Green Meadows Academy

Calculation Policy

2023

Version	1	Review Cycle	Annual
Date of Approval	2/11/23	Approval Level	Principal

WELLSPRING

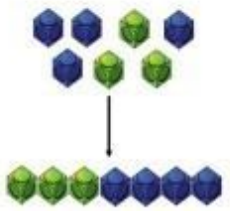
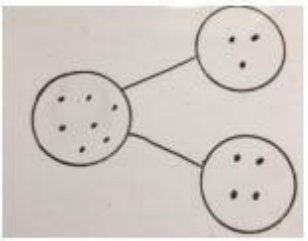
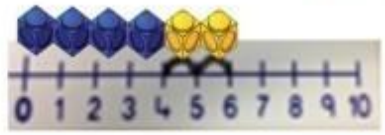
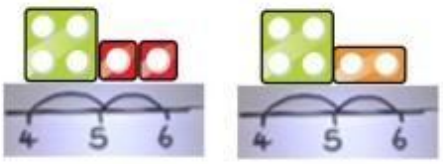
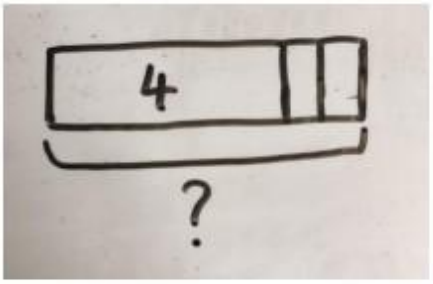
We Make A Difference

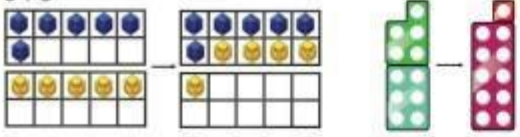
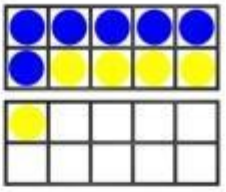
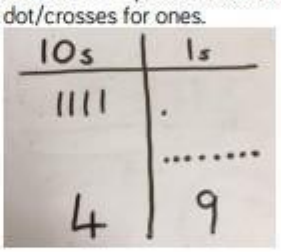
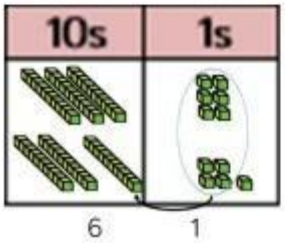
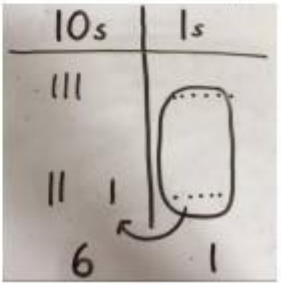
Green Meadows Academy
Calculation Policy

Table of Contents

Encountering Addition

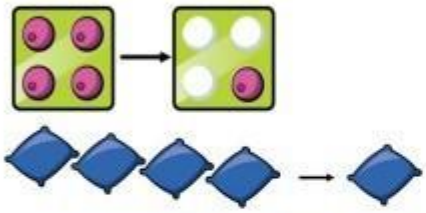
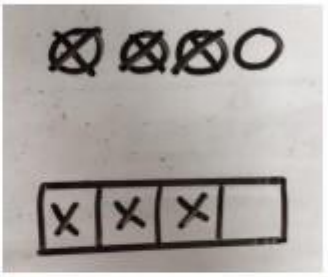
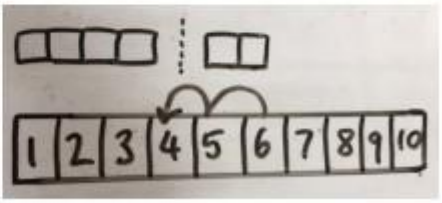
Language to be modelled	Play/Sensory-based activities
Lots More Tall Small Now, next, after that Add Total Plus Altogether	• Building a tower and knocking down • Tidying up and reinforcing the words • Sequencing through now and next and visual timetables • Baking/ cooking • Snack time • Making patterns from objects

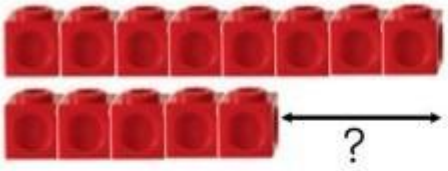
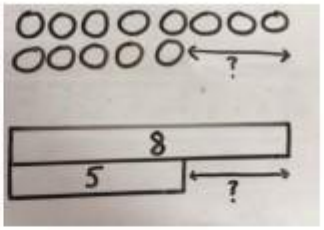
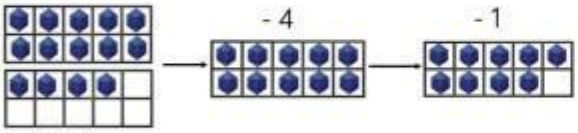
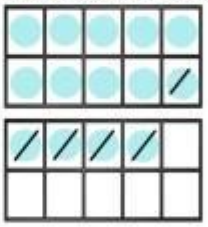
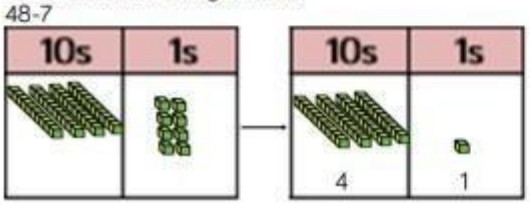
Concrete	Pictorial
Combining two parts to make a whole (use other resources too e.g. eggs, shells, teddy bears, cars). 	Children to represent the cubes using dots or crosses. They could put each part on a part whole model too. 
Counting on using number lines using cubes or Numicon.   	A bar model which encourages the children to count on, rather than count all. 

Regrouping to make 10; using ten frames and counters/cubes or using Numicon. 6 + 5 	Children to draw the ten frame and counters/cubes. 
TO + O using base 10. Continue to develop understanding of partitioning and place value. 41 + 8 	Children to represent the base 10 e.g. lines for tens and dot/crosses for ones. 
TO + TO using base 10. Continue to develop understanding of partitioning and place value. 36 + 25 	Chidlren to represent the base 10 in a place value chart. 

Encountering Subtraction

Language to be modelled	Play/Sensory-based activities
Take away Less Subtract Fewer Remove Before Minus	• Count and Remove Objects- could be a sensory bin filled with colourful objects like small toys, beads, or buttons. • Fruit Snack Subtraction- could use edible items like grapes or cereal pieces. "You had eight grapes, and you ate three. How many grapes are left?" • Sensory Number Line- create a tactile number line on the floor with tape or chalk. "Jump back three spaces from five to find out how many are left." • Storytelling with Puppets- Use puppets or stuffed animals to act out subtraction stories. For example, "Puppet A has six apples, and Puppet B takes away two. How many apples does Puppet A have now?" • Subtraction with Playdough- "You made five snakes, and we squished two. How many snakes are left?" • Singing songs

Concrete	Pictorial
Physically taking away and removing objects from a whole (ten frames, Numicon, cubes and other items such as beanbags could be used). 4 – 3 = 1 	Children to draw the concrete resources they are using and cross out the correct amount. The bar model can also be used. 
Counting back (using number lines or number tracks) children start with 6 and count back 2. 6 – 2 = 4  	Children to represent what they see pictorially e.g. 

Finding the difference (using cubes, Numicon or Cuisenaire rods, other objects can also be used). Calculate the difference between 8 and 5.  	Children to draw the cubes/other concrete objects which they have used or use the bar model to illustrate what they need to calculate. 
Making 10 using ten frames. 14 – 5  	Children to present the ten frame pictorially and discuss what they did to make 10. 
Column method using base 10. 48-7  	Children to represent the base 10 pictorially. 

Addition and Subtraction Without Regrouping

What is the Column Method?

The column method is a mathematical method of calculation where the numbers to be added or subtracted are set out above one another in columns. The use of the terminology for the first column can appear interchangeable, with the ones and ones being used as labels. At primary level we will refer to the ones column exclusively, as prescribed by KS1 and KS2 National Curriculum. Once students get to secondary level we can introduce them to the idea of using the units column as an alternative label.

Column Addition

Also known as columnar addition, column addition is a formal method of adding numbers. When writing the numbers it's important to remember to place the numbers one on top of the other by lining up the hundreds, tens, and ones. (see example below)

Column method in addition:

	1	4			5	2			5	4
+	2	3		+	4	1		+	4	5
	3	7			9	3			9	9

Column Subtraction

Column method in subtraction:

	3	3			2	5			1	6
-	1	1		-	1	3		-	1	0
	2	**2**			**1**	**2**				**6**

Why is Place Value Important in the Column Method?

The column method is a quick way for a student to work out addition and subtraction, but place value also needs to be learnt. This is because students need to understand the role each digit plays.

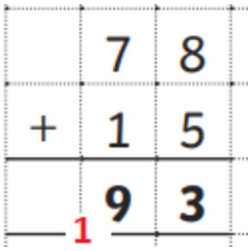
Consider the calculation: 78 + 15.

1. First, as the numbers are lined up, add the ones and write the answer. Adding 8 and 5 gives an answer of 13, but you should write only the ones under the line - in this case, it's the digit 3.

2. Regroup any tens under the tens column. In 13, the digit 1 is the value of the tens, so write it down.

3. Add the tens, including any tens you have regrouped. In this example, 7 plus 1 equals 8, but you need to add 1 from under the line. So the answer for the tens is 9.

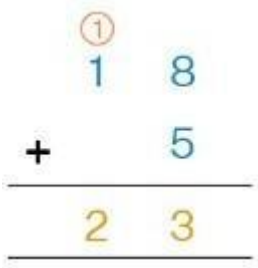
4. Finally, check your answer.



Addition With Regrouping/Exchange

Addition with regrouping is a process of arranging numbers in columns of tens and ones for addition. Addition with regrouping is also known as addition with exchange. In addition with regrouping, we place two or more large numbers column-wise according to their place value, and when the sum of any of these columns is more than 9, we regroup or exchange that sum into tens and ones.

Example: Add 18 + 5

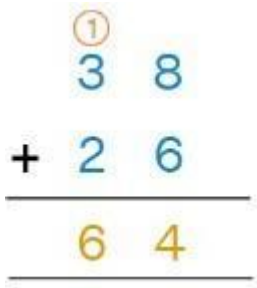


- Step 1: Place 18 and 5 in proper columns according to their place values one below the other as shown above.
- Step 2: Add 8 and 5 which comes to 13. Since 13 has exceeded 9 we will regroup it. In other words, 13 is a two-digit number so we will regroup this sum into tens and ones. This means we will exchange the tens digit of the sum to the preceding column and write the ones digit in that particular column. Here, we will write 3 in the ones column, and exchange the 10 1s to one ten.
- Step 3: This 1 which is an exchange in the tens column will be added to the existing number which is 1. So the sum of this column will be 2. Therefore, the sum of 18 + 5 = 23.

2- Digit Addition With Regrouping/ Exchange

In 2-digit addition with regrouping, we use the same steps as discussed above.

Example: Add 38 + 26

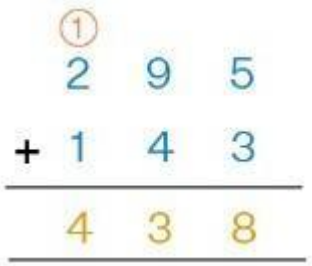


- Step 1: Arrange 38 and 26 column-wise according to their place value. So, 8 and 6 will be placed in the ones column and 3 and 2 will be placed in the tens column.
- Step 2: Start adding the numbers in the ones column, and we get 8 + 6 = 14. Since 14 exceeds 9, we need to regroup it. So, we write 4 in this column and exchange to 10 ones for 1 ten in the next column.
- Step 3: Now we move on to the tens column and add the numbers along with the exchanged ten. This means it is 3 + 2 + 1 = 6. So, we write 6 as the sum of this column. Therefore, 38 + 26 = 64.

3- Digit Addition With Regrouping/ Exchange

3-digit addition with exchange is similar to 2-digit addition with exchange..

Example: Add 295 + 143



- Step 1: Arrange 295 and 143 column-wise according to their place value. So, 5 and 3 will be placed in the ones column, 9 and 4 will be placed in the tens column, and 2 and 1 will be placed in the hundreds column.
- Step 2: Start adding the numbers in the ones column, and we get 5 + 3 = 8.
- Step 3: Now we move on to the tens column and add the numbers, 9 + 4 = 13. Since 13 exceeds 9, we need to exchange it. So, we write 3 in this column and exchange 1 to the next column.
- Step 4: Now, we move on to the hundreds column and add the numbers along with the exchanged number. This means it will be 2 + 1 + 1 = 4. So, we write 4 as the sum of this column. Therefore, 295 + 143 = 438

Subtraction With Regrouping/ Exchange

Subtraction with regrouping/ exchange is a process of arranging two or more large numbers vertically to find the difference between the two given numbers. Exchange is the process of making groups of tens when adding or subtracting two-digit numbers (or more).

Subtraction with exchange is considered extremely helpful in daily life such as when we are dealing with money like shopping, when we want to measure time like calculating the exact time from a different time zone, and when we want to measure distance.

Subtraction With Regrouping/ Exchange Steps

Subtraction with regrouping is also known as subtraction with exchange. Here are the steps used when subtracting numbers with regrouping:

- Step 1: Arrange the numbers according to their place value in a vertical manner.
- Step 2: Start subtracting the digits in the ones column. If the number in the bottom is higher than the top number, we will exchange 1 from the tens column to 10 ones which will be combined to the number in the ones column.
- Step 3: After giving 10 ones to the ones column, the number at the tens column will reduce by 1. Now, subtract the numbers in the ones column.
- Step 4: We follow step 2 with the rest of the numbers in 2-digit and more numbers. As and when we exchange, we subtract the numbers simultaneously.
- Step 5: Subtract the last number to find the final difference.

2- Digit Subtraction With Regrouping/ Exchange

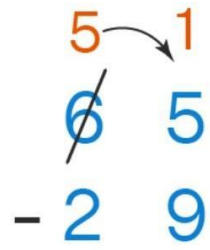
2- digit subtraction with regrouping can be performed by using the steps mentioned above. The place value for 2-digit numbers is ones and tens.

Subtract 29 from 65.

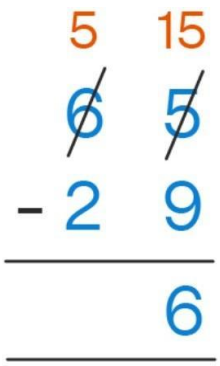
Step 1: Arrange the numbers according to their place value with the greater number on top. So 5 and 9 are in the ones place and 2 and 6 are in the tens place.

$$\begin{array}{r} 6\ 5 \\ -\ 2\ 9 \end{array}$$

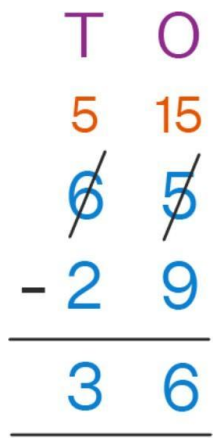
Step 2: We begin with the ones column. Since 5 is smaller than 9, we exchange 1 from the tens column i.e. 6 which becomes 5.



Step 3: The 1 that is exchanged makes 5 as 15. So, 15 - 9 = 6.



Step 4: Once we have subtracted on the ones column, move on to the tens column. 5 - 2 = 3.



The difference between 65 and 29 is 36.

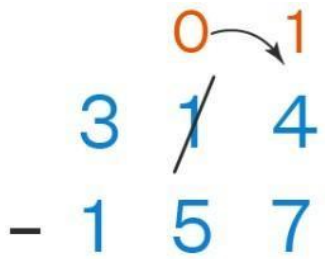
3- Digit Subtraction With Regrouping/Exchange

3- digit subtraction with regrouping is also performed in a similar manner as the one-digit and the 2-digit numbers. The place value for 3-digit numbers is hundreds, tens, and ones.

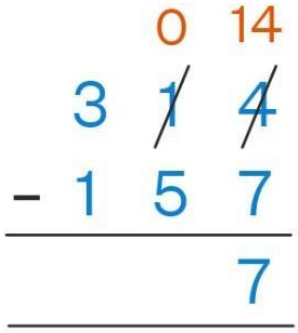
Subtract 314 from 157.

Step 1: Arrange the numbers according to their place value with the greater number on top. So 4 and 7 are in the ones column, 1 and 5 are in the tens column, and 3 and 1 are in the hundreds column.

Step 2: We begin with the ones column. Since 4 is smaller than 7, we exchange 1 from the tens column into 10 ones i.e. 1 which reduces to 0.

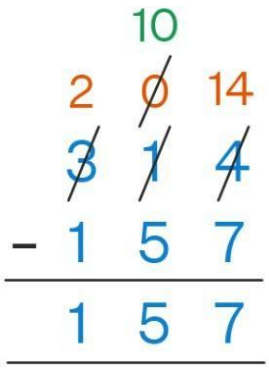


Step 3: The 1 that is exchanged makes 4, 14. So, 14 - 7 = 7.



Step 4: Follow step 2 again with the tens and hundreds column by exchanging 1 hundred into 10 tens from the hundreds column, which will reduce the hundred

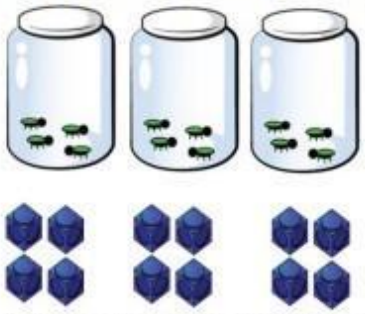
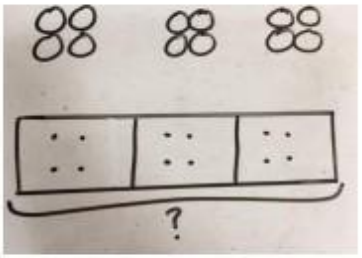
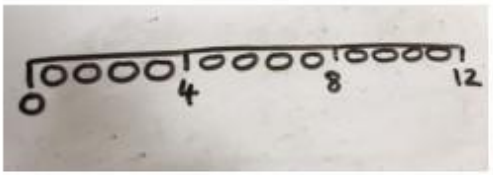
column to 2. This then combines with the 0 in the tens column to make it 10. Subtract all the numbers to find the difference.

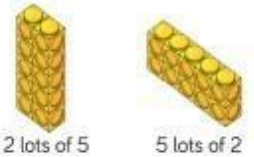
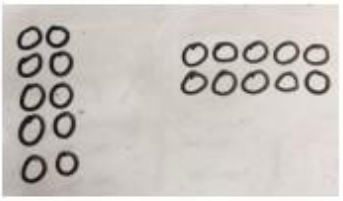
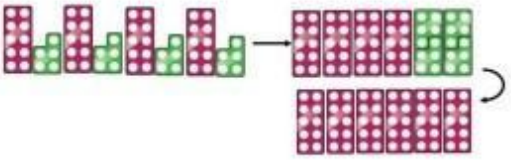
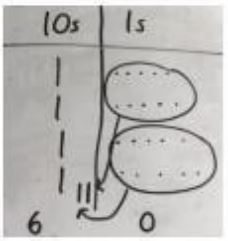
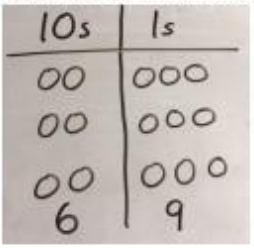


The difference between 314 and 157 is 157.

Encountering Multiplication

Language to be modelled	Play/Sensory-based activities
Altogether Equal groups Total Lots of Big Small Groups of Multiply	• Counting pairs of shoes/ wellies • Counting pairs of socks • Sticking wings on a butterfly during collage • Counting/ sticking eyes on different animals • Counting/ sticking ears on animals • Tidying up- putting groups of objects together • Singing songs/ rhymes

Concrete	Pictorial
Repeated grouping/repeated addition 3 × 4 4 + 4 + 4 There are 3 equal groups, with 4 in each group.  	Children to represent the practical resources in a picture and use a bar model. 
Number lines to show repeated groups- 3 × 4   Cuisenaire rods can be used too.	Represent this pictorially alongside a number line e.g.: 

Use arrays to illustrate commutativity counters and other objects can also be used. 2 × 5 = 5 × 2  2 lots of 5 5 lots of 2	Children to represent the arrays pictorially. 
Partition to multiply using Numicon, base 10 or Cuisenaire rods. 4 × 15 	Children to represent the concrete manipulatives pictorially. 
Formal column method with place value counters (base 10 can also be used.) 3 × 23 	Children to represent the counters pictorially. 

Grid Multiplication

Grid method vs Column Multiplication

We will initially introduce the grid method for up to 3-digit by 2-digit multiplication, with 3 digit and beyond maintaining the column method. Once students are fully familiar with the grid method then it can be used to expand on their column multiplication skills for 3 digit and beyond.

Multiplying a one-digit number by a two-digit number

All grid multiplication questions will be laid out in a box like the one below. The table might have more rows and columns depending on the numbers you're multiplying. The larger the numbers, the more rows and columns you'll have.

✖	TENS	ONES
ONES		

[1]Example: What is 26 x 5?

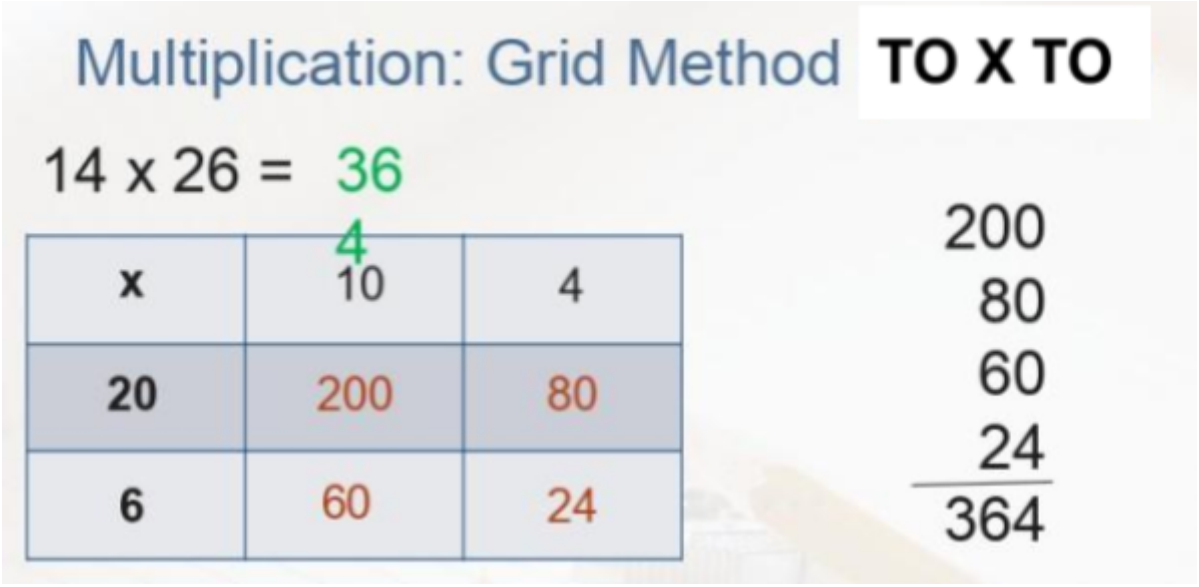
- To put the numbers in the grid, you first need to know that 26 is made of 20 and 6. The 20 would go in the TENS column, the 6 would go in the horizontal ones column, and the 5 would go in the vertical ones column. See the table below of how these are laid out.
- You would then multiply the 20 by the 5, and write the answer (100) in the column below.

- Next, you would do the same with the 6 and the 5, to get the answer 30.
- Finally, add the two answers together to get the final answer to the original sum.

How to multiply a two-digit number by a two-digit number with the grid method

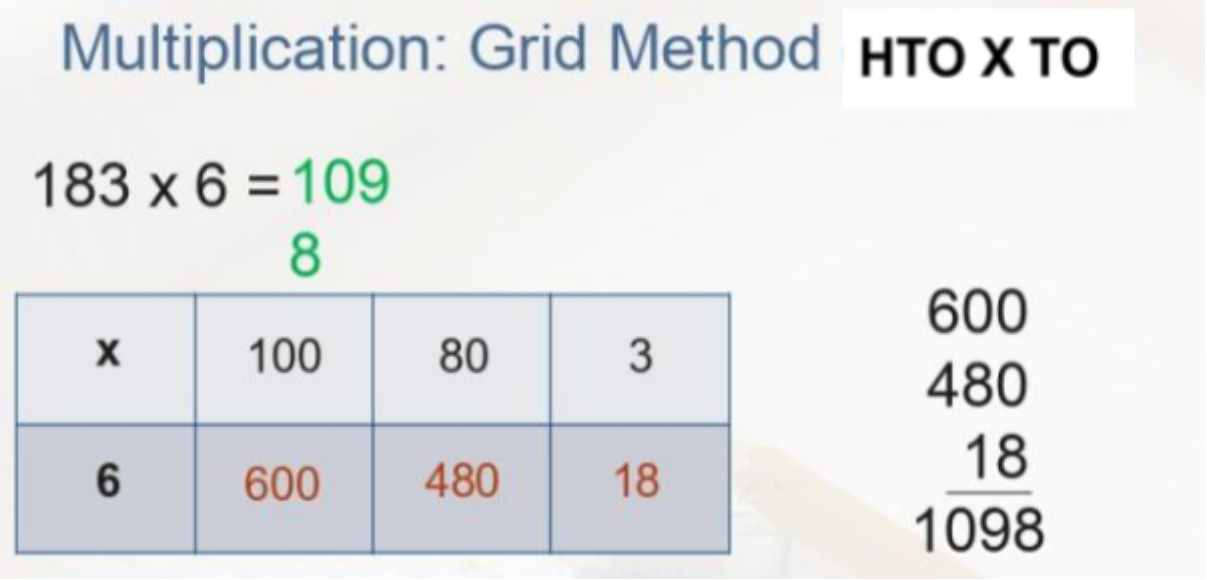
Before exposing students to the grid method for more advanced multiplications they will hopefully be confident in the following areas:

- understanding of times tables;
- multiplying by 10;
- multiplying one-digit numbers by multiples of 10 (for example, 6 x 20, 8 x 70 and so on);
- multiplying two multiples of 10, (for instance, 40 x 90);
- Addition of four numbers, including three-digit.



1. Break down the first number into tens and ones and write it down in the grid.
2. Similarly, break down the second number into tens and ones.
3. Multiply the tens and ones of the first number by the tens and ones of the second number.
4. Find the total of the numbers you got by multiplying. For the example above, you should add 200 + 80 + 60 + 24. This results in 364 as the answer to the calculation 14 × 26.

How to multiply a three-digit number by a one-digit number with the grid method



1. Break down the number into hundreds, tens and ones and put both numbers into a grid.
2. Multiply each digit in the first number by the second number.
3. Find the total of the three numbers you got by multiplying.

How to multiply a three or four-digit number by a two-digit number with the grid method

- Break down the first number into thousands, hundreds, tens and ones.
- Break down the second number into tens and ones.
- Multiply each digit in the first number by the second number.
- Find the total of the numbers you got by multiplying.

How to multiply a decimal by a one-digit number with the grid method

×	6	0.3
4		

Consider the example above: 4 x 6.3.

1. Break down the number ones and tenths and put both numbers into a grid.
2. Multiply each digit in the first number by the second number. In this case:
   4 x 6 = 24
   4 x 0.3 = 1.2
3. Find the total of the two numbers you got by multiplying.

   24 + 1.2 = 25.2

Multiplying amounts of money with the grid method

Multiplying an amount of money with the grid method is similar to the example above.

James is going to the cinema with his three friends.

Each cinema ticket costs £6.30.

How much will four cinema tickets cost altogether?

Simply follow the same steps above. Remember to include the £ sign in the answer and add an extra zero at the end if necessary to get £25.20.

Long Multiplication Column Method

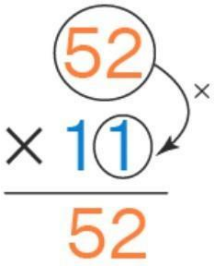
Long multiplication is a method of multiplying 2 or more numbers together. If we need to multiply together any two numbers greater than 10 or 100, we usually perform long multiplication. The other name for long multiplication is the column method of multiplication as numbers can be multiplied in a column as well.

- Step 1: Arrange the numbers in a column format according to their place value. The larger number is usually written on top.
- Step 2: Once arranged, start by multiplying the bottom number in the ones column with the top number.
- Step 3: Always remember to move right to left, hence when the result is obtained arrange it below the two numbers. Start multiplying the tens number in the bottom number with the top number. Place the result by leaving the ones column empty or placing a zero.
- Step 4: Once the numbers are obtained, using the method of addition to arrive at the final solution.

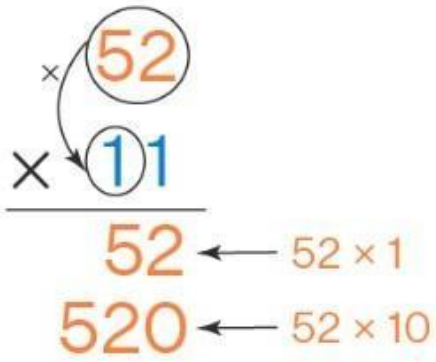
Consider the following example, multiply 52 × 11.

Step 1: Vertically arrange the numbers as shown below.

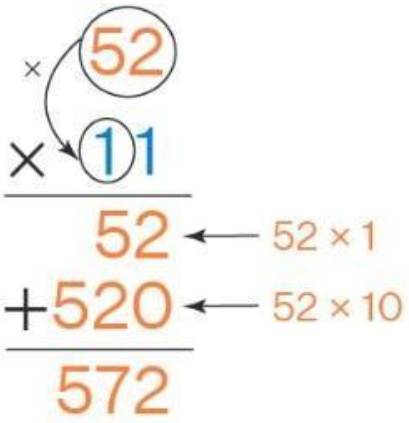
Step 2: First multiply 52 with 1.



Step 3: Now multiply 52 with the 1 in the tens column, here we are actually multiplying 52 with 10.



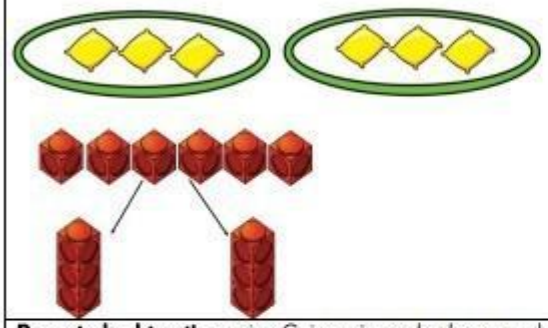
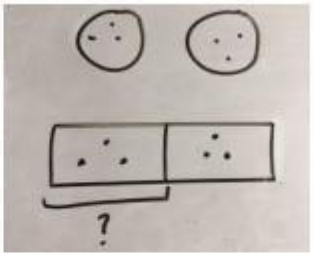
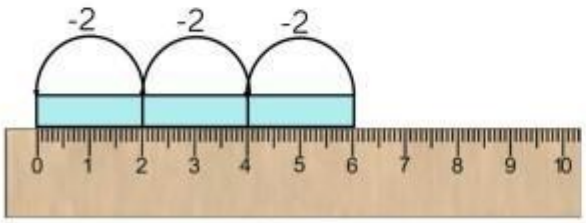
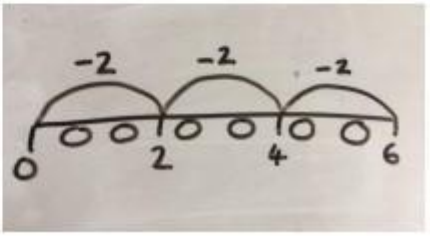
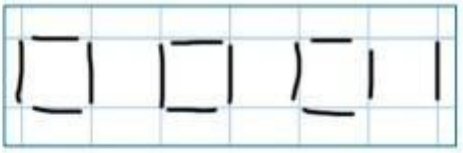
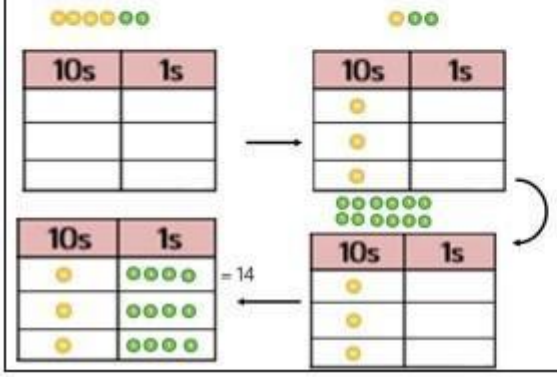
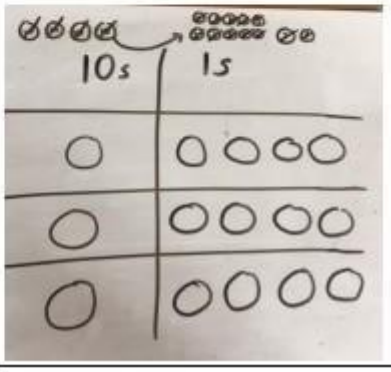
Step 4: Now add 52 and 520.



Therefore, 52 × 11 = 572.

Encountering Division

Language to be modelled	Play/Sensory-based activities
Sharing Equal parts Half Taking turns Sorting objects Divide Equal Groups	• Snacktime- sharing a whole packet of biscuits between children • Playing with cars, animals, cubes and sorting into groups or putting into a bucket/ garage/ box • Asking for half or whole of a slice of toast • Playing games with others and taking turns • Sharing a large block of playdough

Concrete	Pictorial
Sharing using a range of objects. 6 – 2 	Represent the sharing pictorially. 
Repeated subtraction using Cuisenaire rods above a ruler. 6 – 2  3 groups of 2	Children to represent repeated subtraction pictorially. 
2d + 1d with remainders using lollipop sticks. Cuisenaire rods, above a ruler can also be used. 13 – 4 Use of lollipop sticks to form wholes- squares are made because we are dividing by 4.  There are 3 whole squares, with 1 left over.	Children to represent the lollipop sticks pictorially.  There are 3 whole squares, with 1 left over.
Sharing using place value counters. 42 ÷ 3 = 14 	Children to represent the place value counters pictorially. 

Division (Bus-stop)

How to do short division (two-digit number divided by one-digit number)

1. Position the numbers in the right places.
2. Divide the tens digit of the dividend. How many times does the divisor go into the dividend? Write this down.
3. Are there any remainders? Carry the remainders over to the ones column.
4. Divide the ones column by the divisor, including the remainder from the tens column if needed. How many times does the divisor go into the ones column of the dividend? Write this down.
5. Are there any remainders? Write the remainders down to show how many digits are left over once the whole number of the divisor has fit into the dividend as many equal times as possible.

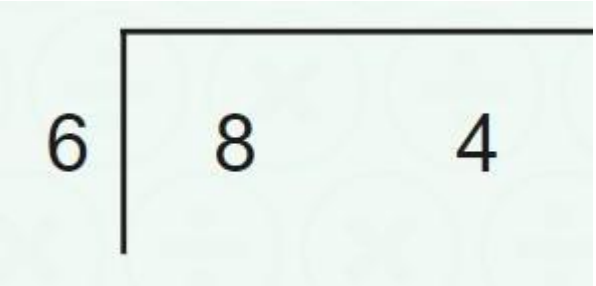
Example: Work out what's 84 divided by six. 84 ÷

6 = ?

Step 1: Positioning the numbers.

To begin with, position the numbers as shown in the image below. Draw the line neatly - if you look at it, you might notice that it looks like a bus stop, which is why this written method is sometimes known as the Bus Stop method.

Then, write the number you're dividing by, the divisor, in front of the vertical line. Once you've done that, write the number that is being divided, the dividend, on the right-hand side of the vertical line.



Step 2: Dividing the tens digit of the dividend.

Start dividing each of the digits in the dividend (84 in our example) by six (our divisor). When dividing, start from the left - the tens digit first.

Eight is the tens digit in this example, so you divide eight by six. However, this wouldn't give you an exact answer. What you need to do is think about how many times six can fit into eight.

Six can fit into eight only once and you'll have two as a remainder. The image below can show you how to write this down.

So, one goes above the line, right above eight. The remainder goes next to the next digit of the dividend.

Step 3: Dividing the next number of the dividend.

Because in the example above there's a remainder (two), this means that when dividing the next digit, you won't divide four by six. Rather, the next number you'll divide into is the combination of the remainder and four. In this example, that's the number 24.

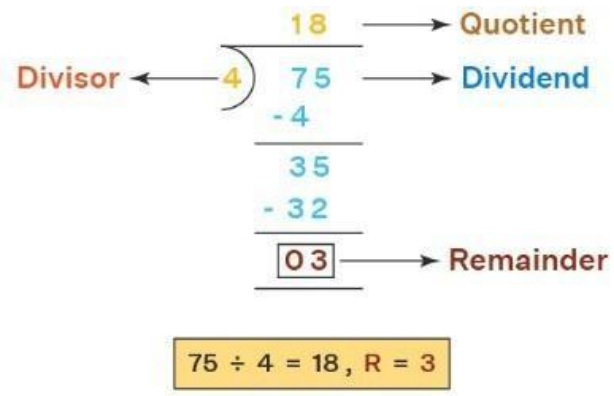
24 divided by six equals four, so you can write on top of the line - see below.

Long Division

Long Division is a method for dividing large numbers, which breaks the division problem into multiple steps following a sequence. Just like the regular division problems, the dividend is divided by the divisor which gives a result known as the quotient, and sometimes it gives a remainder too.

What is the Long Division Method?

Long division is a method for dividing large numbers into steps or parts, breaking the division problem into a sequence of easier steps. It is the most common method used to solve problems based on dividing. The following long division method to see how to divide step by step and check the divisor, the dividend, the quotient, and the remainder.



Parts of Long Division

While performing long division, we need to know the important parts of long division. The basic parts of long division can be listed as follows:

- Dividend
- Divisor
- Quotient
- Remainder

The following table describes the parts of long division with reference to the example shown above.

Dividend	The number which has to be divided.	75
Divisor	The number which divides the dividend.	4
Quotient	The result of division.	18
Remainder	The leftover part or the number left after the division which cannot be divided further.	3

Long Division Steps

In order to perform division, we need to understand a few steps. We can also use the same basic layout as the bus-stop method at the beginning of a problem.

- Step 1: Take the first digit of the dividend from the left. Check if this digit is greater than or equal to the divisor.
- Step 2: Then divide it by the divisor and write the answer on top as the quotient.
- Step 3: Subtract the result from the digit and write the difference below.
- Step 4: Bring down the next digit of the dividend (if present).
- Step 5: Repeat the same process.

While performing long division, we may come across problems when there is no remainder, while some questions have remainders.

Division with Remainders

Case 1: When the first digit of the dividend is equal to or greater than the divisor.

Example: Divide 435 ÷ 4

Solution: The steps of this long division are given below:

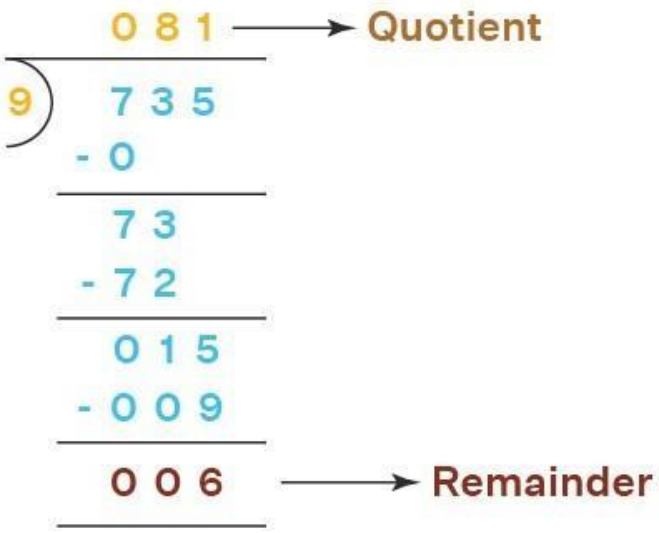
- Step 1: Here, the first digit of the dividend is 4 and it is equal to the divisor. So, 4 ÷ 4 = 1. So, 1 is written on top as the first digit of the quotient.
- Step 2: Subtract 4 - 4 = 0. Bring the second digit of the dividend down and place it beside 0.
- Step 3: Now, 3 is less than 4. So we write 0 as the quotient and bring down the next digit of the dividend and place it beside 3.

- Step 4: So, we have 35 as the new dividend. We can see that 35 is greater than 4 but 35 is not divisible by 4, so we look for the number just less than 35 in the 4 times table. We know that 4 × 8 = 32 which is less than 35 so, we use the 8.
- Step 5: Write 8 in the quotient. Subtract: 35 - 32 = 3.
- Step 6: Now, 3 is less than 4. Therefore, 3 is the remainder and 108 is the quotient.

Case 2: When the first digit of the dividend is less than the divisor.

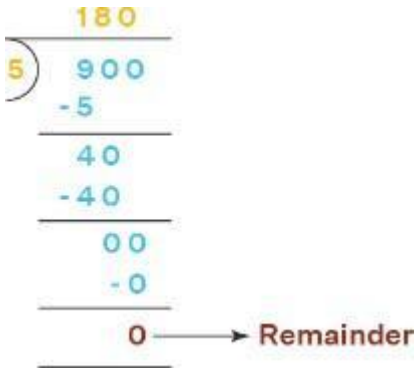
Example: Divide 735 ÷ 9

- Step 1: Since the first digit of the dividend is less than the divisor, put zero as the quotient and bring down the next digit of the dividend. Now consider the first 2 digits to proceed with the division.
- Step 2: 73 is not divisible by 9 but we know that 9 × 8 = 72 so we use the 8.
- Step 3: Write 8 in the quotient and subtract 73 - 72 = 1.
- Step 4: Bring down 5. The number to be considered now is 15.
- Step 5: Since 15 is not divisible by 9 but we know that 9 × 1 = 9, so, we take away the 9.
- Step 6: Subtract: 15 - 9 = 6. Write 1 in the quotient.
- Step 7: Now, 6 is less than 9. Therefore, the remainder = 6 and quotient = 81.



Division without Remainder Example:

Divide 900 ÷ 5



- Step 1: Consider the first digit of the dividend and divide it by 5. Here it will be 9 ÷ 5.
- Step 2: Now, 9 is not divisible by 5 but 5 × 1 = 5, so, write 1 as the first digit in the quotient.
- Step 3: Write 5 below 9 and subtract 9 - 5 = 4.
- Step 4: Since 4 is less than 5, we will bring down 0 from the dividend to make it 40.
- Step 5: 40 is divisible by 5 and we know that 5 × 8 = 40, so, write 8 in the quotient.
- Step 6: Write 40 below 40 and subtract 40 - 40 = 0.
- Step 7: Bring down the next 0 from the dividend. Since 5 × 0 = 0, we write 0 as the remaining quotient.
- Step 9: Therefore, the quotient = 180 and there is no remainder left after the division, that is, remainder = 0.

Long Division by a 2 Digit Number

Long division by a 2 digit number means dividing a number by a 2-digit number. We consider both the digits of the divisor and check for the divisibility of the first two digits of the dividend.

For example, if we need to divide 7248 by 24, we can do it using the long division steps.

- Step 1: Since it is a long division by a 2 digit number, we will check for the divisibility of the first two digits of the dividend. The first 2 digits of the dividend are 72 and it is greater than the divisor, so, we will proceed with the division.
- Step 2: Using the multiplication table of 24, we know that 24 × 3 = 72. So we write 3 in the quotient and 72 below the dividend to subtract these. Subtract 72 - 72 = 0.
- Step 3: Bring down the next number from the dividend, that is, 4. The number to be considered now is 4.
- Step 4: Since 4 is smaller than 24, we will put 0 as the next quotient, since 24 × 0 = 0 and write 0 below 4 to subtract 4 - 0 = 4
- Step 5: Bring down the next number from the dividend, that is, 8 and place it next to this 4. The number to be considered now is 48.
- Step 6: Using the multiplication table of 24, we know that 24 × 2 = 48. So we write 2 in the quotient and 48 below the dividend to subtract these. Subtract 48 - 48 = 0. Therefore, remainder = 0 and quotient = 302. This means, 7248 ÷ 24 = 302.