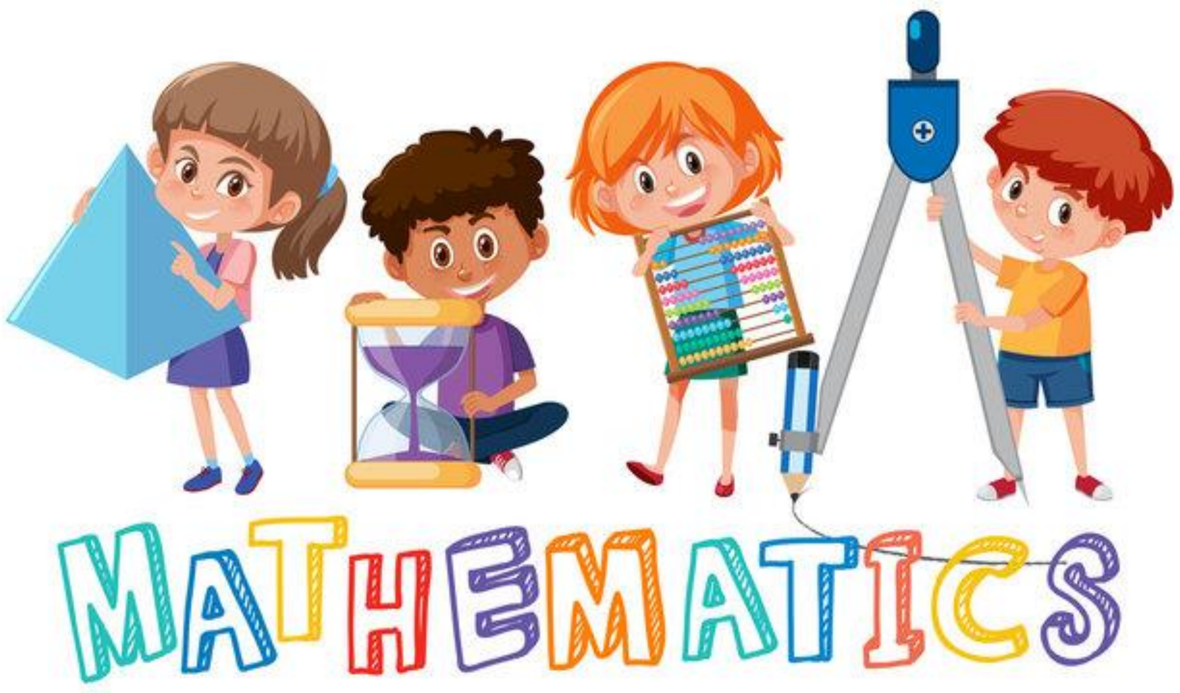
How we teach Maths at Ellingham

Year 6



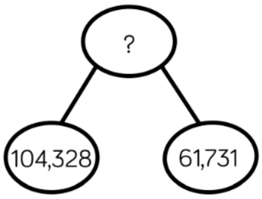
A helpful guide for parents

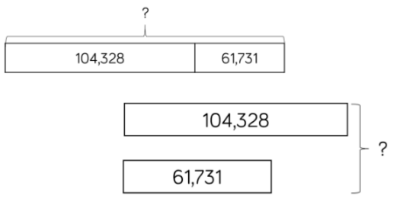
Addition

No new methods for addition are introduced in Year 6. We continue to extend our skills with the column addition method used in Lower KS2 and Year 5, solving problems with numbers of 4 digits or more, up to 10 million.

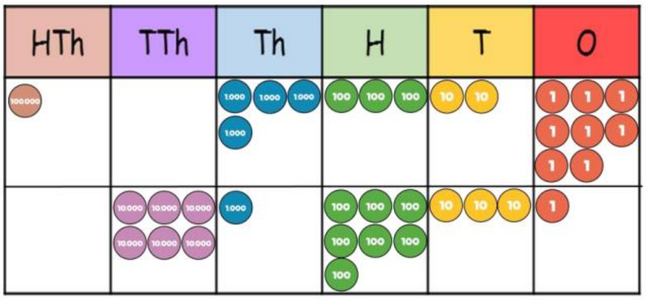
Representations

We continue to use a variety of representations (including part-whole models and bar models), and concrete resources such as place value counters where necessary, to aid understanding and to explain reasoning. However, concrete methods become increasingly unwieldy with large numbers, and children are encouraged to use the column method.



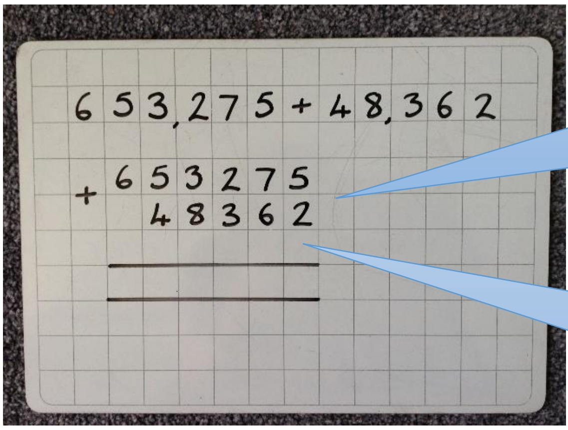


$104{,}328 + 61{,}731 = 166{,}059$



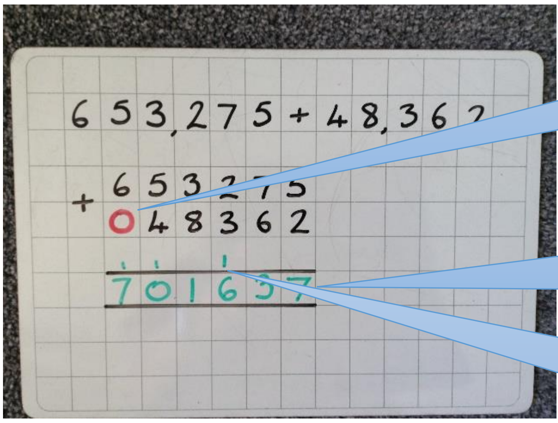
Column Addition Method

Column addition is the most efficient method of adding two or more larger numbers.



It is vital to set out the calculation correctly, with columns directly underneath each other.

'Mind the Gap!' Leave an extra row for writing digits which have been exchanged.



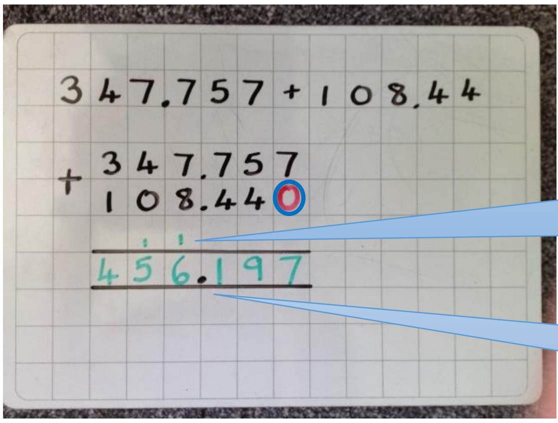
A zero can be added as a 'placeholder', to aid the correct layout and addition of columns.

Add the numbers in each column together, starting with the ones column and record directly below in the answer box.

Exchange into the next column when the sum of the digits in a column is greater than 9. Write the 'tens' digit in the gap.

Column Addition with Decimal Numbers

In Year 6, children can be asked to solve problems with decimal numbers up to 3 decimal places (tenths, hundredths and thousandths). Decimal numbers are added using the column method. As always, it is vital to set out the calculation correctly, and adding a zero as a 'placeholder' can help ensure this is done.



Add a zero as a placeholder.

Exchange into the next column when the sum of the digits in a column is greater than 9. Write the 'tens' digit in the gap.

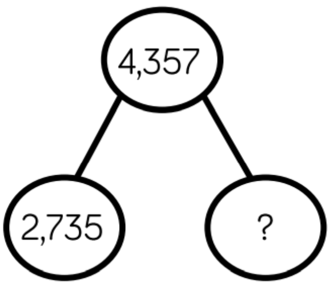
Decimal points must be lined up, including a decimal point in the answer box.

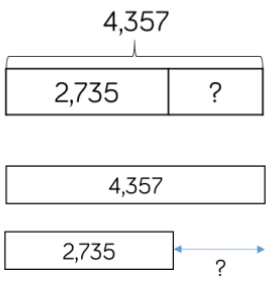
Subtraction

No new methods for subtraction are introduced in Year 6. We continue to extend our skills in using the column subtraction method from Lower KS2 and Year 5, solving problems with numbers of 4 digits or more, up to 10 million.

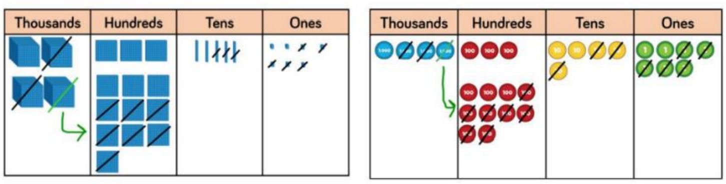
Representations

We continue to use a variety of representations (including part-whole models and bar models), and concrete resources such as place value counters where necessary, to aid understanding and to explain reasoning. However, concrete methods become increasingly unwieldy with large numbers, and children are encouraged to use the column method.



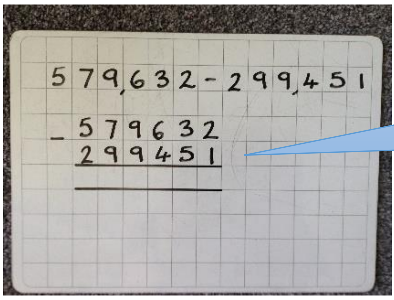


4,357 – 2,735 = 1,622

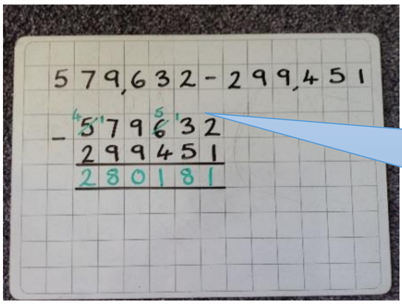


Column Subtraction Method

Column subtraction is the most efficient method of subtracting two larger numbers.



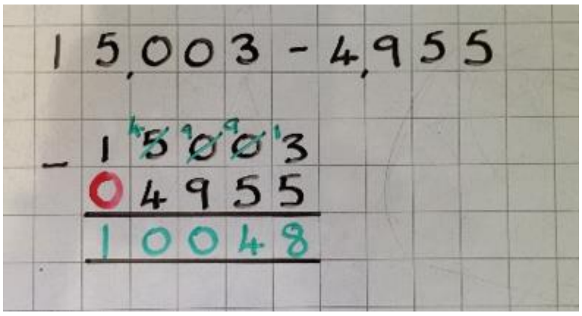
It is vital to set out the calculation correctly, with the largest number at the top, and columns directly underneath each other.



Start subtracting from the ones column, taking the lower digit away from the upper digit and recording the answer directly below in the answer box: 2 – 1 = 1. Then repeat with the tens column, working right to left through the columns.

If the upper digit is smaller than the lower digit, exchange from the column to the left, so here 3 – 5 becomes 13 – 5. The digit in the column to the left is crossed out and decreased by 1: 6 becomes 5.

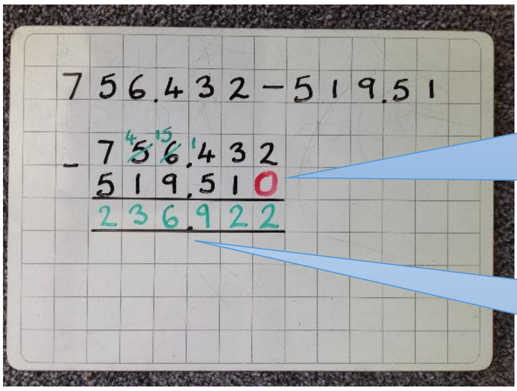
Sometimes it will be necessary to exchange across a number of columns. Here, digits have to be exchanged from the thousands column, across the hundreds and tens, to make the ones column a large enough number from which to subtract.



A zero can be added as a placeholder when subtracting numbers of different sizes.

Column Subtraction with Decimal Numbers

In Year 6, problems can involve decimal numbers with up to 3 decimal places. Use the column subtraction method, taking care to set out the calculation correctly in columns.



Write the largest number at the top of the calculation, with the smaller number underneath. Use a zero as a placeholder with numbers of unequal digits.

Decimal points must be lined up, including a decimal point in the answer box.

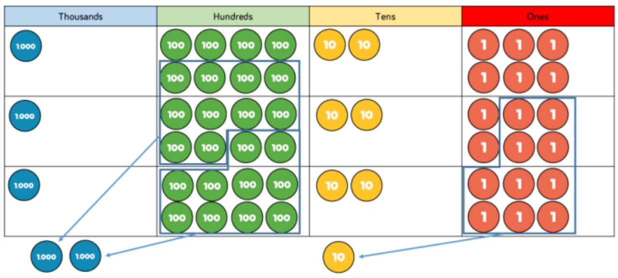
Multiplication

Quick and accurate recall of times tables facts up to 12 x 12 enables Year 6 children, to tackle multiplication, division and fractions problems with confidence.

In Year 6, children continue to use the formal written method of short multiplication learned in Lower KS2 to multiply numbers of four digits and more by 1 digit numbers (e.g. 42,113 x 4). They also use long multiplication (introduced in Year 5) to multiply numbers of four digits or more by 2 digit numbers (e.g. 42,113 x 24).

Representations

Pictorial methods such as the bar model can be used to aid understanding and express reasoning. Place value counters can also be used to support understanding, if necessary, but children are encouraged to use the abstract written methods of short and long multiplication as the most efficient mathematical methods.

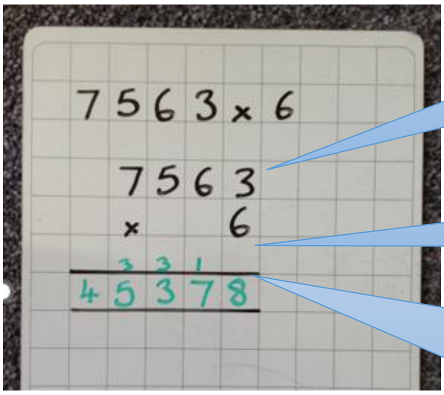


$1{,}826 \times 3 = 5{,}478$

5,478		
1,826	1,826	1,826

Short Multiplication

Short multiplication is the most efficient method of multiplying larger numbers by a one-digit number. Set out the calculation in columns and follow the steps outlined below.



Write the largest number at the top of the calculation, with the 1 digit number (the multiplier) below.

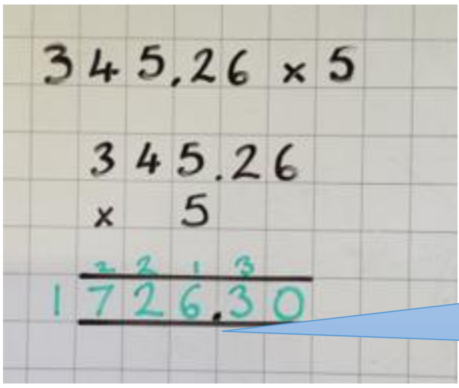
'Mind the Gap!' Leave a row above the answer box to use for exchanging digits.

Start by multiplying the ones digit of the top number by the multiplier. When the total is larger than 9, exchange the 'tens' digit into the next column: 6 x 3 = 18, so the 8 is recorded and the digit 1 is exchanged. Then multiply the digit in the next column, working right to left: 6 x 6.

When multiplying subsequent digits, remember to add any exchanged digits to your total before recording the answer. 6 x 6 = 36. Add the exchanged digit: 36 + 1 = 37. Record the ones digit (7) and exchange the tens digit (3) into the next column.

Using Short Multiplication with Decimal Numbers

The same method of short multiplication is used to multiply decimal numbers by 1 digit numbers.



Add the decimal point into the answer box before starting the calculation and take care to keep the digits in the correct column.

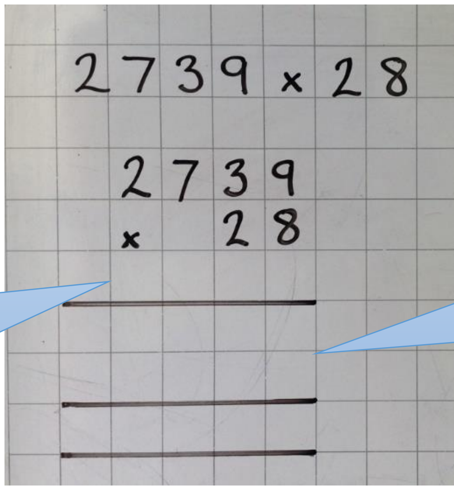
Long Multiplication

The most efficient way of multiplying large numbers by 2 or more digit numbers is to use the long multiplication method, which was introduced in Year 5.

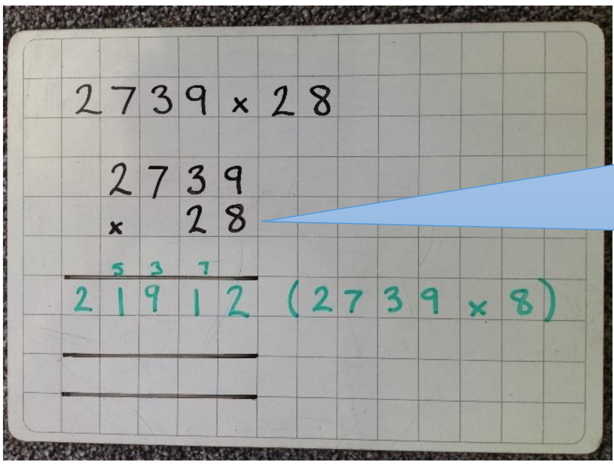
This method takes practise, as it has several steps, each of which require exchanging digits and recording them in a particular place in the calculation. For a long multiplication calculation, the layout is like this:

Set the calculation out carefully in columns, with the multiplier below the number to be multiplied.

'Mind the Gap!' – leave an empty row beneath the numbers, to record any exchanged digits.



Leave two further rows empty, before drawing 2 more lines to create the answer box.

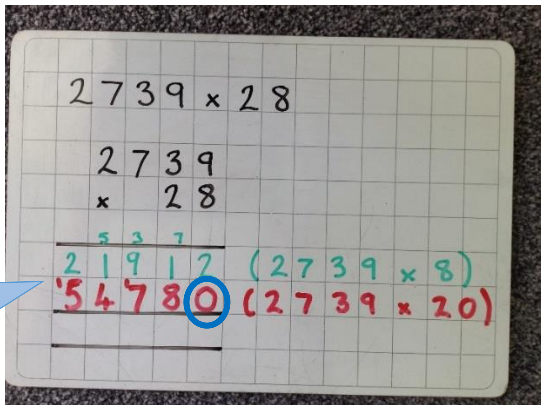


Start by multiplying the top number by the ones digit of the multiplier (8).

As in short multiplication, first multiply the ones digit of the top number, then the tens digit, working right to left through the columns.

Record exchanged digits in the 'gap', as in the short multiplication method.

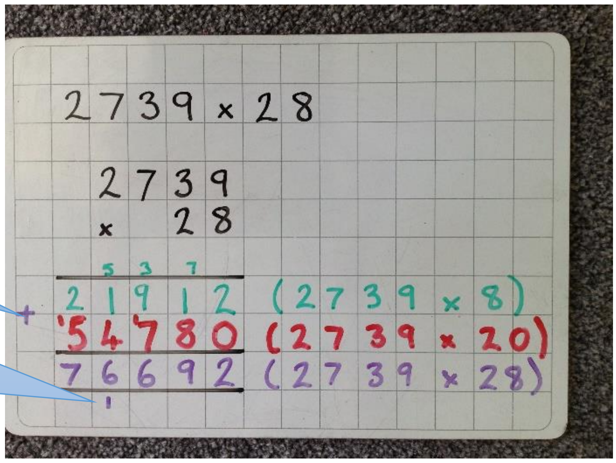
Record exchanged digits at the top of the next column to the left, in the same row of digits.



Now multiply the top number by the tens digit of the multiplier (2). However, as we are actually multiplying by 20 instead of 2, our answer will be ten times bigger, so put a placeholder zero ○ into the ones column before starting to multiply.

Finally, add up the two columns using column addition, to find the total: (2,739 x 8) + (2,739 x 20) = 2,739 x 28.

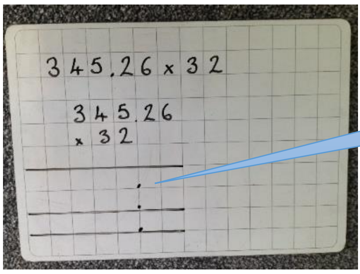
Whilst adding, record any exchanged digits below the answer box, so that they do not become confused with digits from the earlier parts of the calculation.



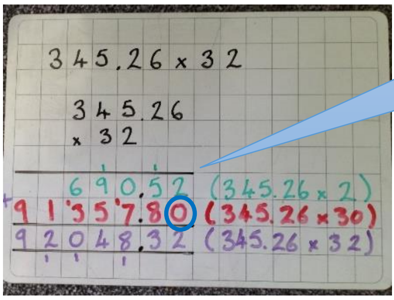
Children are encouraged to check each step of their calculation before moving on to another question, as it is very easy for mistakes to creep in, for instance, forgetting to write the zero when multiplying by the tens digit, or adding exchanged digits from previous steps into the final total.

Using Long Multiplication with Decimal Numbers

Decimal numbers can also be multiplied using long multiplication, and the method is just the same. Getting the initial layout correct is vital.



Add the decimal point into each row before starting the calculation.



Working right to left, multiply the first decimal digit by the ones digit of the multiplier and record in the correct column: e.g. 2 x 0.03 would be recorded in the hundreds column: 0.06.

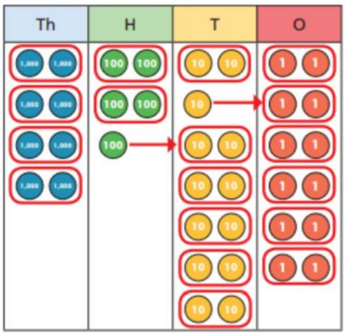
Add the zero placeholder ○ before multiplying by the tens digit of the multiplier.

Division

In Year 6, children will continue to use the short division method learned in Lower KS2 to divide numbers greater than 4 digits by 1 digit numbers. They will also divide by 2 digit numbers using this method and be introduced to long division. They will record remainders as whole numbers, fractions and decimals.

Representations

Children can use bar models to represent a problem and place value counters could be used as a support, but with larger numbers, short division is the most efficient method to use.



	4	2	6	6
2	8	5	$^{1}3$	$^{1}2$

8,532	
4,266	4,266

$8{,}532 \div 2 = 4{,}266$

When dividing by 2 digit numbers, it can help to write out multiples first, to support calculations with larger remainders:

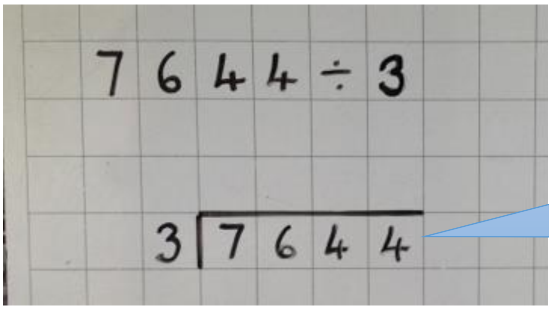
$7{,}335 \div 15 = 489$

	0	4	8	9
15	7	$^{7}3$	$^{13}3$	$^{13}5$

15	30	45	60	75	90	105	120	135	150

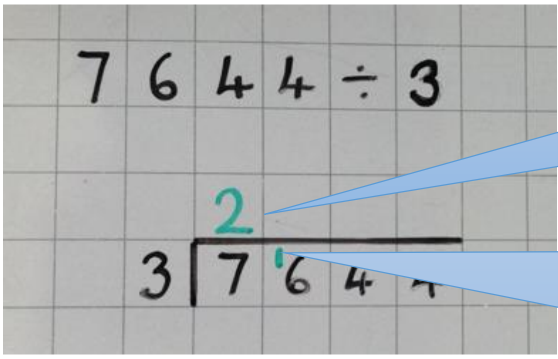
Short Division

This method is sometimes called the 'bus stop' method. The calculation is set out as below:



The number to be divided (the dividend) is placed inside the division symbol (the 'bus stop'), with the number dividing it (the divisor) written outside.

Divide each digit in turn by the divisor, starting with the largest digit, working left to right. Record a remainder by writing it next to the digit in the column to the right. Write the total on top of the 'bus stop'.

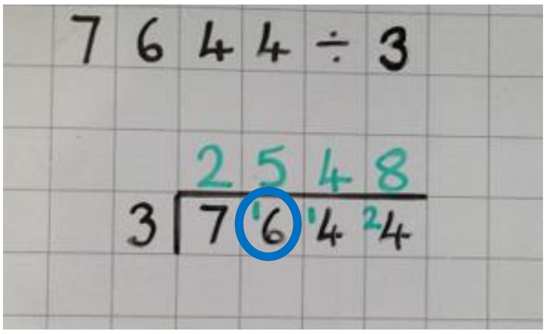


Divide the thousands digit by 3 ('How many 3s go into 7?'). 7 ÷ 3 = 2. Write the answer on the top of the 'bus stop'.

Multiply this number (2) by the divisor (3) and subtract your answer from the thousands digit to find the remainder: 2 x 3 = 6; 7 – 6 = 1. Record this remainder by exchanging into the hundreds column, writing it next to the hundreds digit.

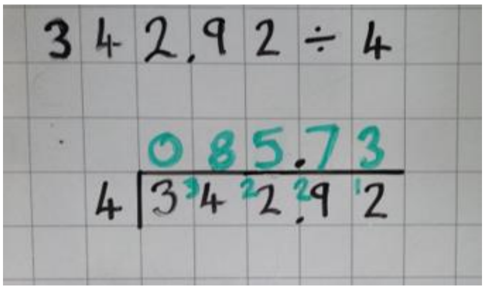
This remainder makes the next number to be divided 16 instead of 6 O. Divide this new target number by the divisor: 16 ÷ 3 = 5. Record the answer and find any remainder, writing it next to the tens digit.

Repeat the process for all remaining digits.



Dividing Decimal Numbers

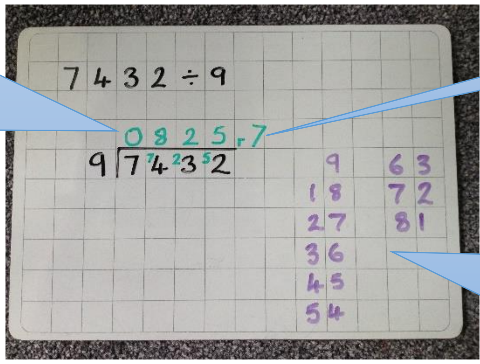
Use the short division method with decimal numbers in exactly the same way as with whole numbers. Write the decimal point in the correct place in the answer space before starting the calculation, and keep digits in the correct column.



Dividing with Remainders

If there are still digits to exchange at the end of the calculation, these are recorded as a remainder (r) at the end of the answer: 825 **r7**.

A zero can be added as a place holder if the first digit is smaller than the divisor. This digit is then exchanged into the column to the right.

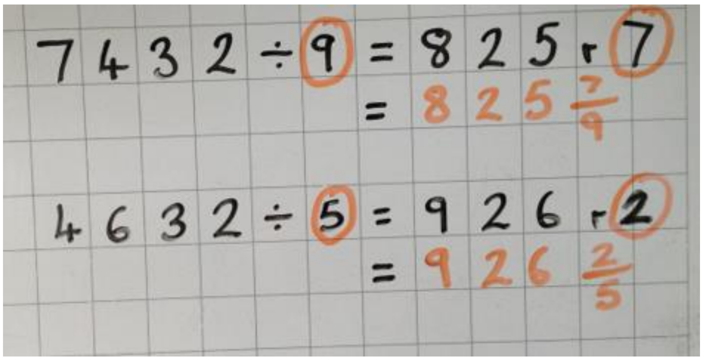


Remainder

If children are unsure of a times table, it can help to write out the multiples of the divisor before starting.

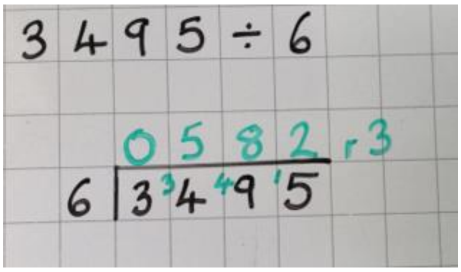
Recording Remainders as Fractions

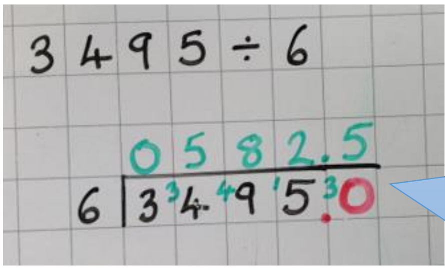
Remainders can also be recorded as fractions. To do this, the remainder is used as the numerator (top number) of the fraction and the divisor becomes the denominator (bottom number).



Recording Remainders as Decimals

Remainders can also be written as decimal numbers. Zeros are used as placeholders.

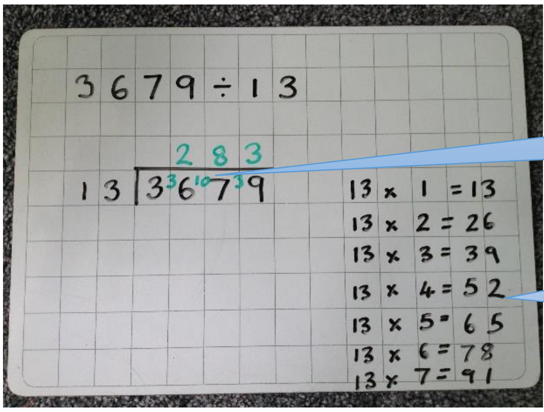




Instead of recording the final remainder (r3), a zero is added as a placeholder, the remainder is exchanged, and the calculation continues, producing a decimal answer.

Using Short Division with 2 Digit Divisors

Short division can also be used with 2 digit numbers. Since these calculations will go beyond most children's times tables knowledge, it is helpful to work out and record the multiples of the divisor before starting the calculation.



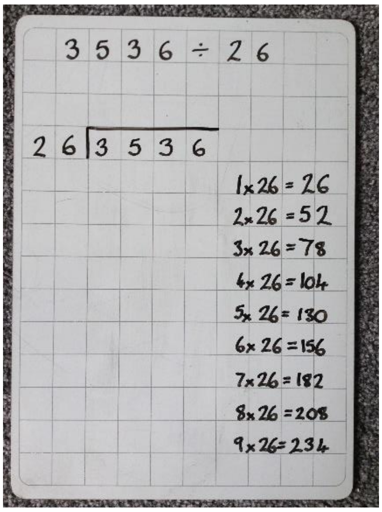
Remainders exchanged may be 2 digit numbers.

Write out the multiples of the divisor before starting the calculation.

Long Division

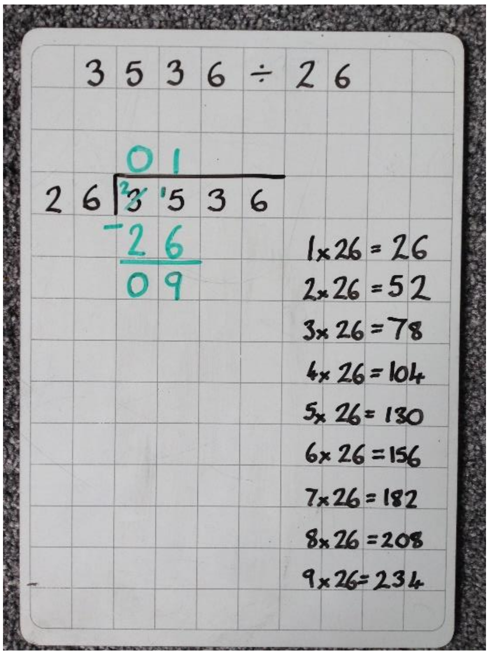
Long division is the most efficient method for dividing larger numbers by a two-digit number. We use the same technique as in short division, but in long division the process of dividing, multiplying and subtracting the remainder, is made explicit, so that large remainders do not have to be calculated mentally. The phrase 'Does McDonald's Sell Burgers?' can help children to remember the sequence of steps required!

Does	Divide
McDonald's	Multiply
Sell	Subtract
Burgers?	Bring Down



Set out the calculation as in short division.

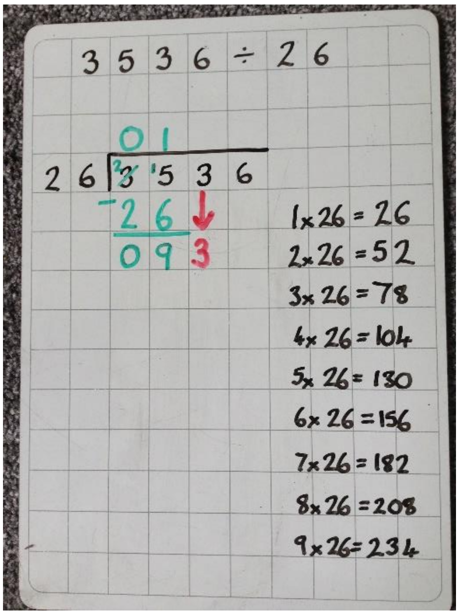
Work out the multiples of the divisor (26) and write them down. Multiples can be calculated by repeated addition (26 + 26 + 26 = 78) or short multiplication (26 x 3 = 78).



Step 1: Divide the first 2 digits of the number by the divisor: 35 ÷ 26 = 1. Record this at the top. A zero can be used as a placeholder.

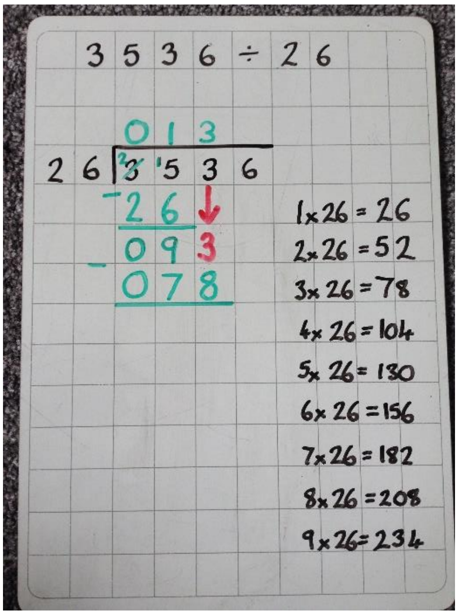
Step 2: Multiply the divisor by your answer to Step 1: 26 x 1 = 26. Record this underneath the number you are dividing, under the first two columns.

Step 3: Subtract the answer from Step 2 from the number above: 35 – 26 = 9. This is the remainder.

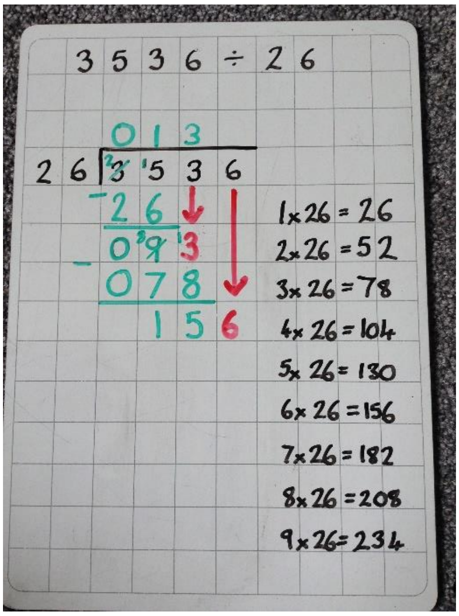


Step 4: Bring Down the next digit from the number you are dividing. This joins the remainder to form the next 'target number' you need to divide: 93.

Step 5: The division cycle now begins again. The next step is to repeat Step 1: Divide your new target number by 26. 93 ÷ 26 = 3. Record this at the top.



Step 6: Multiply 26 x 3. 26 x 3 = 78. Record this at the bottom of the calculation.



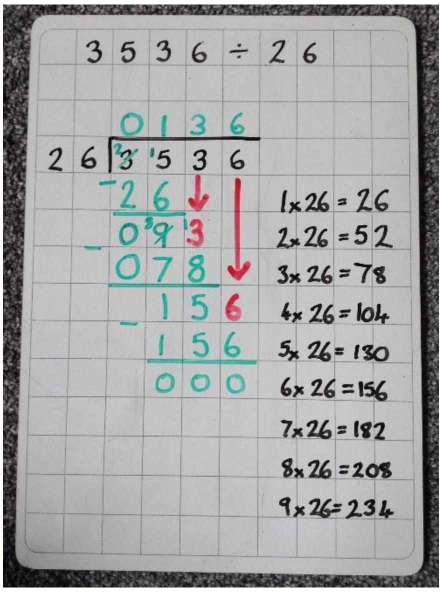
Step 7: Subtract. 93 – 78 = 15. This is the remainder.

Step 8: Bring Down. Bring down the 6 to create your new target number.

Step 9: Divide. Divide your new target number: 156 ÷ 26 = 6. Record this at the top.

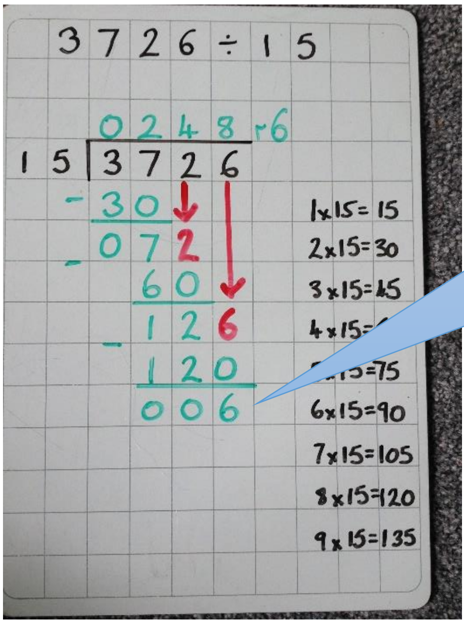
Step 10: Multiply. 6 x 26 = 156. Record this at the bottom of the calculation.

Step 11: Subtract. 156-156 = 0. There is no remainder, and the calculation is complete!



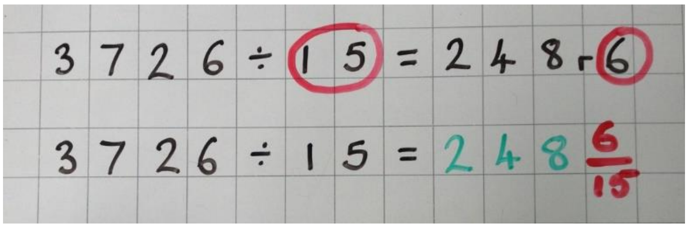
Long Division with Remainders

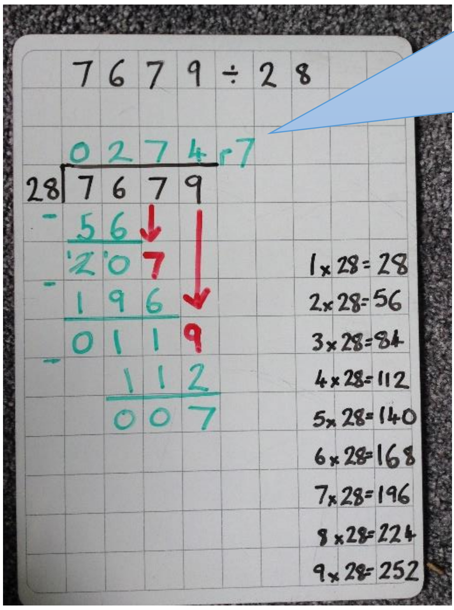
If there are still digits left over in your calculation once you have finished dividing the number, this is your remainder. As in short division, it can be expressed as a whole number, as a fraction, or as a decimal.



The digit 6 is left over when the calculation is complete. This is the remainder: 3,726 ÷ 15 = 248 r6.

As with short division (see above), a remainder can be expressed as a fraction, using the remainder as the numerator and the divisor as the denominator.





Finally, remainders can be expressed as decimals. This calculation has a remainder of 7. However, by using zeros as placeholders, we can continue the calculation.

By adding a decimal point and zero placeholders, we can continue by Bringing Down a zero to create a new target number. By continuing the division cycle, we can divide, multiply, subtract, then bring down and divide again to create a decimal answer.