LONG MULTIPLICATION

Long multiplication is a method used for multiplying larger numbers. It requires knowledge of the multiplication table for single digits.

A MULTIPLICATION TABLES FOR MULTIPLES OF 10

Proposition Multiplication Table for Multiple of 10

To multiply by multiples of 10, use the regular multiplication table and add the zeros from the factors to the result:

$$
\begin{aligned}
3 \times 1 &= 3 & 300 \times 10 &= 3000 \\
3 \times 2 &= 6 & 300 \times 20 &= 6000 \\
3 \times 3 &= 9 & 300 \times 30 &= 9000 \\
3 \times 4 &= 12 & 300 \times 40 &= 12000 \\
3 \times 5 &= 15 & 300 \times 50 &= 15000 \\
3 \times 6 &= 18 & 300 \times 60 &= 18000 \\
3 \times 7 &= 21 & 300 \times 70 &= 21000 \\
3 \times 8 &= 24 & 300 \times 80 &= 24000 \\
3 \times 9 &= 27 & 300 \times 90 &= 27000
\end{aligned}
$$

B LONG MULTIPLICATION BY ONE-DIGIT NUMBERS

Method Column Multiplication

To calculate 23×7, follow these steps:

1. **Step 1: Write the multiplication in columns**
   Write the numbers in columns, aligning the digits based on their place value (units, tens, hundreds).

$$
\begin{array}{r}
2\,3 \\
\times\ \ 7 \\
\hline
\end{array}
$$

2. **Step 2: Multiply the ones**

$$3 \text{ ones} \times 7 \text{ ones} = 21 \text{ ones} = 2 \text{ tens} + 1 \text{ one}$$

   Write the carry-over (2) above the tens column.

$$
\begin{array}{r}
{\scriptstyle 2\ \ } \\
2\,3 \\
\times\ \ 7 \\
\hline
\ \ 1
\end{array}
$$

3. **Step 3: Multiply the tens**

$$2 \text{ tens} \times 7 \text{ ones} + 2 \text{ tens (carry-over)} = 16 \text{ tens}$$

   Write 16 in the tens and hundreds columns.

$$
\begin{array}{r}
{\scriptstyle 2\ \ } \\
2\,3 \\
\times\ \ 7 \\
\hline
1\,6\,1
\end{array}
$$

4. **Result**: $23 \times 7 = 161$.

C LONG MULTIPLICATION BY MULTI-DIGIT NUMBERS

Method **Column Multiplication for Multi-Digit Numbers**

To calculate 23×37, follow these steps:

1. **Step 1: Write the multiplication in columns**

$$\begin{array}{r} 23 \\ \times\, 37 \\ \hline \end{array}$$

2. **Step 2: Multiply the ones digit (7)**

   (a) Multiply the ones: $3 \times 7 = 21$

$$\begin{array}{r} {\scriptstyle 2} \\ 23 \\ \times\, 37 \\ \hline 1 \end{array}$$

   (b) Multiply the tens: $2 \times 7 + 2_{\text{(carried)}} = 14 + 2 = 16$

$$\begin{array}{r} {\scriptstyle 2} \\ 23 \\ \times\, 37 \\ \hline 161 \end{array}$$

3. **Step 3: Multiply the tens digit (3)**

   (a) Add a placeholder . (or 0) as a for the multiplication with a tens digit

$$\begin{array}{r} 23 \\ \times\, 37 \\ \hline 161 \\ . \end{array}$$

   (b) Multiply the ones: $3 \times 3 = 9$

$$\begin{array}{r} 23 \\ \times\, 37 \\ \hline 161 \\ 9\,. \end{array}$$

   (c) Multiply the tens: $2 \times 3 = 6$

$$\begin{array}{r} 23 \\ \times\, 37 \\ \hline 161 \\ 69\,. \end{array}$$

4. **Step 4: Add the intermediate results** $161 + 690 = 851$

$$\begin{array}{r} 23 \\ \times\, 37 \\ \hline 161 \\ 69\,. \\ \hline 851 \end{array}$$

5. **Result**: $23 \times 37 = 851$.