Long multiplication is a method for multiplying large numbers together. It is designed to make the process more straightforward, and allow you to complete complicated multiplications without a calculator.

Method

1. Rewrite the numbers, splitting them into their hundreds, tens, units etc. For example, we write 154 as 100 + 50 + 4.

2. Write this into a grid formation. For example, if we were asked to calculate 235 x 15, we would write this as (200 + 30 + 5) x (10 + 5), and we would write the grid as:

x	200	30	5
10			
5			

3. Figure out which calculations you will need to complete in order to fill in the grid. We do this by multiplying the number at the top of the column by the number at the left of the row, and writing this in the space. For example, the earlier grid's calculations are as follows:

x	200	30	5
10	200 x 10	30 x 10	5 x 10
5	200 x 5	30 x 5	5 x 5

4. Complete these calculations, and write in the answers.

x	200	30	5
10	2000	300	50
5	1000	150	25

5. Add up the numbers in the grid.

2000 + 1000 + 300 + 150 + 50 + 25 = 3525. This is the answer to 235 x 15.

Example

What is 763 x 238?

Answer

First, we separate out the two numbers. So, 763 x 238 = (700 + 60 + 3) x (200 + 30 + 8).

Then we write these numbers into a grid:

x	700	60	3
200			
30			
8			

We figure out which calculations need to be completed:

x	700	60	3
200	700 x 200	60 x 200	3 x 200
30	700 x 30	60 x 30	3 x 30
8	700 x 8	60 x 8	3 x 8

And then complete those calculations:

x	700	60	3
200	140,000	12,000	600
30	21,000	1,800	90
8	5,600	480	24

We add up the numbers we have calculated:

140,000 + 21,000 + 12,000 + 5,600 + 600 + 1,800 + 90 + 480 + 24 = 181,594.

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Multiplying more than two numbers

We can use this method to multiply any amount of numbers together, due to two properties called associativity and commutativity that the multiplication operation has. Associativity basically means that doing the calculation 2 x 3 x 4 can be performed as (2 x 3) x 4, or 2 x (3 x 4), and commutativity means that 2 x 3 x 4 can be performed as or 2 x 4 x 3, or 3 x 4 x 2, etc. We may multiply the numbers in any order and still get the same answer.

So, if we are asked to multiply three numbers together, we may use long multiplication on two of them, and then multiply that answer by the third number. If we multiply four numbers, we follow the previous process and then multiply that answer by the fourth number, and so on.

Example

What is 12 x 18 x 21?

Answer

We begin by using long multiplication on 12 and 18.

We rewrite this as 12 x 18 = (10 + 2) x (10 + 8), and set up the grid as follows:

x	10	2
10		
8		

Now we fill in the answers:

x	10	2
10	100	20
8	80	16

The sum of these answers is 216.

We now calculate 12 x 18 x 21 = (12 x 18) x 21 = 216 x 21.

We rewrite this as 216 x 21 = (200 + 10 + 6) x (20 + 1), and set up the grid as follows:

x	200	10	6
20			
1			

We fill in the answers:

x	200	10	6
20	4000	200	120
1	200	10	6

The sum of the answers is 4536, therefore 12 x 18 x 21 = 4536.

Tips

- It doesn't matter which number you write along the top and which is on the side, as long as all of the numbers on the top add up to make one of the numbers being multiplied, and all of the ones down the side add up to make the other number being multiplied.
- If you are struggling to add up that many numbers, try using the long addition method.
- When multiplying two numbers that end in zeros, the answer will always have the same number of zeros at the end. For example, 10 x 200 has 3 zeros in, so the answer will also have three: 10 x 200 = 2000.

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