HIGHBANK PRIMARY AND NURSERY SCHOOL

Calculation Policy

January 2022

Calculation Policy

Introduction

This calculation policy has been written in line with the programmes of study taken from the revised National Curriculum for Mathematics (2014). It provides guidance on appropriate calculation methods and progression. The content is set out in yearly blocks under the following headings: addition, subtraction, multiplication and division.
Statements taken directly from the programmes of study are listed in bold at the beginning of each section.

Children will use mental methods as their first port of call when appropriate, but for calculations that they cannot do in their heads, they will need to use an efficient written method accurately and with confidence.

Aims of the policy

- To ensure consistency and progression in our approach to calculation
- To ensure that children develop an efficient, reliable, formal written method of calculation for all operations
- To ensure that children can use these methods accurately with confidence and understanding

How to use the policy

- Use the policy as the basis of your planning but ensure you use previous or following years' guidance to allow for personalised learning
- Always use Assessment for Learning to identify suitable next steps in calculation for groups of children
- If, at any time, children are making significant errors, return to the previous stage in calculation
- Cross reference with the mental maths policy for guidance on key facts, key vocabulary and mental methods
- Always use suitable resources, models and images to support children's understanding of calculation and place value, as appropriate
- Encourage children to make sensible choices about the methods they use when solving problems

Stages in Addition

Key Vocabulary

- **Addition**
- **Addend**
- **Sum**
- **Total**
- **Altogether**
- **Increase**
- **More than**
- **Commutative**
- **Partition**
- **Bridge**

Stage 1

Children will engage in a wide variety of songs and rhymes, games and activities. They will begin to relate addition to combining two groups of objects, first by counting all and then by counting on from the **largest number**.

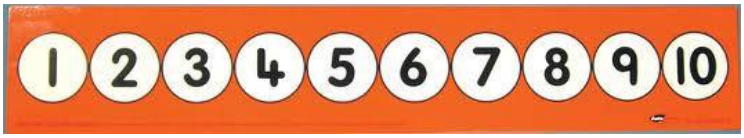
They will find one more than a given number.

In practical activities and through discussion they will begin to use the vocabulary involved in addition.

'You have five apples and I have three apples. How many apples altogether?'

Children will continue to practise counting on from any number e.g. 'Put five in your head and count on four.'

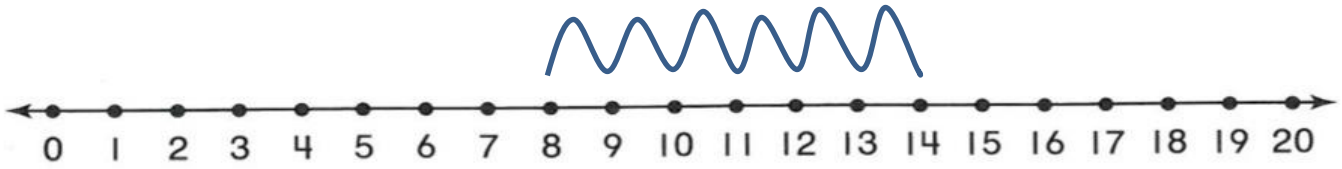
Initially use a number track to count on for addition, counting on from the **largest number**.



5 + 4 = 9 - 'Put your finger on number five. Count on (count forwards) four.'

Then progress to a marked number line.

6 + 8 = 14

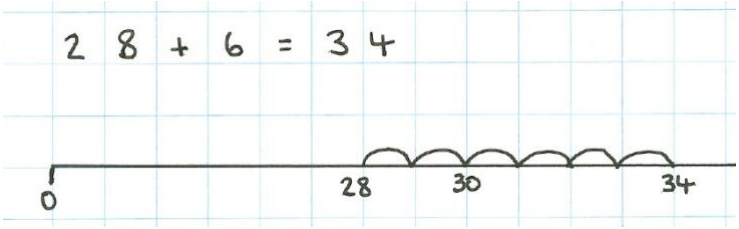


Regardless of how the calculation is written, the children are told to start at the **largest number** and count on - 'Put your finger on number eight and count on six.'

Continue to practise counting on from the **largest number** for addition.

Stage 2 - Counting on in ones using a blank number line

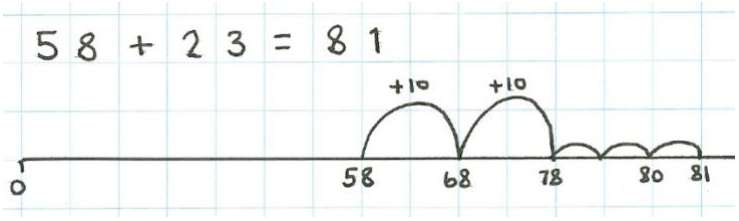
28 + 6 = 34



Start with the largest number and make jumps of one. Then count on, mark each 10s number that is landed on as well as the final number.

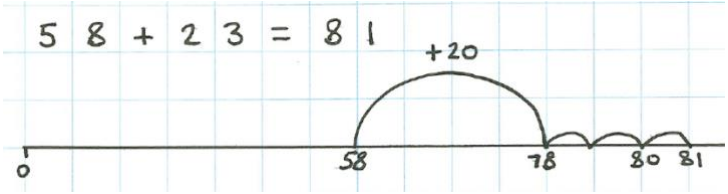
Adding 2 two-digits numbers on a blank number line

58 + 23 = 81



Start with the largest number and count on in tens and then ones. When all the jumps are drawn, mark where you land after every tens jump then mark the multiple of ten that is landed on when jumping in ones as well as the final number.

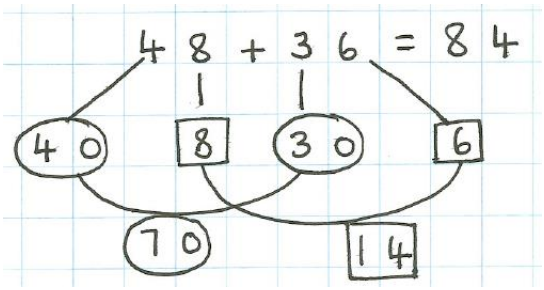
When children are confident, use jumps that are more efficient.



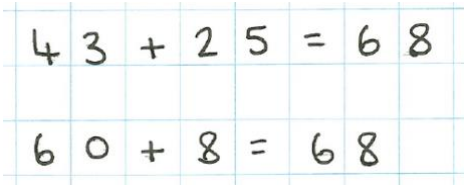
Partitioning

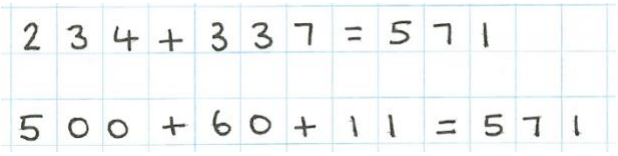
Partition the numbers into tens and ones. Circle the tens and put a square around the ones. Recombine and write the answer to complete the number sentence.

Then move on to calculations that **bridge** the tens.



This is an alternative way of recording the partitioning method.

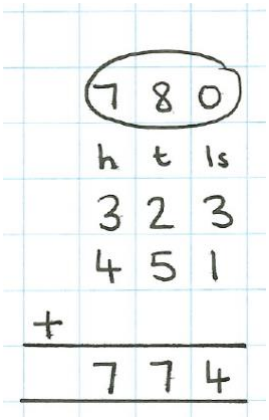


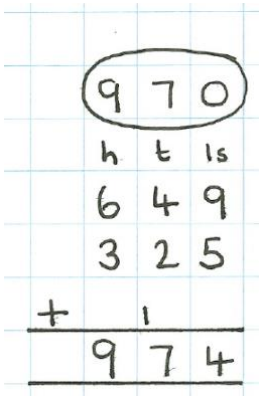


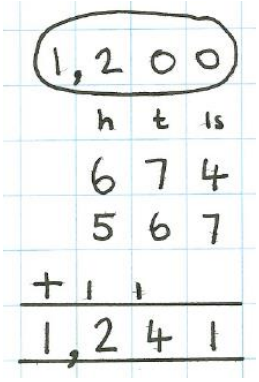
Stage 3 - Formal written methods (not to be introduced until Y3)

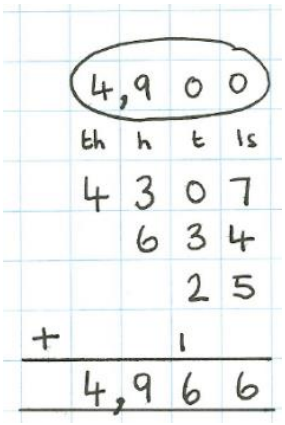
Formal written methods for addition (columnar) must always include at least 1 three-digit number OR at least 3 two-digit numbers.

Before attempting any written method, children must make an estimate and write this in a circle above. Children should not be given a calculation to do in a formal written method if they can do it mentally e.g. 122 + 123.

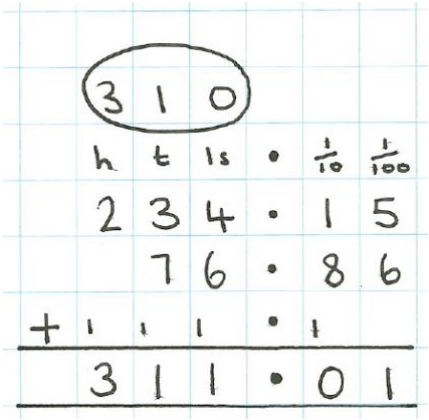








Example of columnar addition involving decimals.



Stages in Subtraction

Key Vocabulary

- **Subtraction**
- **Subtrahend**
- **Minuend**
- **Difference**
- **Decrease**
- **Less than**
- **Take away**
- **Remain/left**
- **Exchange**

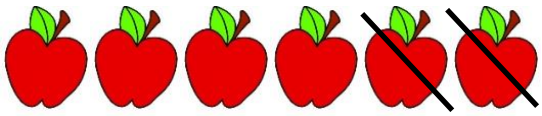
Stage 1

Children will engage in a variety of counting songs and rhymes and practical activities.

In practical activities and through discussion they will begin to use the vocabulary associated with subtraction.

They will find one less than a given number.

They will begin to relate subtraction to 'taking away' using objects to count 'how many are left' after some have been taken away.



6 – 2 = 4

'I have six apples and I take two apples away. How many are left?'

Children will begin to count back from a given number.

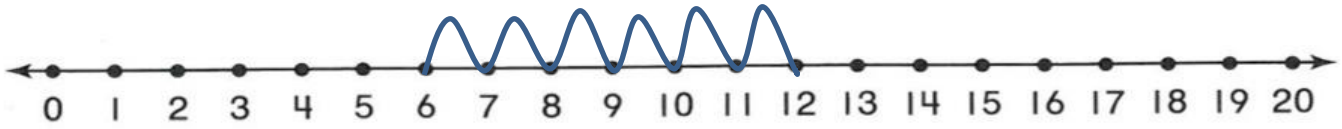
Children will continue to practise counting back from a given number.

Initially use a number track to count back for subtraction:

9 – 5 = 4 'Put your finger on number nine. Count back 5.'

Then progress to a marked number line:

12 – 6 = 6



'Put your finger on number twelve and count back 6'

Stage 2 - Counting on to find a small difference

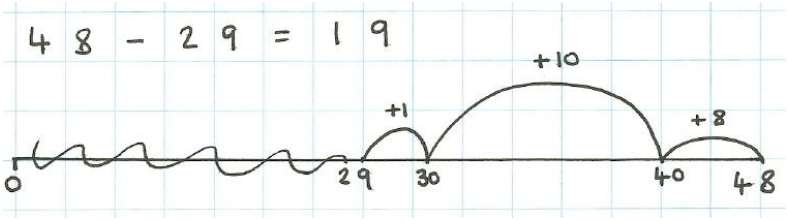
Introduce complementary addition to find **differences** (only use for small **differences**).
The use of models is extremely important here to understand the idea of "**difference**".

Count up from the **smallest number** to the **largest** to find the **difference** using resources, e.g. cubes, beads, number tracks/lines:

11 – 9 = 2

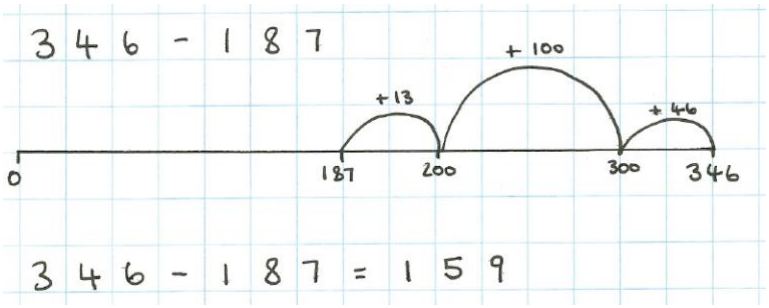
There are 11 counters altogether. 9 counters are blue and 2 are yellow. The **difference between** nine and eleven is two.

Finding a small **difference** on a number line by counting on.



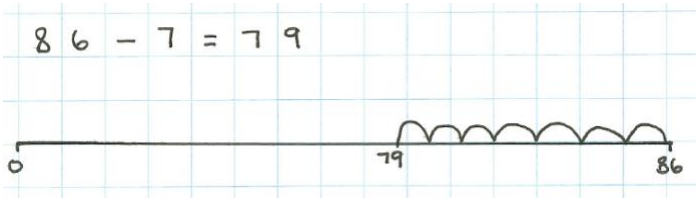
Draw a number line that starts at zero and ends in the larger number. Mark the number that will be taken away. Count on to the next ten. Make jumps of ten until you reach the nearest ten to the larger number and then count on to the end. As shown in the example above, counting on in ones should be done in a single jump. Draw the jumps above the line and write above each jump how much has been added.

Counting on to find the **difference** can also be used with three-digit numbers.



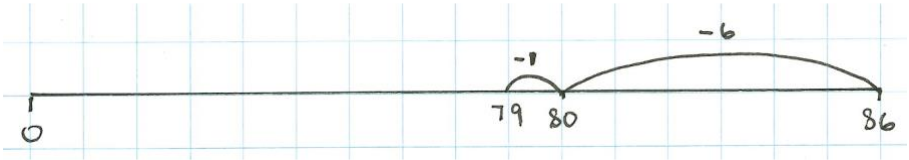
Counting back to find a large difference

If the **difference** is large then counting on is not an efficient method. Children need to be able to recognise when it would be better to count back rather than count on. For example, when subtracting a one-digit number from a large two-digit number, counting back would be the most efficient method.

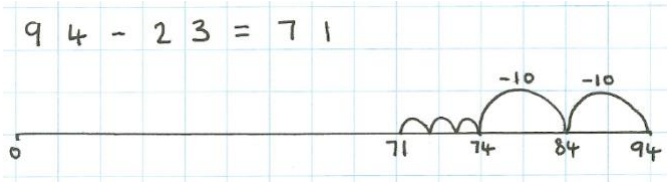


Draw a number line that starts at zero and ends in the larger number. Jump back from the larger number in ones, drawing the jumps above the line and stopping when you have made the correct number of jumps. Using the jumps, count down from the larger number to find out where you have landed and then record the answer.

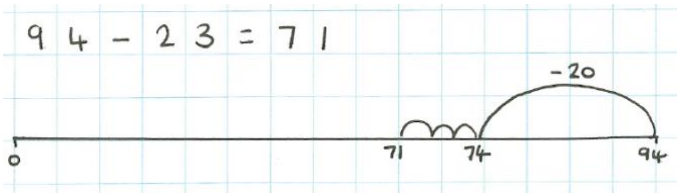
Instead of jumping back in ones, you can jump back to the nearest ten in one jump and then jump back in ones as shown in the example below where 86 – 7 = 86 take 6 and then take 1.



When subtracting a two-digit number by counting back, jump back in tens and then ones. Record how many tens you have subtracted above the jumps.



Jumps of ten can be more efficient, as shown below.



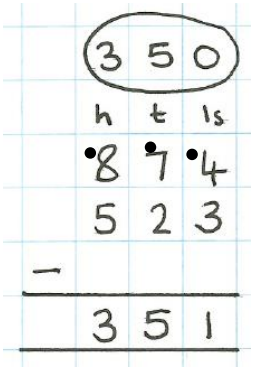
Stage 3 - Formal written methods (not to be introduced until Y3)

Formal written methods for subtraction (columnar) must always include at least 1 three-digit number. Subtractions involving two-digits and one-digits (e.g. 56 – 35, 78 – 7, 84 – 67) should be done mentally or on a number line.

Before attempting any written method, children must make an estimate and write this in a circle above. Once the columnar subtraction is set out, **put a small dot against the largest of the two numbers** in each column. This makes it clear as to whether or not exchanging (borrowing) will be required.

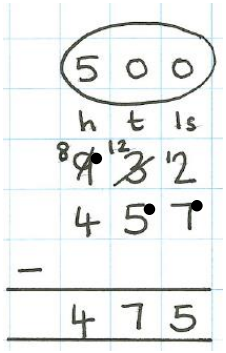
Example of a columnar subtraction with no exchanging required.

874 – 523 = 351



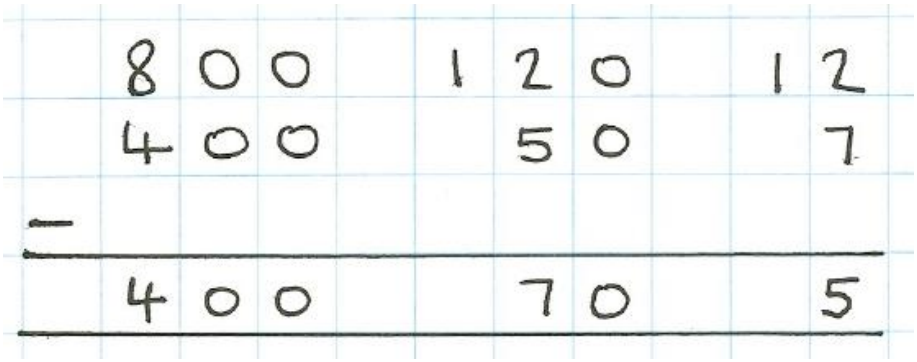
Example of a columnar subtraction that requires exchanging.

932 – 457 = 475



When modelling exchanging, the children need to be shown what is actually happening to the numbers when they are exchanged (1 hundred is exchanged for 10 tens etc.) so that they have a secure understanding of how the method works. When teaching the calculation above, model as follows:

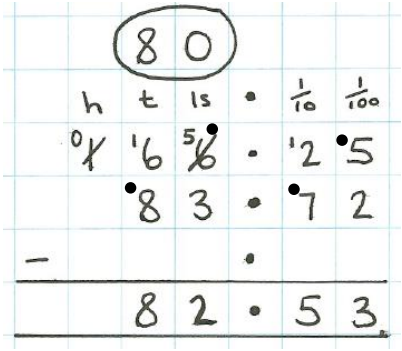
932 – 457 becomes 800 and 120 and 12 (the amount is still the same) subtract 400 and 50 and 7.



This method is for modelling purposes only. Children <u>are not expected</u> to use this method.

Example of subtraction involving decimals

166.25 – 83.27 = 82.53



Stages in Multiplication

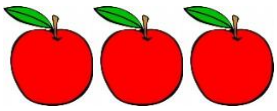
Key Vocabulary

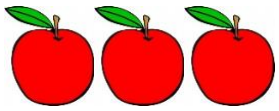
- **Multiplication**
- **Multiply**
- **Multiple**
- **Factor**
- **Product**
- **Increase**
- **Repeat**
- **Repetition**
- **Array**
- **Lots of**
- **Groups of**
- **Times**
- **Altogether**

Stage 1

Children will engage in a wide variety of songs and rhymes, games and activities.

In practical activities and through discussion they will begin to solve problems involving doubling.





'Three apples for you and three apples for me. How many apples altogether?'

Children will count repeated groups of the same size in practical contexts.

They will use the vocabulary associated with multiplication in practical contexts.

They will solve practical problems that involve combining groups of 2, 5 or 10. E.g. socks, fingers and cubes

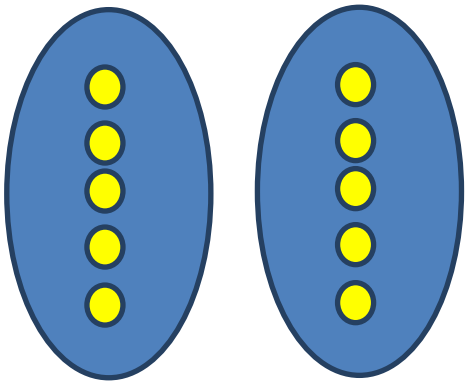
'Six pairs of socks. How many socks altogether? 2, 4, 6, 8, 10, 12'

‘Three pots of ten crayons. How many crayons altogether? 10, 20, 30’

Use arrays to support early multiplication

‘Five groups of two faces. How many faces altogether? 2, 4, 6, 8, 10’

Two groups of five faces. How many faces altogether? 5, 10’

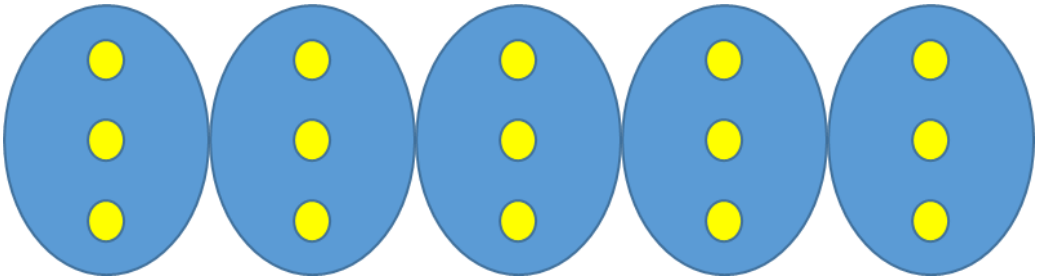


‘2 groups of 5’. ‘How many altogether?’. ‘5+5=10’. “Double five is ten’.

Continue to solve problems in practical contexts and develop the language of early multiplication, with appropriate resources, throughout stage 2.

Stage 2 - Combining Groups (repeated addition)

‘3 groups of 10 crayons’
‘How many crayons altogether?’
’10 + 10 + 10 = 30’
‘3 groups of 10’ ‘ 3 times 10’
‘3 x 10 = 30’ ’10 x 3 = 30’



‘5 groups of 3’ ‘5 lots of 3’ ‘3 + 3 + 3 + 3 +3 = 15’

‘5 times 3’ ‘3 multiplied by 5’ ‘5 x 3 = 15’ ‘3 x 5 = 15’

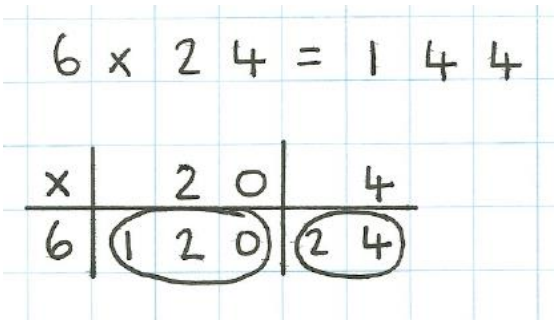
Continue to use arrays

4 x 6 = 24

6 x 4 = 24

Stage 3 - Informal written method (grid multiplication)

One-digit x two-digit



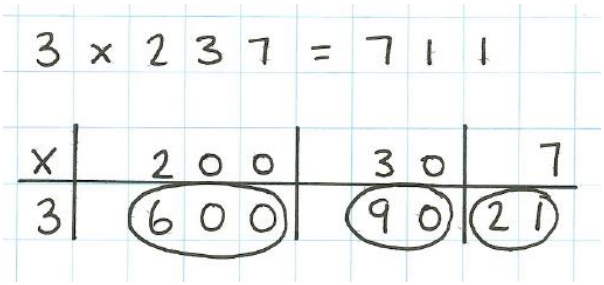
When drawing grids, the boxes where the answers will go need to be one square larger than the number at the top. Circle all the answers and then add them up to find the total. A written method made be required to do the addition.

6 x 24 = (6 x 20) + (6 x 4)

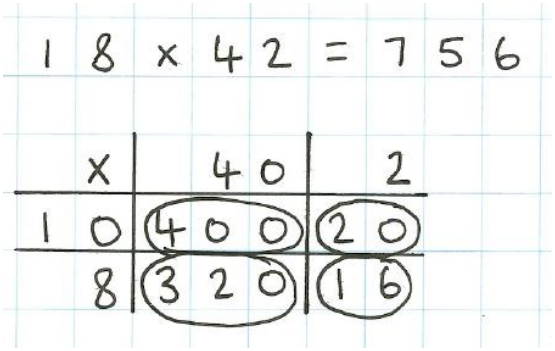
120 + 24 = 144

6 x 24 = 144

One-digit x three-digit



Two-digit x two-digit

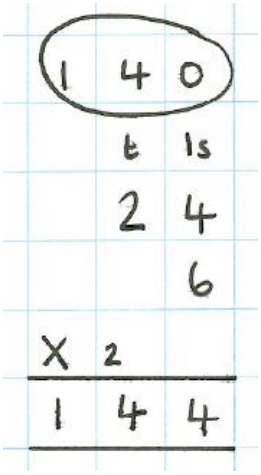


Formal written method – short multiplication (Year 4 onwards)

Short multiplication (columnar) is used to multiply a one-digit number by a two-digit or three-digit number.

Children in Year 5 and Year 6 are expected to use this method to multiply numbers up to four-digits by one-digit.

Before attempting any written method, children must make an estimate and write this in a circle above.



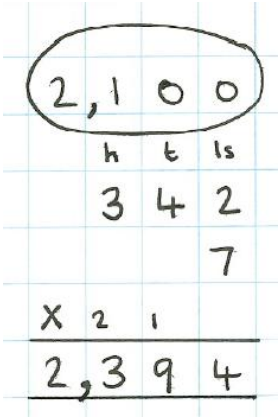
6 x 24

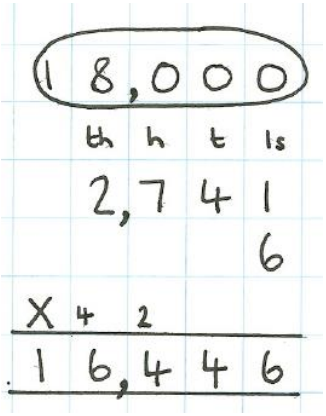
Put the larger number (24) at the top. As with previous methods, a space must be left for any carrying.

Step 1 – 6 x 4 = 24 – write the 2 (2 tens) in the space for the carry in the tens column and the 4 in the answer box in the 1s column
Step 2 – 6 x 20 = 120. Add the 2 tens to make this 140. Write 1 in the answer box in the hundreds column and 4 in the answer box in the tens column
Ensure that the correct language is used for the value of each digit:

e.g. if the product is 167, it consists of 1 hundred/100, 6 tens/60 and 7 ones/7.

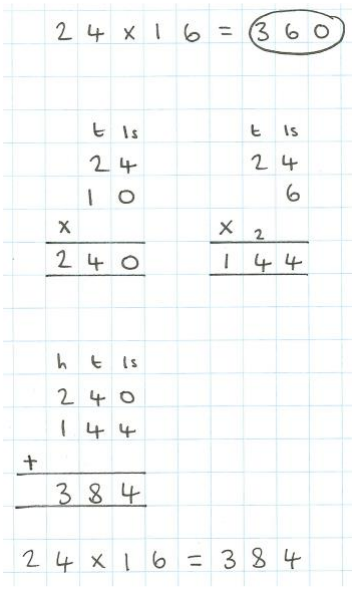
More examples of short multiplication:





Formal written method – long multiplication (Year 5 onwards)

Long multiplication (columnar) is used when multiplying numbers up to four digits (or more) by a two-digit number.



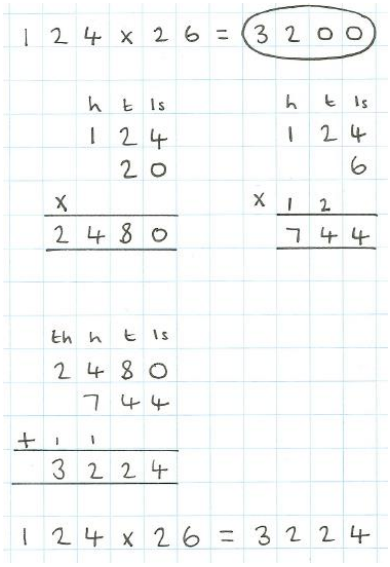
24 x 16

Step 1 – write the calculation and draw a circle around the estimate
Step 2 – set out two vertical multiplication calculations – 10 x 24 and 6 x 24
Step 3 – 10 x 24 = 240 – write 240 in the answer box
Step 4 – 6 x 24 = calculate 6 x 4 and write the 2 (2 tens) in the space for the carry in the tens column and the 4 in the answer box in the 1s column
Step 5 – 6 x 20 = 120. Add the 2 tens to make this 140. Write 1 in the answer box in the hundreds column and 4 in the answer box in the tens column
Step 6 – set out a columnar addition using the two amounts from the answer boxes (240 + 144)
Step 7 – find the answer and then record the number sentence below the written methods

Long multiplication – three-digit by two-digit:

124 x 26

Step 1 – write the calculation and draw a circle around the estimate
Step 2 – set out two vertical multiplication calculations – 20 x 124 and 6 x 124
Step 3 – (124 x 20) 20 x 4 = 80 – write 80 in the answer box (8 in the tens column an 0 in the 1s column)
Step 4 – 20 x 20 = 400 – write 4 in the answer box in the hundreds column
Step 5 – 20 x 100 = 2000 – write 2 in the answer box in the thousands column
Step 6 – (124 x 6) 6 x 6 = 24 – write 4 in the answer box in the 1s column and write the 2 in the space for the carry in the tens column
Step 7 – 6 x 20 = 120 – and the 2 tens in the carry space to make 140 – write 4 in the answer box in the tens column and 1 in the space for the carry in the hundreds column
Step 8 – 6 x 100 = 600 – and the 1 hundred in the carry space to make 700 – write 7 in the answer box in the hundreds column
Step 8 – set out a columnar addition using the two amounts from the answer boxes (2480 + 744)
Step 9 – find the answer and then record the number sentence below the written methods



Stages in Division

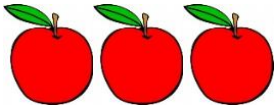
Key Vocabulary

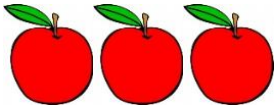
- **Division**
- **Divide**
- **Dividend**
- **Divisor**
- **Quotient**
- **Groups of**
- **Sharing**
-

Stage 1

Children will engage in a wide variety of songs and rhymes, games and activities.

In practical activities and through discussion they will begin to solve problems involving halving and sharing.



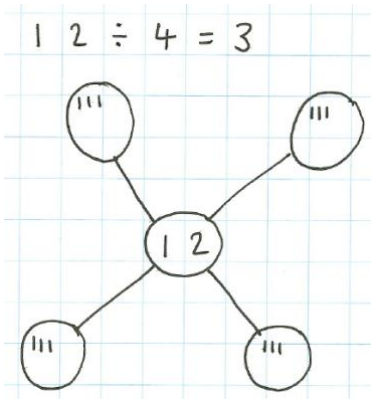


Share the apples between two people.

'Half of the apples for you and half of the apples for me.'

Stage 2 - Sharing a two-digit number by a one-digit number (spider diagram)

Draw a circle and write in it the number that is be shared out. Draw the number of 'legs' with circular 'feet' on the end that this number is to be shared by. Count in ones, going round in a clockwise direction and drawing a line in each of 'foot' as you count. When you reach the amount that is in the middle circle, count up how many marks are in one 'foot' to find the answer.

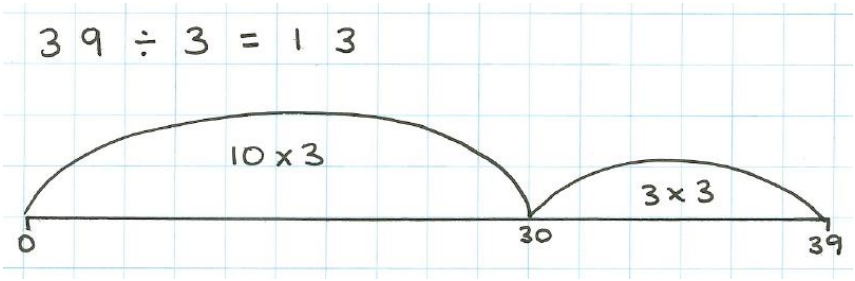


Stage 3 - Division on a number line counting in multiples of the divisor

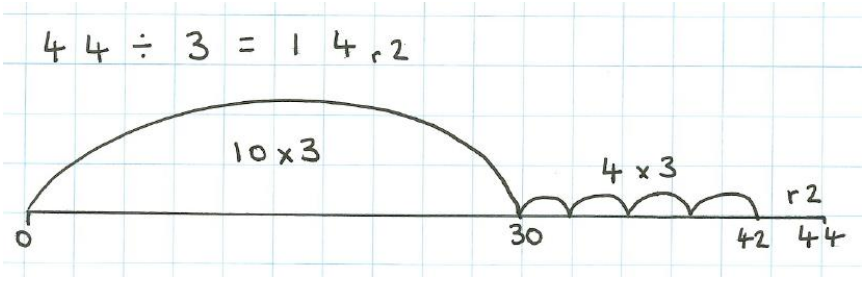
Draw a number line that starts at zero and ends in the number that is to be divided (**dividend**). Mark on the line multiples of the **divisor** that you know you will land on when you count, multiples of ten are the easiest ones to do. For example, when counting in threes you know that you will land on 30, 60, 90 etc.

Jump to the first multiple of the **divisor** that is marked on the line and record how many lots this is. Jump to the end (or to the next multiple of ten depending on how large the number is) and record how many lots this is.

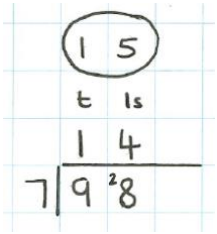
Finally, add up the total number of lots and complete the number sentence. In the example below, 39 is 10 lots of 3 and 3 lots of 3 – in total this makes 13 lots of 3 therefore, 39 ÷ 3 = 13.



This method can also be used with amounts that will leave a remainder.

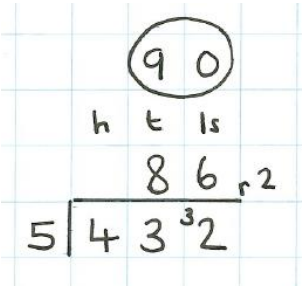


Stage 4 - Formal written method - Short Division (bus shelter) - (Y4 onwards)



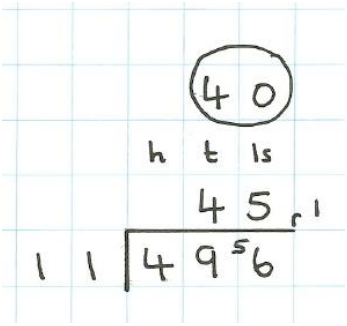
98 ÷ 7

Step 1 – draw a 'bus shelter' – write 7 on the left outside of the shelter and write 9 inside the shelter in the tens column and 8 in the ones column
Step 2 – Estimate in a circle above
Step 3 – work out how many times 7 goes into 9 and write the answer in the tens column above. Carry any remainder into the ones column
Step 4 – work out how many time 7 goes into 28 and write the answer in the ones column
Step 5 – record any remainders by writing a small 'r' at the end of the shelter followed by the amount left



432 ÷ 5

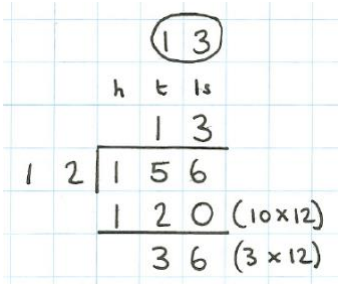
Step 1 – draw a 'bus shelter' – write 5 on the left outside of the shelter and write 4 inside the shelter in the hundreds column, 3 in the tens column and 2 in the ones column
Step 2 – Estimate in a circle above
Step 3 – work out how many times 5 goes into 4 and write the answer in the hundreds column above. Carry any remainder into the tens column
Step 4 – In the example shown, 5 doesn't go into 4 and so you have to work out how many times 5 goes into 43 (8 remainder 3)
Step 5 – work out how many times 5 goes into 32 and write the answer in the ones column
Step 5 – record any remainders by writing a small 'r' at the end of the shelter followed by the amount left



496 ÷ 11

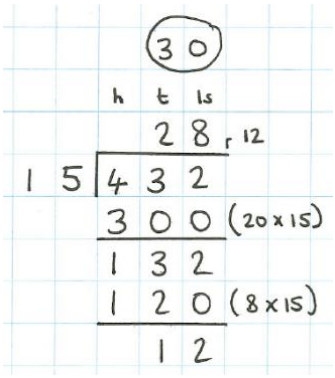
Step 1 – draw a 'bus shelter' – write 11 on the left outside of the shelter and write 4 inside the shelter in the hundreds column, 9 in the tens column and 6 in the ones column
Step 2 – Estimate in a circle above
Step 3 – work out how many times 11 goes into 49 and write the answer in the hundreds column above. Carry any remainder into the tens column
Step 4 – work out how many times 11 goes into 56 and write the answer in the ones column
Step 5 – record any remainders by writing a small 'r' at the end of the shelter followed by the amount left

Long Division – 'chunking' with multiples of the divisor



156 ÷ 12

Step 1 – draw a 'bus shelter' – write 12 on the left outside of the shelter and write 1 inside the shelter in the hundreds column, 5 in the tens column and 6 in the ones column
Step 2 – Estimate in a circle above
Step 3 – multiply 12 by 10 and record this below 156, this is the first 'chunk' dealt with. Write 10 x 12 in brackets at the side and draw a line under 120
Step 4 – subtract 120 from 156 and record the answer
Step 5 – as 12 will go into 36 exactly there is no need for any more 'chunks'. Write 3 x 12 in brackets at the side
Step 6 – add up how many lots of 12 there are in the brackets (in this case 10 lots and 3 lots) and record the answer (13) above the bus shelter



432 ÷ 15

Step 1 – draw a 'bus shelter' – write 15 on the left outside of the shelter and write 4 inside the shelter in the hundreds column, 3 in the tens column and 2 in the ones column
Step 2 – Estimate in a circle above
Step 3 – multiply 15 by 20 (you can multiply by 10 but 20 is more efficient) and record this below 432, this is the first 'chunk' dealt with. Write 20 x 15 in brackets at the side and draw a line under 300
Step 4 – subtract 300 from 132 and record the answer
Step 5 – work out the closest multiple of 15 to 132. 8 x 15 is 120, this is the next 'chunk'. Write 8 x 15 in brackets at the side and draw a line under 120
Step 6 – subtract 120 from 132 and record the answer. As 15 doesn't go into 12, this is the remainder
Step 6 – add up how many lots of 15 there are in the brackets (in this case 20 lots and 8 lots) and record the answer (28) above the bus shelter
Step 7 – record any remainders by writing a small 'r' at the end of the shelter followed by the amount left

Review

This policy will be reviewed in the _____.

Signed: _____ Chair of Governors

Date:___/___/___