

*Enrichment*

**Lesson:** Distributive Property

**Sixth Grade Objective:** 5.01 Simplify algebraic expressions and verify the results using the basic properties of rational numbers.

- a) Identity
- b) Commutative
- c) Associative
- d) Distributive
- e) Order of operations

**Review**

There are certain rules or properties of math that are always true. The **Commutative Properties** of addition and multiplication state that the order in which numbers are added or multiplied does not change the result.

$$\begin{array}{l} x + y = y + x \quad \text{and} \quad x \cdot y = y \cdot x \\ 4 + 3 = 7 \qquad \qquad 4 \cdot 3 = 12 \\ 3 + 4 = 7 \qquad \qquad 3 \cdot 4 = 12 \end{array}$$

The **Associative Properties** of addition and multiplication state that the way in which addends or factors are grouped does not change the result

$$\begin{array}{l} (x + y) + z = x + (y + z) \quad \text{and} \quad (x \cdot y) \cdot z = x \cdot (y \cdot z) \\ (4 + 3) + 8 = 4 + (3 + 8) \qquad \qquad (4 \cdot 3) \cdot 8 = 4 \cdot (3 \cdot 8) \\ 7+8 \qquad \qquad 4 + 11 \qquad \qquad 12 \cdot 8 \qquad \qquad 4 \cdot 24 \\ 15 \qquad \qquad 15 \qquad \qquad 96 \qquad \qquad 96 \end{array}$$

The **Identity Property of Addition** states that the sum of an addend and 0 is the addend.  
 $11 + 0 = 11$

The **Identity Property of Multiplication** states that the products of a factor and 1 is that factor.  
 $23 \cdot 1 = 23$

The **Distributive Property** combines the operations of addition and multiplication.

$$\begin{array}{l} x \cdot (y + z) \qquad \qquad = \qquad \qquad (x \cdot y) + (x \cdot z) \\ 4 \cdot (3 + 8) \qquad \qquad \qquad \qquad (4 \cdot 3) + (4 \cdot 8) \\ 4 \cdot 11 \qquad \qquad \qquad \qquad \qquad 12 + 32 \\ 44 \qquad \qquad \qquad \qquad \qquad \qquad 44 \end{array}$$


**Lesson:**

In this lesson we will concentrate in depth on the **Distributive Property**. This seems to be the most difficult of the properties, yet once you get it, you get it.

When simplifying expressions with parentheses, you will be applying the **Distributive Property**. That is, you will be distributing over (multiplying through) the parentheses in order to simplify a given expression. I will walk you through examples of increasing difficulty, and you should note, as this lesson progresses, the importance of simplifying as you go and of doing each step neatly, completely, and exactly.

**Simplify  $3(x + 4)$ .**

To "simplify" this, I have to get rid of the parentheses. The **Distributive Property** says to multiply the 3 onto everything inside the parentheses.

$$3(x + 4) = 3x + 3(4)$$


Simplified:


$$3x + 12$$

*Note: A common error at this stage is to take the 3 through the parentheses but only onto the x, forgetting to carry it through onto the 4 as well. You may need to draw arrows to help you remember to carry through onto everything inside the parentheses.*

Here is another example of using the **Distributive Property** to simplify. It is similar to the above problem. There is one additional step.

**Simplify  $8 + 4(8 + y)$** 

Like in the first problem I have to get rid of the parenthesis. The **Distributive Property** says to multiply 4 onto everything inside the parenthesis.

$$8 + 4(8 + y) \quad \text{or} \quad 8 + 4(8) + 4(y)$$


I still can simplify!  $8 + 32 + 4y$

Simplified:

$$40 + 4y$$

**Try these on your own!**

Use the Distributive Property to simplify

1.  $5(x + 6) + 11$

2.  $110 + 12(y - 2)$

3.  $x(3 + y)$

**Check your answers!**

1.  $5(x + 6) + 11$   
 $5x + 30 + 11$   
 **$5x + 41$**

2.  $110 + 12(y - 2)$   
 $110 + 12y - 24$   
 **$86 + 12y$**

3.  $x(3 + y)$   
 **$3x + yx$**

**Quiz yourself!**

Use the Distributive Property to simplify

1.  $5(x + y)$

2.  $33 + 8(x - 4)$

3.  $5(x + 3) + 4(y + 4)$

Check your answers!

1.  $5(x + y)$   
 **$5x + 5y$**

2.  $33 + 8(x - 4)$   
 $33 + 8x - 32$   
 **$1 + 8x$**

3.  $5(x + 3) + 4(y + 4)$   
 $5x + 15 + 4y + 16$   
 $5x + 4y + 31$