

1.7. Long Multiplication and Division Review

Multiplication of large numbers is done using the distributive property of multiplication over addition. The numbers are first split into ones, tens, hundreds, etc.

$$259 \cdot 5 = (200 + 50 + 9) \cdot 5 = 200 \cdot 5 + 50 \cdot 5 + 9 \cdot 5$$

An **algorithm** known as **long multiplication** is used to simplify writing:

				5	
	×	2	5	9	
				4	5
			2	5	
	+	1	0		
		1	2	9	5

multiply the **ones** $5 \cdot 9$ ones
multiply the **tens** $5 \cdot 5$ tens
multiply the **hundreds** $5 \cdot 2$ hundreds

Example 1: Multiply integers: 67 and 8.

		6	7						8		
		×	8					×	6	7	
			5	3	6				5	6	
									4	8	
									5	3	6

Practice 1: Calculate:

$$\begin{array}{r} 65 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 24 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 19 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 36 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 18 \\ \times 7 \\ \hline \end{array}$$

$$\begin{array}{r} 23 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ \times 56 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ \times 12 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ \times 99 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ \times 45 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ \times 61 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ \times 82 \\ \hline \end{array}$$

Example 2: Multiply 619 and 7 using long multiplication.

$$\begin{array}{r} 619 \\ \times \quad 7 \\ \hline 4313 \end{array}$$

multiply the ones $619 \cdot 7$ ones

Start by multiplying ones $9 \cdot 7 = 63$. Write ones (3) at ones spot, and carry the 6.

Multiply tens and add the 6 that was carried over $1 \cdot 7 + 6 = 7 + 6 = 13$. Write tens (3) at the tens spot and carry the 1.

Multiply hundreds and add the 1 that was carried over $6 \cdot 7 + 1 = 42 + 1 = 43$. Write hundreds (3) at the hundreds spot and carry the 4.

There are no thousands in this problem, so just use the 4 that was carried over to the thousand column.

Practice 2: Calculate:

$$\begin{array}{r} 215 \\ \times \quad 2 \\ \hline \end{array}$$

$$\begin{array}{r} 216 \\ \times \quad 2 \\ \hline \end{array}$$

$$\begin{array}{r} 370 \\ \times \quad 3 \\ \hline \end{array}$$

$$\begin{array}{r} 308 \\ \times \quad 3 \\ \hline \end{array}$$

$$\begin{array}{r} 450 \\ \times \quad 5 \\ \hline \end{array}$$

$$\begin{array}{r} 601 \\ \times \quad 9 \\ \hline \end{array}$$

$$\begin{array}{r} 430 \\ \times \quad 8 \\ \hline \end{array}$$

$$\begin{array}{r} 304 \\ \times \quad 5 \\ \hline \end{array}$$

$$\begin{array}{r} 504 \\ \times \quad 3 \\ \hline \end{array}$$

$$\begin{array}{r} 901 \\ \times \quad 9 \\ \hline \end{array}$$

Example 3: Multiply 342 and 37 using long multiplication.

$$\begin{array}{r}
 342 \\
 \times 37 \\
 \hline
 2394 \\
 + 1026 \\
 \hline
 12654
 \end{array}$$

multiply with **ones** $342 \cdot 7$ ones
 multiply with **tens** $342 \cdot 3$ tens

Start by multiplying the first factor, 342, by the ones digit of the second factor, 7, and write the result underneath the line:

$$342 \cdot 7 = (2 + 40 + 300) \cdot 7 = 14 + 280 + 2100 = 2394$$

Multiply 342 by the number of tens of the second factor, 3. Write the result aligned with the tens column.

$$342 \cdot 3 = (2 + 40 + 300) \cdot 3 = 6 + 120 + 900 = 1026$$

Finally add the two rows in order to get the final result of **12654**.

Practice 3: Multiply.

$$\begin{array}{r}
 164 \\
 \times 12 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 235 \\
 \times 15 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 705 \\
 \times 35 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 214 \\
 \times 13 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 221 \\
 \times 64 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 453 \\
 \times 23 \\
 \hline
 \end{array}$$

Example 4: Divide $124 \div 4$ using long division.

$$\begin{array}{r} 31 \\ 4 \overline{)124} \\ \underline{12} \\ 04 \\ \underline{4} \\ 0 \end{array}$$

Example 5: Divide $175 \div 7$ using long division.

$$\begin{array}{r} 25 \\ 7 \overline{)175} \\ \underline{14} \\ 35 \\ \underline{35} \\ 0 \end{array}$$

Practice 4: Divide the following integers. Use long division.

a) $328 \div 8 =$

b) $295 \div 5 =$

c) $426 \div 6 =$

d) $576 \div 8 =$