

Multiplying Whole Numbers

Palomar College

2015

Objectives

- Introduce specific vocabulary
- Define properties of multiplication
- Learn how to use number lines to multiply
- Using Partial Products to multiply

To find out how many cans there are in three 6-packs requires repeated addition which is called **multiplication**.

$$6 + 6 + 6 = 3 \times 6 = 18$$

The multiplication sign (\times) can also be written as \cdot or by using parentheses. The following are all also read as "3 times 6 equals 18."

$$3 \cdot 6 = 18, \quad 3(6) = 18, \quad (3)(6) = 18$$

In the statement $3 \times 6 = 18$, 3 and 6 are called **factors** and 18 is called the **product**.

Properties of Multiplication

• Multiplication Property of Zero:

The product of 0 and any number is 0.

$$0 \times 3 = 0 \text{ and } 3 \times 0 = 0$$

• Multiplicative Identity Property:

The product of 1 and a number is the number.

$$1 \times 3 = 3 \text{ and } 3 \times 1 = 3$$

• Commutative Prop of Multiplication:

Changing the order of the factors does not change the product.

$$3 \times 2 = 6 \text{ and } 2 \times 3 = 6$$

• Associative Property of Multiplication:

Changing the grouping of factors does not change their product.

$$(2 \cdot 4) \cdot 3 = 24 \text{ and } 2 \cdot (4 \cdot 3) = 24$$

• Distributive Property:

Multiplication distributes over addition.

$$2(3 + 4) = 2 \cdot 3 + 2 \cdot 4$$

Multiplying Larger numbers

When numbers are large we can write numbers in expanded form and use the distributive property to help multiply.

$$4 \cdot 23 = 4 \cdot (20 + 3) = 4 \cdot (20) + 4 \cdot (3) = 80 + 12 = 92$$

80 and 12 are called the **partial products**. The product is the sum of the partial products.

We can also do this vertically by placing the numbers on top of each other. It is usually easier to place the smaller number on the bottom.

$$\begin{array}{r} 23 \\ \times 4 \\ \hline 12 \leftarrow 4 \cdot 3 \\ + 80 \leftarrow 4 \cdot 20 \\ \hline 92 \end{array}$$

$$\begin{array}{r} 58 \\ \times 32 \\ \hline 16 \leftarrow 2 \cdot 8 \\ 100 \leftarrow 2 \cdot 50 \\ 240 \leftarrow 30 \cdot 8 \\ + 1500 \leftarrow 30 \cdot 50 \\ \hline 1856 \end{array}$$

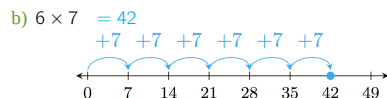
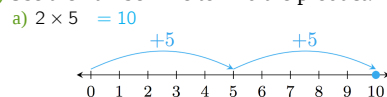
Similar to addition, we can shorten the process by carrying. We multiply the ones place value of the bottom number to the entire top number, then move to the tens place, and so on.

$$\begin{array}{r} 1 \\ 23 \\ \times 4 \\ \hline 92 \end{array}$$

$$\begin{array}{r} 2 \\ 58 \\ \times 32 \\ \hline 116 \leftarrow 2 \cdot 58 \\ + 1740 \leftarrow 30 \cdot 58 \\ \hline 1856 \end{array}$$

Examples

1) Use the number line to find the product.



2) Multiply:

a) 56×37

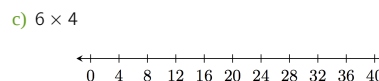
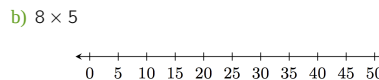
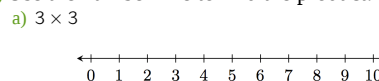
$$\begin{array}{r} 56 \\ \times 37 \\ \hline 392 \\ + 1680 \\ \hline 2072 \end{array}$$

b) $2,317 \times 169$

$$\begin{array}{r} 2317 \\ \times 169 \\ \hline 20853 \\ 139020 \\ + 231700 \\ \hline 391573 \end{array}$$

Let's Try It

1) Use the number line to find the product.



2) Multiply:

a) 58×3

$$\begin{array}{r} 58 \\ \times 3 \\ \hline \end{array}$$

b) 45×27

$$\begin{array}{r} 45 \\ \times 27 \\ \hline \end{array}$$

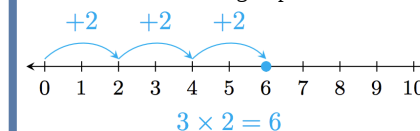
c) 285×134

$$\begin{array}{r} 285 \\ \times 134 \\ \hline \end{array}$$

Multiplying with Number Lines

You can use a number line to multiply whole numbers. Always start at 0. You may relabel the number to make it easier.

3×2 means three groups of 2 each.

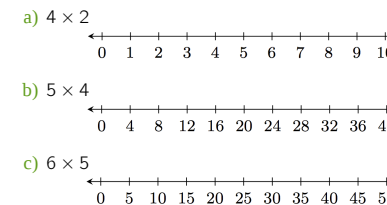


Practice

1) Identify what property is being used.

- $11 \cdot 50 = 50 \cdot 11$
- $(2 \cdot 3) \cdot 5 = 2 \cdot (3 \cdot 5)$
- $28 \cdot 0 = 0$
- $(1 \cdot 3) \cdot 7 = (3 \cdot 1) \cdot 7$
- $5(2 + 6) = 5 \cdot 2 + 5 \cdot 6$
- $1 \cdot 17 = 17$

2) Use the number line to find the product.



3) Multiply.

- 28×0
- $17 \cdot 1$
- 45×6
- $63(21)$
- 253×42
- $1,259 \times 742$

Multiplying Whole Numbers

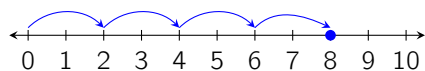
Answers to Practice

1. Identify what property is being used.

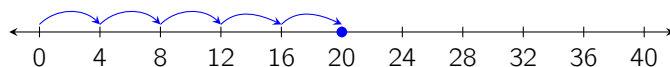
- (a) $11 \cdot 50 = 50 \cdot 11$ commutative property of multiplication
- (b) $(2 \cdot 3) \cdot 5 = 2 \cdot (3 \cdot 5)$ associative property of multiplication
- (c) $28 \cdot 0 = 0$ multiplication property of zero
- (d) $(1 \cdot 3) \cdot 7 = (3 \cdot 1) \cdot 7$ commutative property of multiplication
- (e) $5(2 + 6) = 5 \cdot 2 + 5 \cdot 6$ distributive property
- (f) $1 \cdot 17 = 17$ multiplicative identity property

2. Use the number line to find the product.

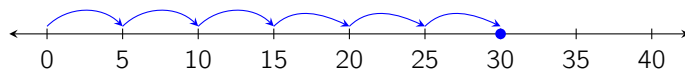
(a) $4 \times 2 = 8$



(b) $5 \times 4 = 20$



(c) $6 \times 5 = 30$



3. Multiply.

(a) 28×0
0

(b) $17 \cdot 1$
17

(c) 45×6
$$\begin{array}{r} 45 \\ \times 6 \\ \hline 270 \end{array}$$

(d) $63(21)$
$$\begin{array}{r} 63 \\ \times 21 \\ \hline 63 \end{array}$$

(e) 253×42
$$\begin{array}{r} 253 \\ \times 42 \\ \hline 506 \\ \hline 1012 \\ \hline 10626 \end{array}$$

(f) $1,259 \times 742$
$$\begin{array}{r} 1259 \\ \times 742 \\ \hline 2518 \\ 5036 \\ \hline 8813 \\ \hline 934178 \end{array}$$