

Properties in Algebraic Expressions

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WHAT'S COVERED

In this lesson, you will learn how to simplify an algebraic expression using the Distributive Property. Specifically, this lesson will cover:

1. Commutative Properties of Addition and Multiplication

In short, the commutative properties of addition and multiplication allow us to add algebraic terms in any order we wish, as well as multiply algebraic terms in any order we wish. These properties are illustrated in the following examples:

➤ EXAMPLE

$3x + 4x$ To simplify, add $4x$ to $3x$

$7x$ Sum of $3x$ and $4x$

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➤ EXAMPLE

$5 \cdot 2c$ To simplify, multiply 5 by $2c$

$10c$ Product of 5 and $2c$

$2c \cdot 5$ To simplify, multiply $2c$ by 5

$10c$ Product of $2c$ and 5

In each example above, notice that the order in which applied the operation (either addition or multiplication) did not affect the solution. It is important to note that subtraction and division are not commutative.



BIG IDEA

Addition and multiplication are commutative. When adding terms, you can add them in any order you wish. When multiplying terms, you may multiply the terms in any order you wish.

2. Associative Properties of Addition and Multiplication

The associative property deals with how terms of an expression are grouped together. For algebraic expressions in which several terms are being added together, you can group terms together in any way in order to make simplification easier.

↪ EXAMPLE

$(3+2a)+5a$ We can group terms in any way. Regroup $2a$ and $5a$ instead

$3+(2a+5a)$ Add $2a$ to $5a$

$3+7a$ Our Solution

In some cases, such as the example above, the associative property is helpful when grouping like terms together. We used the associative property first to add $2a$ and $5a$ to get $7a$, then we added 3 at the end.

The associative property holds true for multiplication as well and works in a similar way to addition.

↪ EXAMPLE

$x \cdot (3x \cdot 2)$ We can group terms in any way. Regroup x and $3x$

$(x \cdot 3x) \cdot 2$ Multiply x and $3x$

$(3x^2)2$ Multiply by 2

$6x^2$ Our Solution

3. Distributive Property

Often as we work with problems, there will be a set of parentheses that make solving a problem difficult, if not impossible. To get rid of these unwanted parentheses, we can use the distributive property. Using this property, we multiply the number in front of the parentheses by each term inside.

↪ EXAMPLE

$4(2x-7)$ Multiply each term by 4

$8x-28$ Our Solution

↪ EXAMPLE

$-7(5x-6)$ Multiply each term by -7

$-35x+42$ Our Solution



Notice that in the previous example, we multiplied each term inside the parentheses by a negative number. With the subtraction inside, this means we multiplied -7 by -6 , to result in a positive 42. The most common error in distributing is a sign error. Be careful with your signs!



SUMMARY

The **commutative, associative, distributive properties**, as well as factoring, can be extended to expressions that are involving variables. These properties will be useful when simplifying expressions and solving equations.

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