

An **algorithm** is a set of steps used for solving a particular type of problem.

There are many different algorithms used to compute a product. These are three of our favorites.



**EXAMPLE** | Compute  $3 \times 456$ .

**The Distributive Property:**

First, split 456 into  $400 + 50 + 6$ .  
Distribute the 3 to the 400, to the 50, and to the 6.

$$\begin{aligned}
 3 \times 456 &= 3 \times (400 + 50 + 6) \\
 &= (3 \times 400) + (3 \times 50) + (3 \times 6) \\
 &= 1,200 + 150 + 18 \\
 &= \mathbf{1,368}
 \end{aligned}$$

**The Area Model:** Find the area of a rectangle.

	400	50	6	1,200
3	1,200	150	18	150
				+ 18
				<u>1,368</u>

**The Multiplication Algorithm:**

Stack the two numbers as shown below, lining up the units digits.

$$\begin{array}{r}
 456 \\
 \times 3 \\
 \hline
 \end{array}$$

Remember that the 5 in 456 stands for 5 tens (50), and the 4 in 456 stands for 4 hundreds (400).

Distributing the 3 gives three **partial products**:  $3 \times 6 = 18$ ,  $3 \times 50 = 150$ , and  $3 \times 400 = 1,200$ . Stack the partial products so that the ones, tens, and hundreds digits line up, as shown below.

$$\begin{array}{r}
 456 \\
 \times 3 \\
 \hline
 18
 \end{array}
 \qquad
 \begin{array}{r}
 456 \\
 \times 3 \\
 \hline
 18 \\
 150
 \end{array}
 \qquad
 \begin{array}{r}
 456 \\
 \times 3 \\
 \hline
 18 \\
 150 \\
 1,200
 \end{array}$$

Finally, add the three partial products:

$$\begin{array}{r}
 456 \\
 \times 3 \\
 \hline
 18 \\
 150 \\
 + 1,200 \\
 \hline
 \mathbf{1,368}
 \end{array}$$

Look carefully at all three methods above. At the end of each, we add  $18 + 150 + 1,200$  to get 1,368. Each method gives a different way of organizing the same computations using the distributive property.

# MULTIPLICATION

The Multiplication Algorithm

**PRACTICE**

Fill in the blanks in each computation below to find the product using the multiplication algorithm from the previous page.

20.

$$\begin{array}{r} \phantom{0}42 \\ \times \phantom{0}3 \\ \hline \phantom{0} \\ + \phantom{000} \\ \hline \phantom{000} \end{array}$$

21.

$$\begin{array}{r} \phantom{0}63 \\ \times \phantom{0}5 \\ \hline \phantom{00} \\ + \phantom{000} \\ \hline \phantom{000} \end{array}$$

22.

$$\begin{array}{r} \phantom{0}154 \\ \times \phantom{0}8 \\ \hline \phantom{00} \\ \phantom{000} \\ + \phantom{000} \\ \hline \phantom{0000} \end{array}$$

23.

$$\begin{array}{r} \phantom{0}239 \\ \times \phantom{0}6 \\ \hline \phantom{00} \\ \phantom{000} \\ + \phantom{0000} \\ \hline \phantom{0000} \end{array}$$

24.

$$\begin{array}{r} \phantom{0}750 \\ \times \phantom{0}5 \\ \hline \phantom{00} \\ \phantom{000} \\ + \phantom{0000} \\ \hline \phantom{0000} \end{array}$$

25.

$$\begin{array}{r} \phantom{0}427 \\ \times \phantom{0}7 \\ \hline \phantom{00} \\ \phantom{000} \\ + \phantom{0000} \\ \hline \phantom{0000} \end{array}$$

# MULTIPLICATION

## The Multiplication Algorithm

### PRACTICE

Use the multiplication algorithm to find each product below. You will need to organize the work on your own. Be careful to line up the digits correctly.

*You can find more multiplication problems for practice at [BeastAcademy.com](http://BeastAcademy.com).*

$$\begin{array}{r} 26. \quad 15 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 27. \quad 46 \\ \times 7 \\ \hline \end{array}$$

$$\begin{array}{r} 28. \quad 512 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 29. \quad 193 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 30. \quad 285 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 31. \quad 643 \\ \times 9 \\ \hline \end{array}$$

If you need more practice on problems like these, choose your own numbers to multiply.

You can check your final answers with a calculator.



# MULTIPLICATION

## The Multiplication Algorithm

Each product below is missing some information.

We can use the given digits in each problem to fill in all of the missing digits in each product!

### EXAMPLE

Fill each empty box on the right with the correct digit to complete the product.

The first partial product is 18. Since  $3 \times \boxed{6} = 18$ , the missing digit of the top number must be 6.

Then, we add the two partial products to get  $18 + 150 = 168$ .

The complete diagram for the computation is shown to the right.

$$\begin{array}{r} \boxed{5} \boxed{\phantom{0}} \\ \times \quad \boxed{3} \\ \hline \boxed{1} \boxed{8} \\ + \boxed{1} \boxed{5} \boxed{0} \\ \hline \boxed{\phantom{0}} \boxed{\phantom{0}} \boxed{\phantom{0}} \end{array}$$

$$\begin{array}{r} \boxed{5} \boxed{6} \\ \times \quad \boxed{3} \\ \hline \boxed{1} \boxed{8} \\ + \boxed{1} \boxed{5} \boxed{0} \\ \hline \boxed{1} \boxed{6} \boxed{8} \end{array}$$



### PRACTICE

Fill each empty box with the correct digit to complete each product.

32. 
$$\begin{array}{r} \boxed{4} \boxed{5} \\ \times \quad \boxed{\phantom{0}} \\ \hline \boxed{1} \boxed{5} \\ + \boxed{\phantom{0}} \boxed{\phantom{0}} \boxed{\phantom{0}} \\ \hline \boxed{\phantom{0}} \boxed{\phantom{0}} \boxed{\phantom{0}} \end{array}$$

33. 
$$\begin{array}{r} \boxed{2} \boxed{7} \\ \times \quad \boxed{\phantom{0}} \\ \hline \boxed{\phantom{0}} \boxed{\phantom{0}} \\ + \boxed{1} \boxed{6} \boxed{0} \\ \hline \boxed{\phantom{0}} \boxed{\phantom{0}} \boxed{\phantom{0}} \end{array}$$

34. 
$$\begin{array}{r} \boxed{8} \boxed{\phantom{0}} \\ \times \quad \boxed{4} \\ \hline \boxed{2} \boxed{4} \\ + \boxed{\phantom{0}} \boxed{\phantom{0}} \boxed{\phantom{0}} \\ \hline \boxed{\phantom{0}} \boxed{\phantom{0}} \boxed{\phantom{0}} \end{array}$$

35. 
$$\begin{array}{r} \boxed{\phantom{0}} \boxed{9} \\ \times \quad \boxed{3} \\ \hline \boxed{\phantom{0}} \boxed{\phantom{0}} \\ + \boxed{1} \boxed{5} \boxed{0} \\ \hline \boxed{\phantom{0}} \boxed{\phantom{0}} \boxed{\phantom{0}} \end{array}$$

36. ★ 
$$\begin{array}{r} \boxed{\phantom{0}} \boxed{8} \\ \times \quad \boxed{6} \\ \hline \boxed{\phantom{0}} \boxed{\phantom{0}} \\ + \boxed{\phantom{0}} \boxed{\phantom{0}} \boxed{\phantom{0}} \\ \hline \boxed{1} \boxed{6} \boxed{8} \end{array}$$

37. ★ 
$$\begin{array}{r} \boxed{\phantom{0}} \boxed{\phantom{0}} \\ \times \quad \boxed{8} \\ \hline \boxed{3} \boxed{2} \\ + \boxed{\phantom{0}} \boxed{\phantom{0}} \boxed{\phantom{0}} \\ \hline \boxed{5} \boxed{9} \boxed{2} \end{array}$$