Student Learning Centre

Long Multiplication

Flinders University
inspiring achievement

Doing long multiplication requires understanding *place-value.*

So what is place-value?

Place-value refers to the numerical value that a digit has according to its position in a number. Each place has a value of 10 times the place to its right. The ones place is to the immediate left of the decimal point. For example:

In the number **5 2 1 6 3 . 7 9 6**, because of its position in the number, each digit has the following value (digits listed from left to right):

Place-value	Ten Thousands	Thousands	Hundreds	Tens	Ones	Tenths	Hundredths	Thousandths
Example Figure	**5**	**2**	**1**	**6**	**3**	**.7**	**9**	**6**
Example Meaning	50 000	2000	100	60	3	$\frac{7}{10}$	$\frac{9}{100}$	$\frac{6}{1000}$

The number 52163.796 can also be written as:

$$(5 \times 10{,}000) + (2 \times 1000) + (1 \times 100) + (6 \times 10) + (3 \times 1) + (7 \times \tfrac{1}{10}) + (9 \times \tfrac{1}{100}) + (6 \times \tfrac{1}{1000})$$

How do we apply long multiplication?

EXAMPLE 1: 522×64

Step 1

Line up the numbers according to place-value:

✓

	H	T	Ones
	5	2	2
×		6	4

These numbers are lined up correctly, according to place-value.

✗

	H	T	Ones
	5	2	2
×	6	4	

But here, the numbers are ***not*** lined up according to place-value.

(EXAMPLE 1 continued)

Step 2a

Multiply the top number with the number in the ones place-value (522×4). Start writing the results in the ones place-value and work from right to left:

- 2×4
- 20×4 Think of this a 2×4, put answer (8) in tens place-value.
- 500×4 Think of this as 5×4, put the answer in the hundreds place-value. Since 5 is the leftmost digit of the top number, we have now finished multiplying, and can write the answer **(20)** straight in as the result.

	Th	H	T	Ones
		5	2	2
×			6	4
	2	0	8	8

Step 2b

Multiply the top number with the number in the ten place-value (522×60). (Think of this as 522×6):

- Put a **0** (zero) in the ones place-value and start writing the results from the tens place-value, on the second line.
- $\mathbf{2 \times 60}$. Think of this as 2×6, put results (12) in tens place-value. Note that instead of writing **12** as the result, we put the 2 in the tens place-value and carry the 1 over to the next place-value to your left.
- $\mathbf{20 \times 60}$ Think of this as 2×6, put results in hundreds place-value. Note that our result is **13** ($6 \times 2 + 1$ where 1 is carried over). Instead of writing 13 as a result, we put the 3 in the hundreds place-value and again, carry the 1.
- $\mathbf{500 \times 60}$ Think of this as 5×6, put results in thousands place-value. Note that our result is **31** ($5 \times 6 + 1$, where 1 was carried over). Since 5 is the leftmost digit of the top number, we have now finished multiplying, and can write the answer (31) straight in as the result.

	Ten Th	Th	H	T	Ones
			$^{1}5$	$^{1}2$	2
×				6	4
		2	0	8	8
	3	1	3	2	0

Step 3

Add line one and line two below to get your answer **(2088 + 31320).** Note that when we add 8 and 2 we get **10**, so we put the zero as part of our results and carry the 1.

	Ten Th	Th	H	T	Ones
			5	2	2
×				6	4
		2	$^{1}0$	8	8
+	3	1	3	2	0
Answer	3	3	4	0	8

How to multiply a three digit number by a thee digit number?

The principle of multiplying a three digit number is the same as multiplying a two digit number (see previous example), we just add a third line below.

EXAMPLE 2:
283×249

	Ten Th	Th	H	T	Ones
			$^{1}2$	8	3
×			(2)	4	9
		2	5	4	7
	1	1	3	2	0
+	5	6	6	0	0
=	7	0	4	6	7

Step 1 & 2: Use the same principles from example 1 on the previous page to get the first two lines.

Step 3: Add a **0** in both the ones place-value and the tenth place-value. *You can also leave these place-values blank.*

Step 4: Multiply the (2) in the hundreds place-value with each number above and place the answers below – on the third line.

- $2 \times 3 = 6$
- $2 \times 8 = 16$ (Put the **6** in the thousands place-value and carry the **1**)
- $2 \times 2 + 1 = 5$

Step 5: Add line 1, 2 and 3 to get your answer.

Now you try

Use long multiplication to calculate the figures below. We've done the first two for you. Check your answers on the back.

1) 156×247	2) 871×48	3) 123×79	4) 473×84	5) 471×395	6) 621×578
156 x 247 1092 6240 + 31200 = 38532	871 x 48 6968 + 34840 = 41808				

Answers:

1) 38532
2) 41808
3) 9717
4) 37732
5) 186045
6) 358938

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