year 6 **Subtracting with increasingly large and more complex numbers and decimal values.**



Using the compact column method to subtract more complex integers



Using the compact column method to subtract money and measures, including decimals with different numbers of decimal places.

Empty decimal places can be filled with **zero** to show the place value in each column.

Pupils should be able to apply their knowledge of a range of mental strategies, mental recall skills, and informal and formal written methods when selecting **the most appropriate method** to work out subtraction problems.

Approximate,
Calculate,
Check it mate!

Key vocabulary: *equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back , how many left, how much less is_? difference, count on, strategy, partition, tens, units exchange, decrease, hundreds, value, digit, inverse, tenths, hundredths, decimal point, decimal*

Key skills for subtraction at Y6:

- Solve addition and subtraction multi-step problems in context, deciding which operations and methods to use and why.
- Read, write, order and compare numbers up to 10 million and determine the value of each digit
- Round any whole number to a required degree of accuracy
- Use negative numbers in context, and calculate intervals
- across zero.
- Children need to utilise and consider a range of mental subtraction strategies, jottings and written methods before choosing how to calculate.

Multiplication

Reception

Begin to count in 2s 5s and 10s and remembering double numbers to 5.

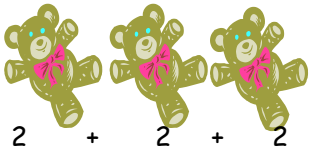
Introduce simple repeated addition using objects and pictures.

Year 1

Multiply with concrete objects, arrays and pictorial representations

Begin with repeated addition then show the correlation with multiplication.

How many legs will 3 teddies have?

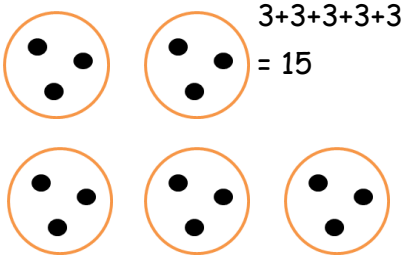


2 + 2 + 2 = 6

3x2=6 (3 teddies with 2 legs each)

2x3=6 (2 legs each and 3 teddies)

There are 3 sweets in one bag.
How many sweets are in 5 bags altogether?



3+3+3+3+3
= 15

5x3=15 (5 groups with 3 in each)

3x5=15 (3 in each group and 5

- Introduce practical arrays
- Introduce using fingers and counting in 2s 5s 10s to solve problems eg 2x7= 7 fingers up and count in 2s

Key vocabulary: *groups of, lots of, times, array, altogether, multiply, count*

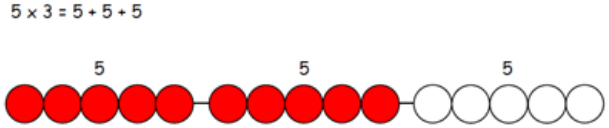
Key skills for multiplication at Y1:

Count in multiples of 2, 5 and 10.
Solve one-step problems involving multiplication, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.
Make connections between arrays, number patterns, and counting in twos, fives and tens.
Begin to understand doubling using concrete objects and pictorial representations.

Multiplication

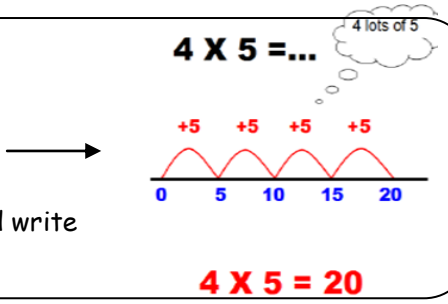
Year 2 Multiply using arrays and repeated addition (using at least 2s, 5s and 10s)

- Begin to formally chant timetables
- Use Bead strings

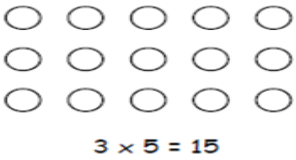


Use repeated addition on a number line:

- Starting from zero, make equal jumps up on a number line to work out multiplication facts and write multiplication statements using x and = signs.



Use arrays:



5 x 3 = 15

5 x 3 = 3 + 3 + 3 + 3 = 15

Use arrays to help teach children to understand the commutative law of multiplication, and give examples such as 3 x ___ = 6.

Use Objects, pictures counters, multilink.

Use mental recall:

- Children should begin to **recall multiplication facts for 2, 5 and 10** times tables through practice in counting and understanding of the operation.

Key vocabulary: *groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times...*

Key skills for multiplication at Y2:

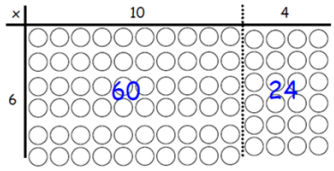
- Count in steps of 2, 3 and 5 from zero, and in 10s from any number.
- Recall and use multiplication facts from the **2, 5 and 10** multiplication tables, including recognising odds and evens.
- Write and calculate number statements **using the x and = signs**.
- Show that multiplication can be done in any order (commutative).
- Solve a range of problems involving multiplication, using concrete objects, arrays, repeated addition, mental methods, and multiplication facts.
- Pupils use a variety of language to discuss and describe multiplication.

Multiplication

Year 3 Multiply 2-digits by a single digit number

Introduce the grid method for multiplying 2-digit by single-digits:

Write the number sentence to show what exactly is happening at each stage.



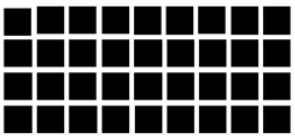
14 x 6 = 84
60 + 24 = 84

23x8=184
23x8=(20x8)+(3x8)

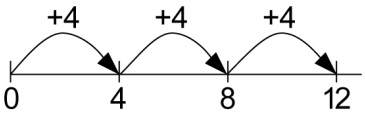
x	8
20	160
3	24
	184

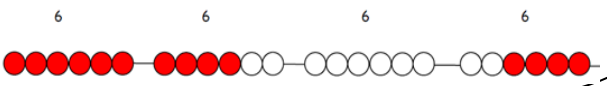
To do this, children must be able to:

- Partition numbers into tens and units
- Multiply multiples of ten by a single digit (e.g. 20 x 4 or 2x4x10, NOT add 0) using their knowledge of multiplication facts and place value
- Recall and work out multiplication facts in the **2, 3, 4, 5, 8 and 10** times tables.
- Work out multiplication facts not known by repeated addition or other taught mental strategies (e.g. by commutative law, working out near multiples and adjusting, using doubling etc.) Strategies to support this are repeated addition using a number line, bead bars and arrays:



9 x 4 = 36





Key vocabulary: *groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times, _times as big as, once, twice, three times…,* ***partition, grid method, multiple, product, tens, units, value***

Key skills for multiplication:

- Recall and use multiplication facts for the **2, 3, 4, 5, 8 and 10** multiplication tables, and multiply multiples of 10.
- Write and calculate number statements using the multiplication tables they know, including **2-digit x single digit**, drawing upon mental methods, and progressing to reliable written methods.
- Solve multiplication problems, including missing number problems.
- Develop mental strategies using commutativity (e.g. 4 x 12 x 5 = 4 x 5 x 12 = 20 x 12 = 240)
- Solve simple problems in contexts, deciding which operations and methods to use.
- Develop efficient mental methods to solve a range of problems e.g using commutativity (**4 × 12 × 5** = 4 × 5 × 12 = **20 × 12** = 240) and for missing number problems □ x 5 = 20, 3 x □ = 18, □ x □ = 32

Multiplication

Year 4 Multiply 2 and 3-digits by a single digit, using all multiplication tables up to 12 x 12

Developing the grid method:
136x5=680
136x5=(5x100)+(5x30)+(5x6)

x	5
100	500
30	150
6	30
	680

Encourage column addition to add accurately.

Move onto **short multiplication** (see Y5) if and when children are confident and accurate multiplying 2 and 3-digit numbers by a single digit this way, **and** are already confident in 'carrying' for written addition.

Children should be able to:

- **Approximate before they calculate**, and make this a regular part of their calculating, going back to the approximation to check the reasonableness of their answer. e.g:

  "346 x 9 is approximately 350 x 10 = **3500"**

  Record an approximation to check the final answer against.

- Multiply multiples of ten and one hundred by a single-digit, using their multiplication table knowledge.
- Recall all times tables **up to 12 x 12**

Approximate,
Calculate,
Check it mate!

Key vocabulary: *groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, array, column, row, commutative, groups of, sets of, lots of, equal groups, times, multiply, times as big as, once, twice, three times... partition, grid method, total, multiple, product, sets of,* ***inverse***

Key skills for multiplication at Y4:

- Count in multiples of 6, 7, 9, 25 and 1000
- Recall multiplication facts for **all multiplication tables up to 12 x 12.**
- Recognise place value of digits in up to 4-digit numbers
- Use place value, known facts and derived facts to multiply mentally, e.g. multiply by 1, 10, 100, by 0, or to multiply 3 numbers.
- Use commutativity and other strategies mentally 3 x 6 = 6 x 3 , 2 x 6 x 5 = 10 x 6 , 39x7 = 30 x 7 + 9 x 7.
- Solve problems with increasingly complex multiplication in a range of contexts.
- Count in multiples of 6, 7, 9, 25 and 1000
- Recognise the place value of each digit in a four-digit number (thousands, hundreds, tens, and units)

Multiplication

Year 5 Multiply up to 4-digits by 1 or 2 digits.

Introducing column multiplication

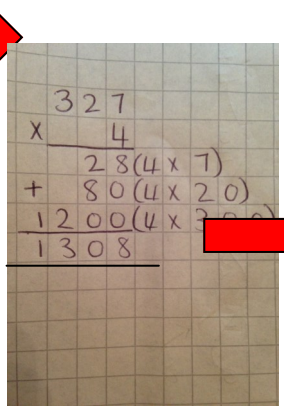
- Introduce by comparing a grid method calculation to a short multiplication method, to see how the steps are related, but notice how there are less steps involved in the column method (see video).
- Children need to be taught to approximate first, e.g. for **72 x 38, they will use rounding: 72 x 38** is approximately 70 x 40 = **2800**, and use the approximation to check the reasonableness of their answer against.

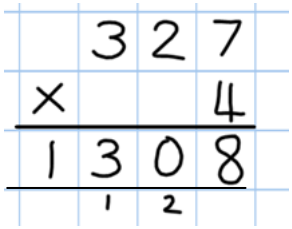
Short multiplication for multiplying by a single digit

327x4=

327x4=(300x4)+(20x4)+(7x4)

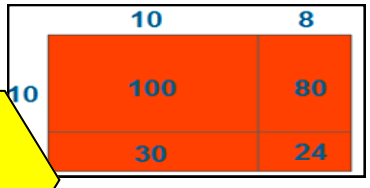
x	4
300	1200
20	80
7	28

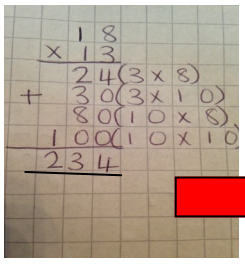


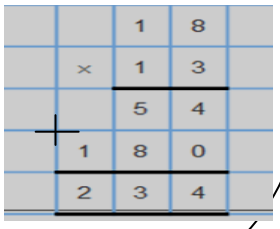


Introduce **long multiplication for multiplying by**

13x18=







Approximate,
Calculate,
Check it mate!

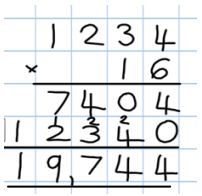
Key vocabulary *groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, _times as big as, once, twice, three times..., partition, grid method, total, multiple, product, inverse,* ***square, factor, integer, decimal, short/long multiplication, 'carry'***

Key skills for multiplication at Y5:

Identify multiples and factors, using knowledge of **multiplication tables to 12x12.**
Solve problems where larger numbers are decomposed into their factors
Multiply and divide integers and decimals by 10, 100 and 1000
Recognise and use square and cube numbers and their notation
Solve problems involving combinations of operations, choosing and using calculations and methods appropriately.

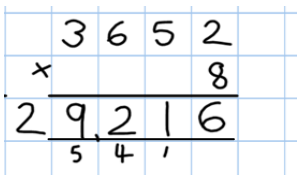
Multiplication

Year 6 Short and long multiplication as in Y5, and multiply decimals with up to 2d.p by a single digit.



(1234 x 6)

(1234 x 10)

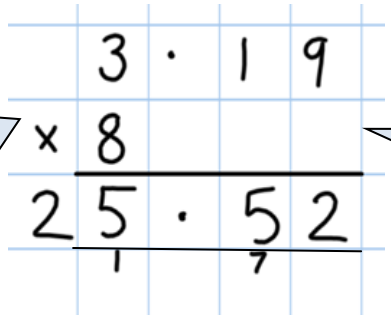


Approximate,

Calculate,

Check it mate!

Remind children that the single digit belongs in the units column.



This works well for multiplying money (£.p) and other measures.

Children will be able to:

- Use rounding and place value to make approximations before calculating and use these to check answers against.
- Use **short multiplication** (see Y5) to multiply numbers with **more than 4-digits by a single digit**; to multiply money and measures, and to **multiply decimals with up to 2d.p. by a single digit**.

Key vocabulary: *groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, array, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times… partition, grid method, total, multiple, product, inverse, square, factor, integer, decimal, short / long multiplication, 'carry',* ***tenths, hundredths, decimal***

Key skills for multiplication at Y6:

- Recall multiplication facts for all times tables up to **12 x 12 (as Y4 and Y5).**
- Multiply multi-digit numbers, up to 4-digit x 2-digit using long multiplication.
- Perform mental calculations with mixed operations and large numbers.
- Solve multi-step problems in a range of contexts, choosing appropriate combinations of operations and methods.
- Estimate answers using round and approximation and determine levels of accuracy.
- Round any integer to a required degree of accuracy.

Division

Reception

Introduce practical concepts of sharing objects and finding half.

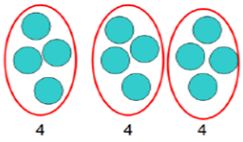
Year 1 Group and share small quantities

Using objects, diagrams and pictorial representations to solve problems involving **both grouping and sharing**.

How many groups of 4 can be made with 12 stars? = **3**

Grouping:

Sharing:



12 shared between 3 is 4

Example division problem in a familiar context:

There are 6 pupils on this table and there are 18 pieces of fruit to share between us. If we share them equally, how many will we

Introduce repeated subtraction and link it to concept of division

12-4-4-4=0 makes 3 groups → 12÷4=3

Pupils should :

- use lots of practical apparatus, arrays and picture representations
- Be taught to understand the difference between 'grouping' objects (How many groups of 2 can you make?) and 'sharing' (Share these sweets between 2 people)
- Be able to count in multiples of 2s, 5s and 10s.
- Find **half** of a group of objects by sharing into 2 equal groups.

Key Vocabulary: *share, share equally, one each, two each…, group, groups of, lots of, array*

Key number skills needed for division at Y1:

- Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations arrays with the support of the teacher
- Through grouping and sharing small quantities, pupils begin to understand, division, and finding simple fractions of objects, numbers and quantities.
- They make connections between arrays, number patterns, and counting in twos, fives and tens.

Division

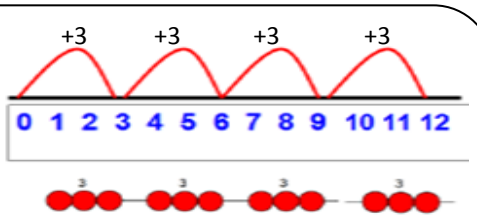
Year 2 Group and share, using the ÷ and = sign

Use objects, arrays, diagrams and pictorial representations, and grouping on a number line.

Develop an understanding of the relationship between x and ÷ and use multiplication facts to solve division problems.

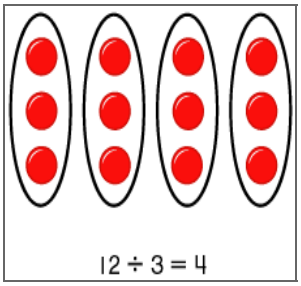
Grouping using a number line:

Group from zero in equal jumps of the divisor to find out 'how many groups of _ in _ ?'. Pupils could use a number line and a bead string or other practical apparatus to work out problems like 'A CD costs £3. How many CDs can I buy with £12?' **This is an important method to develop understanding of division as grouping.**



12 ÷ 3 = 4

Arrays:



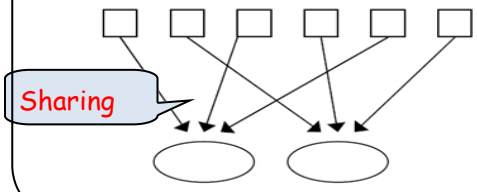
This represents **12 ÷ 3, posed as**
how many groups of 3 are in 12?

Pupils should also show that the same array can represent **12 ÷ 4 = 3** if grouped horizontally.

Children should be taught to recognise whether problems require sharing or grouping.

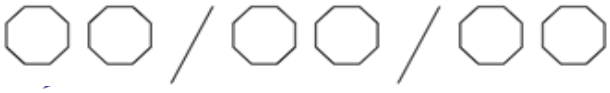
Know and understand sharing and grouping:

6 sweets shared between 2 people, how many do they each get?



Grouping

There are 6 sweets, how many people can have 2 sweets each?



Pose **12 ÷ 3** as '**How many groups of 3 are in 12?**'

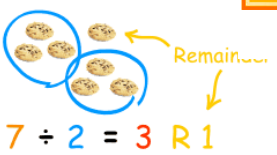
Key Vocabulary: *share, share equally, one each, two each…, group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over*

Key number skills needed for division at Y2:

- Count in steps of 2, 3, and 5 from 0
- Recall and use multiplication and division facts for the **2, 5 and 10** multiplication tables, including recognising odd and even numbers.
- Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the x, ÷ and = signs.
- Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot.
- Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.

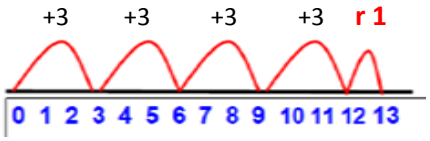
Division

Year 3 Divide 2-digit numbers by a single digit



Grouping on a number line:

13 ÷ 3 = 4 r 1

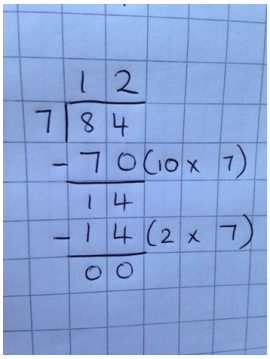


Children continue to work out unknown division facts by grouping on a number line from zero. They are also now taught the concept of **remainders,** as in the example. This should be introduced practically and with arrays, as well as being translated to a number line. Children should work towards calculating some basic division facts with remainders mentally for the 2s, 3s, 4s, 5s, 8s and 10s, ready for 'carrying' remainders across within the short division method.

Real life contexts need to be used routinely to help pupils gain a full understanding, and the ability to recognise the place of division and how to apply it to problems.

84÷7=

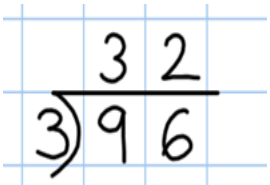
Chunking method



We, and the Cheshire consultant, believe that chunking is the best method for division because it helps the children understand what is going on in the calculation. However the national curriculum says that the children need to be moving towards formal methods from year 3 so we will teach the chunking method **alongside** the formal methods.

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

96÷3=(90÷3)+(6÷3)



Division

Short division: Limit numbers to NO remainders in the final answer, but with remainders occurring within the calculation to be carried to the next digit.

$$4\overline{)7^{3}2}\quad 18$$

Once children demonstrate a full understanding of remainders, and also the short division method taught, they can be taught how to use the method when remainders occur within the calculation (e.g. 96÷4), and be taught to 'carry' the remainder onto the next digit. **If needed, children should use the number line to work out individual division facts that occur which they are not yet able to recall mentally.**

Only taught when pupils can calculate '**remainders**'.

Key Vocabulary: *share, share equally, one each, two each…, group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over,* ***inverse, short division, 'carry', remainder, multiple***

Key number skills needed for division at Y3:

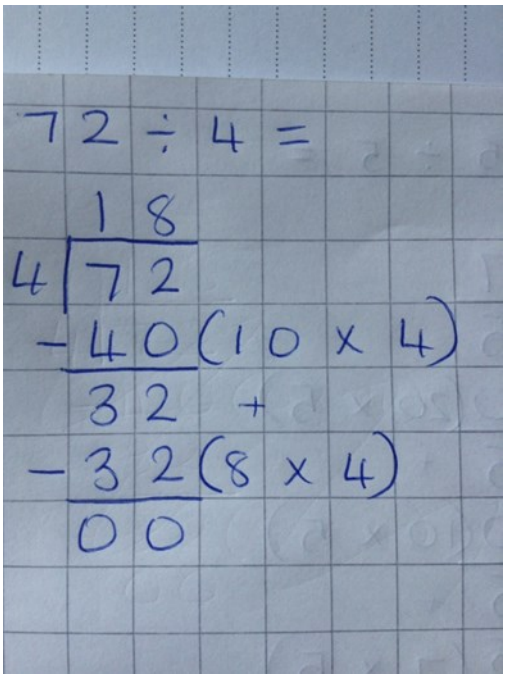
- Recall and use multiplication and division facts for the 2, 3, 4, 5, 8 and 10 multiplication tables (through doubling, connect the 2, 4 and 8s).
- Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods.
- Solve problems, in contexts, and including missing number problems, involving multiplication and division.

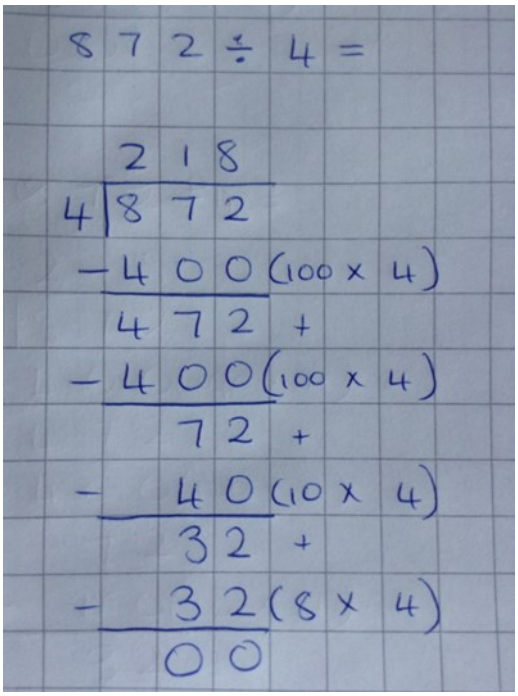
Real life contexts need to be used routinely to help pupils gain a full understanding, and the ability to recognise the place of division and how to apply it to problems.

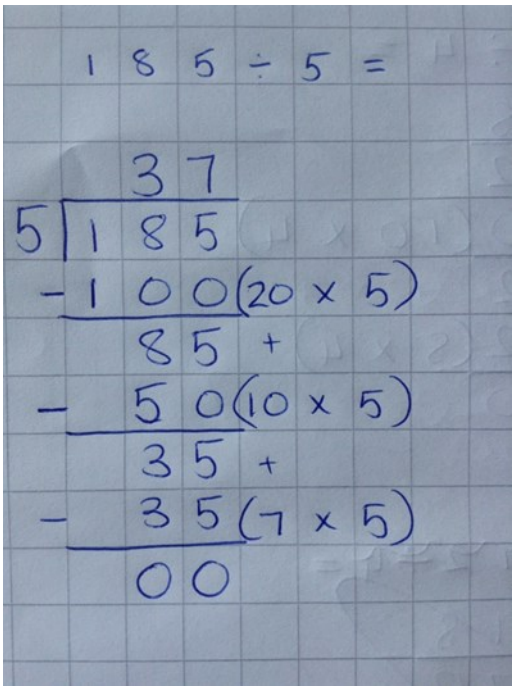
Year 4 Divide up to 3-digit numbers by a single digit

(without remainders initially)

Chunking Method







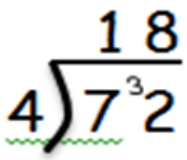
Division

Year 4 Divide up to 3-digit numbers by a single digit

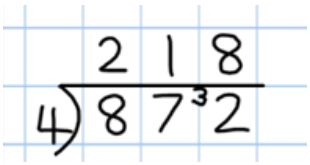
(without remainders initially)

Continue to develop short division:

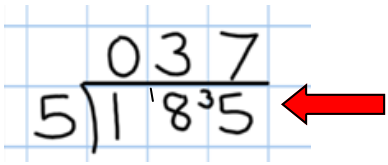
Short division should only be taught once children have secured the skill of calculating 'remainders'.



STEP 1: Pupils must be secure with the process of short division for dividing 2-digit numbers by a single digit (**those that do not result in a final remainder** —see steps in Y3), but must understand how to calculate remainders, using this to 'carry' remainders within the calculation process (see example).



STEP 2: Pupils move onto dividing numbers with up to **3-digits** by a single digit, however problems and calculations provided should **not result in a final answer with remainder** at this stage. Children who exceed this expectation may progress to Y5 level.



When the answer for the **first column** is zero (1 ÷ 5, as in example), children could initially write a zero above to acknowledge its place, and must always 'carry' the number (1) over to the next digit as a remainder.

Include money and measure contexts when confident.

Real life contexts need to be used routinely to help pupils gain a full understanding, and the ability to recognise the place of division and how to apply it to problems.

Key Vocabulary: *share, share equally, one each, two each…, group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, 'carry', remainder, multiple,* ***divisible by, factor***

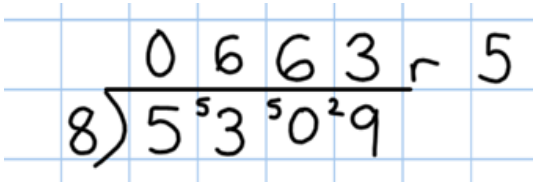
Key number skills needed for division at Y4:

- **Recall multiplication and division facts for all numbers up to 12 x 12.**
- Use place value, known and derived facts to multiply and divide mentally, including: multiplying and dividing by 10 and 100 and 1.
- Pupils practise to become fluent in the formal written method of short division with exact answers when dividing by a one-digit number
- Pupils practise mental methods and extend this to three-digit numbers to derive facts, for example 200 × 3 = 600 so 600 ÷ 3 = 200
- Pupils solve two-step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers. This should include correspondence questions such as three cakes shared equally between 10 children.

Division

Year 5 Divide up to 4 digits by a single digit, including those with remainders.

Short division, including remainder answers:



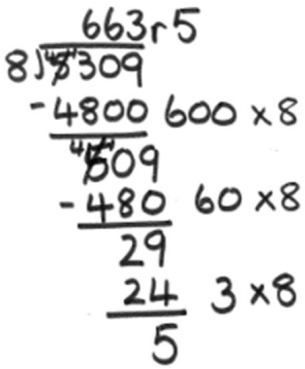
The answer to 5309 ÷ 8 could be expressed as 663 and five eighths, 663 r 5, as a decimal, or rounded as appropriate to the problem involved.

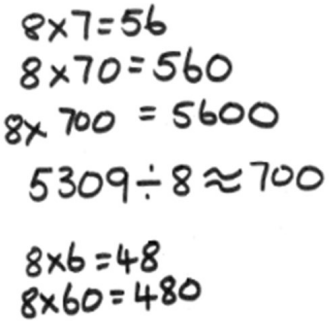
Short division with remainders: Now that pupils are introduced to examples that give rise to remainder answers, division needs to have a real life problem solving context, where **pupils consider the meaning of the remainder and how to express it,** ie. as a fraction, a decimal, or as a rounded number or value , depending upon the context of the problem.

See Y6 for how to continue the short division to give a decimal answer for children who are confident.

Include money and measure contexts.

5309÷8=





Approximate,
Calculate,
Check it mate!

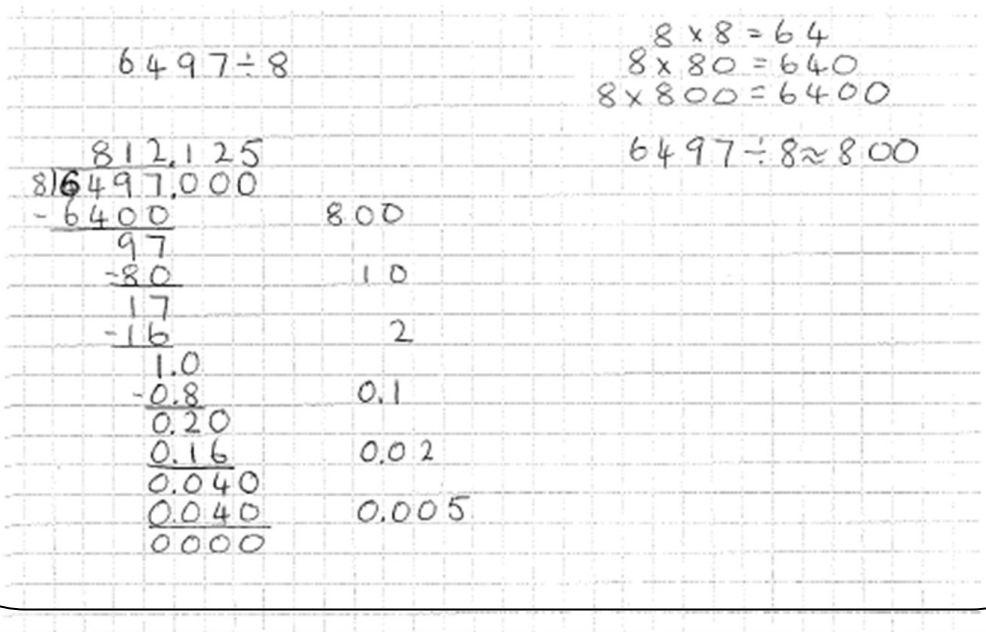
Key Vocabulary: *share, share equally, one each, two each…, group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, 'carry', remainder, multiple, divisible by, factor, inverse,* ***quotient, prime number, prime factors, composite number (non-prime)***

Key number skills needed for division at Y5:

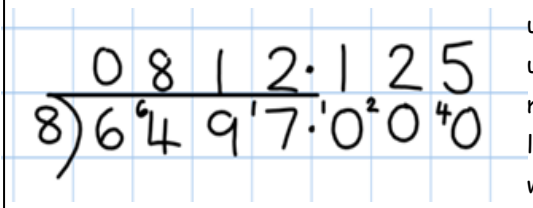
- Recall multiplication and division facts for all numbers up to 12 x 12 (as in Y4).
- Multiply and divide numbers mentally, drawing upon known facts.
- Identify multiples and factors, including finding all factor pairs of a number, and common factors of two number.
- Solve problems involving multiplication and division where larger numbers are decomposed into their factors.
- Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000.
- Use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers.
- Work out whether a number up to 100 is prime, and recall prime numbers to 19.
- 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
- Use multiplication and division as inverses.
- Interpret non-integer answers to division by expressing results in different ways according to the context, including with remainders, as fractions, as decimals or by rounding (e.g. 98 ÷ 4 = 24 r2 = 24½ = 24.5 ≈ 25).
- Solve problems involving combinations of all four operations, including understanding of the equals sign, and including division for scaling by different fractions and problems involving simple rates.

Division

Year 6 Divide at least 4 digits by both single-digit and 2-digit numbers (including decimal numbers and quantities)



Short division, for dividing by a single digit: e.g. 6497 ÷ 8



Short division with remainders: Pupils should continue to use this method, but with numbers to at least 4 digits, and understand how to express remainders as fractions, decimals, whole number remainders, or rounded numbers. Real life problem solving contexts need to be the starting point, where pupils have to consider the most appropriate way to express the remainder.

Calculating a decimal remainder: In this example, rather than expressing the remainder as **r 1**, a decimal point is added after the units because there is still a remainder, and the one remainder is carried onto zeros after the decimal point (to show there was no decimal value in the original number). Keep dividing to an appropriate degree of accuracy for the problem being solved.

Key Vocabulary: *As previously, & common factor*

Key number skills needed for division at Y6:

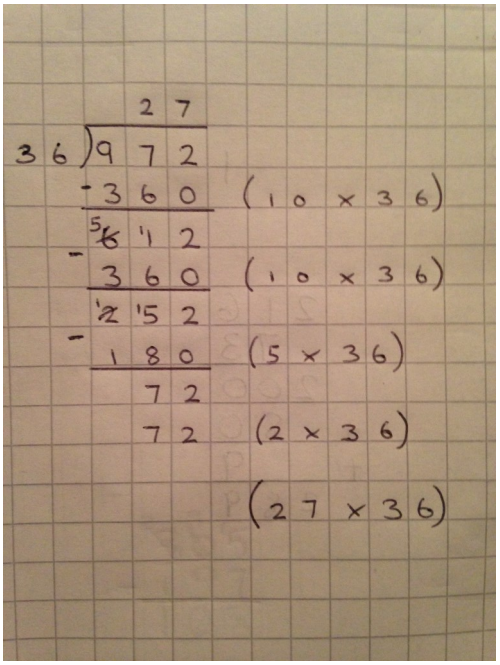
- Recall and use multiplication and division facts for all numbers to 12 x 12 for more complex calculations
- Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context. Use short division where appropriate.
- Perform mental calculations, including with mixed operations and large numbers.
- Identify common factors, common multiples and prime numbers.
- Solve problems involving all 4 operations.
- Use estimation to check answers to calculations and determine accuracy, in the context of a problem.
- Use written division methods in cases where the answer has up to two decimal places.
- Solve problems which require answers to be rounded to specified degrees of accuracy.

Division

Year 6

Introduce long division by chunking **for dividing by 2 digits.**

Where **remainders** occur, pupils should express them as fractions, decimals or use rounding, depending upon the problem.



Approximate,
Calculate,
Check it mate!

Must be aligned in place value for subtracting.

- Find out 'How many 36s are in 972?' by subtracting 'chunks' of 36, until zero is reached (or until there is a remainder).
- Teach pupils to write a '**useful list**' first at the side that will help them decide what chunks to use, e.g.:

  'Useful' list: 1x = 36
  10x = 360
  100x = 3600
- Introduce the method in a simple way by limiting the choice of chunks to 'Can we use 10 lots? Can use 100 lots? As children become confident with the process, encourage more efficient chunks to get to the answer more quickly (e.g. 20x, 5x), and expand on their 'useful' lists.

Key Vocabulary: ***As previously, & common factor***

Key number skills needed for division at Y6:

- Recall and use multiplication and division facts for all numbers to 12 x 12 for more complex calculations
- Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context. Use short division where appropriate.
- Perform mental calculations, including with mixed operations and large numbers.
- Identify common factors, common multiples and prime numbers.
- Solve problems involving all 4 operations.
- Use estimation to check answers to calculations and determine accuracy, in the context of a problem.
- Use written division methods in cases where the answer has up to two decimal places.
- Solve problems which require answers to be rounded to specified degrees of accuracy.