Year 6

Multiplication and division

Children are expected to:

♦ **Perform mental calculations, including those with mixed operations and large numbers.**

Children should be able to draw upon a range of mental strategies to solve calculations in their head. They should be able to quickly identify which questions can be solved using a mental method and which may need jottings or a formal written method. Daily 'Masters of Arithmetic' supports the children to do this accurately and with confidence and enables the children to become fluent mathematicians.

Strategies for mental calculation may include:

- Times tables up to 12 x 12
- Corresponding multiples of 10, 100 and 100 e.g. 8 x 8 = 64 so 80 x 80 = 6400, 800 x 800 = 640,000 etc.
- Corresponding decimals facts e.g. 8 x 8 = 64 so 0.8 x 0.8 = 0.64, 0.08 x 0.08 = 0.0064 etc.
- Square numbers
- Cube numbers
- Multiplying and dividing by 0
- Multiplying and dividing by 10. 100 and 1000

The strategy of rounding should also be used to enable children to make sensible approximations when multiplying decimals e.g. 3.6 x 18.2 becomes 4 x 18 = 72. The children therefore know that the answer will be close to 72 and can use this to check their final answer.

♦ **Identify common factors, common multiples and prime numbers.**

See Year 4 and 5 policy.

♦ **Multiply and divide numbers with up to 3 decimals places by 10, 100 and 1000.**

See Year 4 and 5 policy.

Year 6

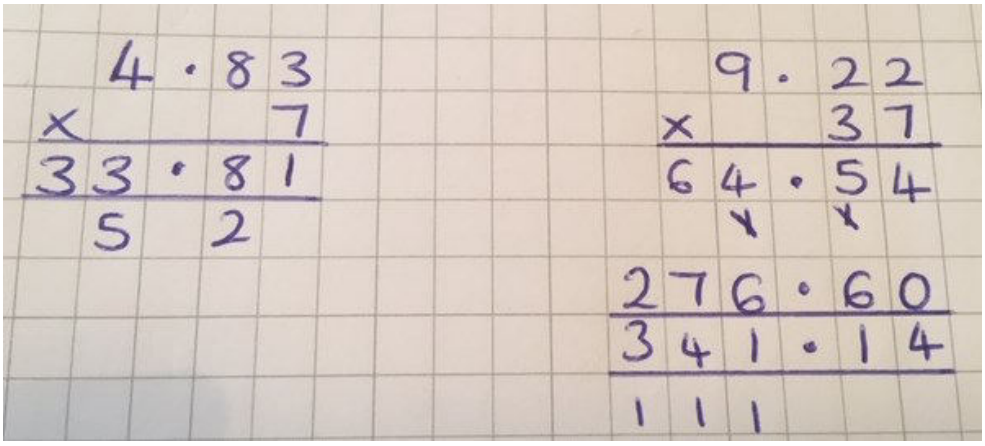
Multiplication and division

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

See Year 4 and 5 policy for detailed examples and explanations of short and long multiplication.

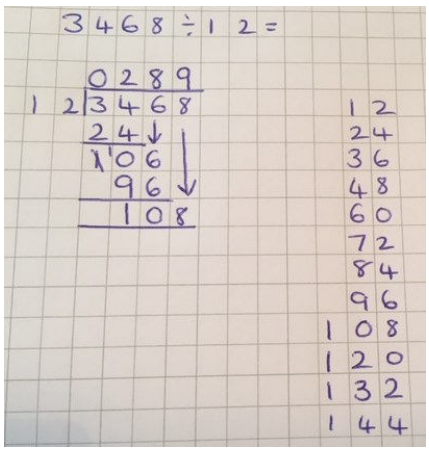
In Year 6, this method is consolidated. Children are expected to apply this method to multiplying numbers with up to two decimal places. The method remains the same. Children are taught to ensure that the decimal point is in its own square and to place this in the answer line before beginning the calculation.

Examples of short and long multiplication of numbers with up to two decimal places.



- **Divide numbers with up to 4 digits by a two-digit 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.**

Children build on their knowledge and understanding of the 'bus stop' method and extend this understanding to solve problems where they must divide by a two-digit number. This method is known as **long division**.

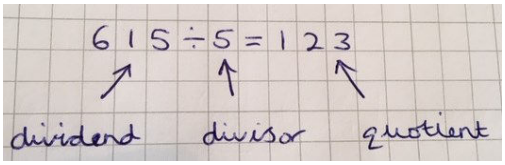


Year 6

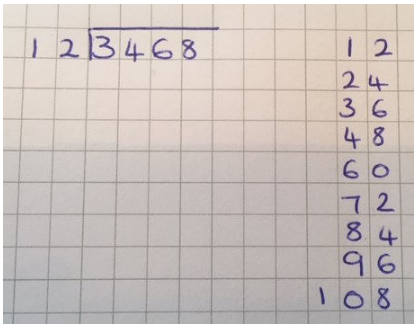
Multiplication and division

Example and explanation of long division with no remainders:

Key vocabulary:

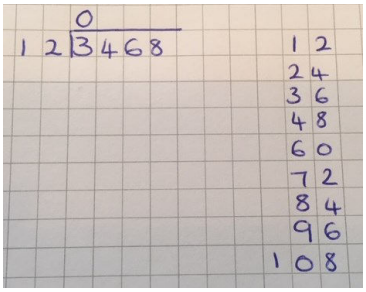


Step 1:
Write out the calculation in the bus stop method.
Write the multiples of the divisor (the number dividing by) on the right hand side - ideally up to 9 x (for some calculations where the number dividing by is a large two-digit number, children may need to do repeated addition in order to calculate the multiples).
This step is extremely important and will make the process of long division much quicker and more accurate.



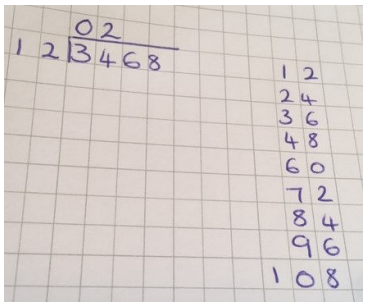
Most calculation errors in long division come from this step, therefore it is important that the children ensure that their list of multiplies is accurate and can be relied upon throughout the calculation.

Step 2:
Since we are dividing by a 2 digit number, we can treat the first 2 digits in the dividend (the number we are dividing) as a two-digit number.
In this case, 12 does not go into 3 therefore we can straight away treat the 3 and the 4 as a two-digit number and work out how many times does 12 go into 34?
This will always be the case for long division as the number that we are dividing by will always be larger than the one-digit at the beginning of the number we are dividing.
It is helpful initially to fill in a 0 as a place holder to show this step, however children may quickly learn to leave this space in empty.



Step 3:
How many times does the divisor go into the first 2 digits of the dividend?
In this case, how many times does 12 go into 34?

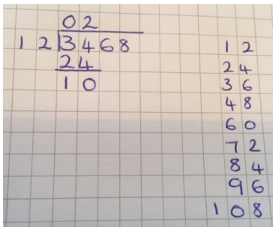
Children should count down their list of multiples to find the answer and write how many in the answer space.
In this case, 12 goes into 34 two times.



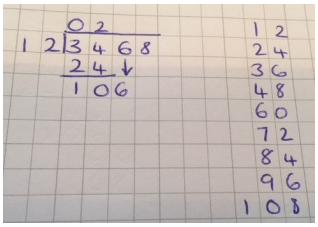
Year 6

Multiplication and division

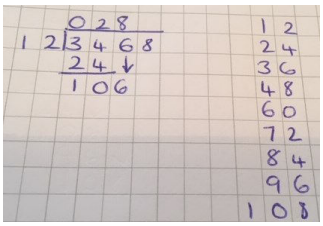
Step 4:
We then need to write the multiple underneath the dividend and subtract it so that we can see how many this leaves to continue the calculation.
In this case, 34 - 24 = 10.



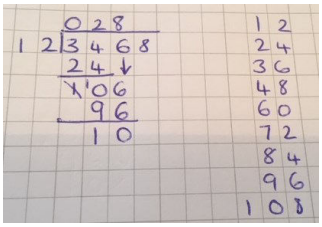
Step 5:
The next digit in the dividend is 'pulled down' to sit next to the amount left over.
In this case, the 6 is 'pulled down' to sit next to the 10 making 106.



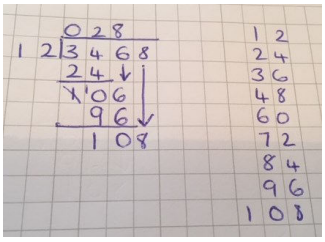
Step 6:
How many times does the divisor go into this?
In this case, how many times does 12 go into 106?
Children count down their list of multiples and write how many in the answer space.
In this case, the answer is 8 times.



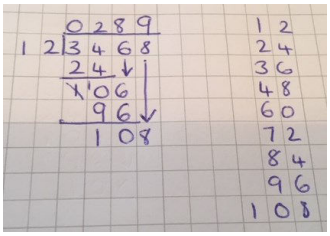
Step 7:
Subtract the multiple to see what is left over to continue the calculation.
In this case, the multiple is 96 so 106 - 96 = 10.



Step 8:
The next digit in the dividend is 'pulled down' to sit next to the amount left over.
In this case, the 8 is 'pulled down' to sit next to the 10 making 108.



Step 9:
How many times does the divisor go into this?
In this case, how many times does 12 go into 108?
Children count down their list of multiples and write how many in the answer space.
In this case, the answer is 9 times.



As 12 goes into 108 exactly, there is no need to subtract the multiple as this would leave 0.
The calculation is complete.

Year 6

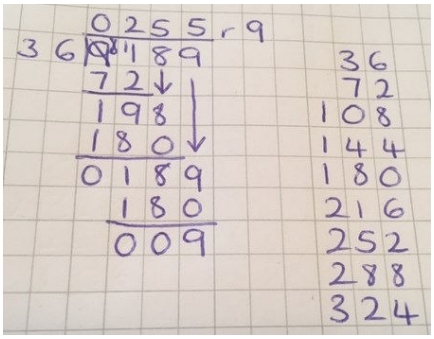
Multiplication and division

Example and explanation of long division with a remainder:

The same process is followed as in the previous example. The difference comes when the calculation is completed however the divisor does not go into the dividend exactly and some are left over.

In this example, the final step in the calculation is how many times does 36 go into 189?
The answer is 5 as 6x36=216 which is too big.
However, 5x36=180 leaving 9 left over.

The answer is therefore 255 r 9.



Children are expected to be able to **interpret remainders as whole numbers, fractions and decimals or round the remainder up or down depending on the context of the question.**

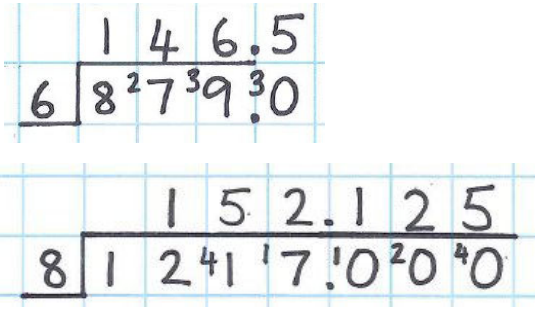
Converting a remainder to a fraction is a fairly straight forward process.

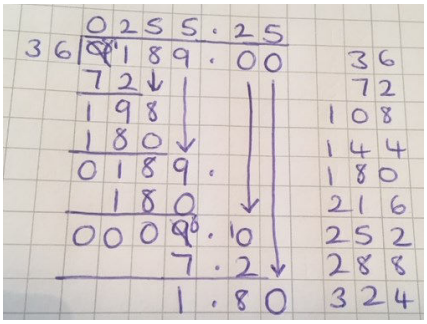
The remainder becomes the numerator and the number that we were dividing by becomes the denominator. As there are ? remaining out of ?

In this example: 255 r 9 would become 255 9/36
In some calculations the fraction can then be simplified for example:
255 r 9 = 255 9/36 = 255 3/12 = 255 1/4

Children can also convert a remainder into a decimal. When using both long and short division, children can add a decimal point and a 0 or more than one 0 (depending on how many decimal places they are asked to/would like to show the answer to) to the number being divided.

Examples of short and long division with remainders expressed as decimals.



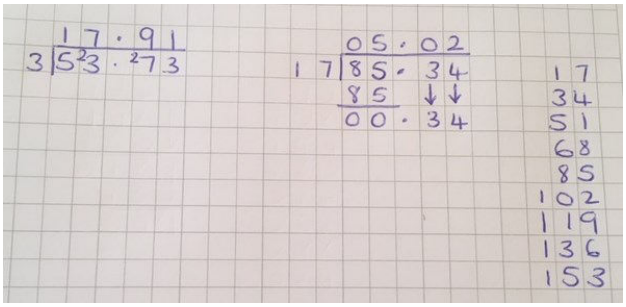


Year 6

Multiplication and division

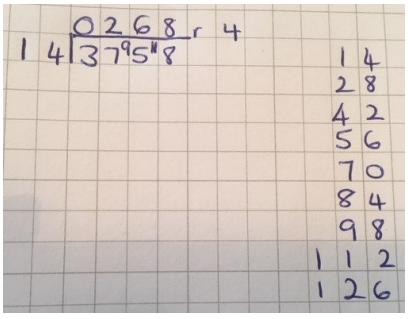
Short and long division can be used to divide decimals as well as whole numbers.
Children must remember to give the decimal point its own square to avoid unnecessary mistakes and ensure that the decimal point remains in the same position on the answer line as it is in the question line.

Examples of short and long division with decimals.



Once children are confident using the long method for division, they can move onto the short method of division for dividing by two-digit numbers where appropriate.

Example of short division when dividing by a two-digit number:



In order to use the short division method when dividing by a two-digit number, children must be extremely confident with the method for long division and be able to complete the subtraction calculations mentally in order to work out how much is left over each time to continue the calculation.

Year 6

Multiplication and division

- **Use their knowledge of order of operations to carry out calculations involving the four operations.**

The term 'operation' refers to the function being carried out in a calculation, such as addition, subtraction, multiplication, division, squaring etc. When children are presented with a calculation that includes more than one operation, they need to know the correct order to complete the functions in to arrive at the correct answer as doing them in the incorrect order would result in an incorrect answer.
For example, the following calculation would result in 2 different answers depending on the order that the functions are completed in:

6 x 9 + 4 =
Either 54 + 4 = 58
Or 6 x 13 = 78

Therefore, there is a set of rules to follow to ensure that the calculation is carried out in the correct order.
Children are encouraged to use the acronym **BIDMAS** to help them to remember the correct order.
B - brackets ()
I - indicies (squares/cubes/to the power of)
D - division
M - multiplication
A - addition
S - subtraction

Following the rules of BIDMAS the above calculation should be completed as: 6 x 9 = 54 + 4 = 58

- **Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.**

Children are encouraged to use their estimation and approximation skills prior to completing a calculation in order to enable them to check that their answer is accurate. This skills is practised during Masters of Arithmetic sessions and in all maths lessons in order to ensure that it becomes a skills that children do naturally when completing calculations and therefore make fewer unnecessary mistakes.

Year 6

Multiplication and division

- **Solve problems involving addition, subtraction, multiplication and division.**
- **Solve multi-step problems in context, deciding which operations and methods to use and why.**

A soft toy costs £4.50

A suitcase costs ten times as much.

How much does the soft toy and suitcase cost in total?

£4.50 x 10 = £45.00
£45.00 + £4.50 = £49.50
Children should be able to complete this problem using mental methods.

Draw a pair of brackets to make the number sentence true.

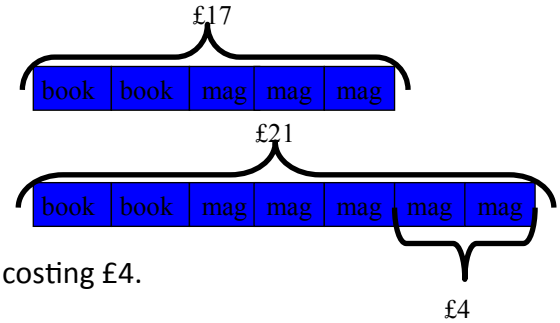
$$8 + 4 \times 3 - 2 + 1 = 13$$

Children should follow the rules of BIDMAS considering which operations would be completed towards the end of the calculation and therefore would be completed first if inside brackets.

2 books and 3 magazines cost £17

2 books and 5 magazines cost £21

How much does a magazine cost?



The difference between the 2 bars is 2 magazines costing £4.
Therefore 1 magazine costs £2.

How much does a book cost?

2 books cost £11.
Therefore 1 book costs £5.50.

Here are the ingredients needed to make **8 pancakes**.

Ingredients	
Sugar	150 g
Butter	275 g
Eggs	2
Flour	400 g

How much butter is needed for 24 pancakes?

8 x 3 = 24
275 x 3 = 825g
Children may choose to use short multiplication to solve this problem.

A shop sells single apples and bags of 4 apples.

Bag of 4 apples
£1.32

Single apple
40p

How much cheaper is it to buy 12 apples in bags rather than 12 single apples?

3 X 4 = 12 so to buy 12 apples I would need to buy 3 bags. 3 x £1.32 = £3.96 (short division)
12 x 40 = £4.80p (mental calculation)
£4.80 - £3.96 = 84p (column subtraction)

Year 6

Multiplication and division

Key vocabulary

See previous year group policies.

Vocabulary taught in previous years needs to be consolidated throughout the year.