



# Introduction to Algebra

Based on power point presentations by Pearson Education, Inc.  
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# Learning Objectives

1. Memorize and use vocabulary of algebra.
2. Memorize and use the *Distributive Property*.

# What is Algebra? (1 of 2)

So far, we have discussed concepts from the mathematical branch called Arithmetic. The term itself has been derived from a Greek word meaning “number”. It is the most basic branch of mathematics. It is all about numbers, and therefore is commonly used by everyone in day-to-day life. Arithmetic works around addition, subtraction, division, and multiplication.

Algebra is another branch of mathematics. The word is derived from the Arabic word “al-jabr”, which is an ancient medical term meaning the “reunion of broken parts”. Algebra can be considered as the next level of mathematics after the foundation of arithmetic.

Unlike arithmetic, algebra deals with unknown quantities in combination with numbers and many different mathematical operations.

# 1. Some Vocabulary of Algebra (1 of 4)

**Variable:** It is a letter of the alphabet that takes on different values in different situations. In mathematics, we most often use the letters **x** and **y**. However, we can use any other letter.

**Expression:** A combination of variables and numbers linked by addition, subtraction, multiplication, and division.

Example:  $7x + 9y - 8$

Please note that there is an implied multiplication sign between the numbers and the variables.  $7x$  actually means  $7 \cdot x$  and  $9y$  means  $9 \cdot y$ . The multiplication sign is usually not written.

**Equation:** An expression that is equal to another expression. In mathematics we use the = (equal) symbol.

Example:  $7x + 9y - 8 = 5$

# Some Vocabulary of Algebra (2 of 4)

**Evaluating an Expression:** Find the value of the expression when the variables are replaced with numbers.

Example: Find the value of the expression  $7x + 9y - 8$  when  $x = 1$  and  $y = 2$ .

$$7(1) + 9(2) - 8 = 7 + 18 - 8 = 17$$

Please note that there is an implied multiplication sign between the numbers and the variables. When a variable is replaced by a number, we use parentheses ( ) to indicate multiplication.

**Term:** Those parts of an expression separated by addition or subtraction.

Example: In  $7x + 9y - 8$ , the terms are  $7x$ ,  $9y$ , and  $-8$

**Constant:** A term that consists of just a number.

Example: In  $7x + 9y - 8$ , the constant is  $-8$

# Some Vocabulary of Algebra (3 of 4)

**Coefficient:** The numerical part of a term (excluding the constant).

Example: In  $7x + 9y - 8$ , the coefficients are 7 and 9

**Factor:** A factor is a number that divides into another number evenly without leaving a remainder.

Example: 5 is a factor of 10 because  $10 \div 5 = 2$  Remainder 0. On the other hand, 6 is not a factor of 10 because  $10 \div 6 = 1$  Remainder 4.

**Like Term:** Terms having the exact same variable factors.

Example: In  $5x - 3y + 2x$ , the like terms are  $5x$  and  $2x$

**Combining Like Term:** To combine like terms, we add/subtract the coefficients of like terms.

Example: In  $5x - 3y + 2x$ , we get  $(5 + 2)x - 3y$  or  $7x - 3y$

## Some Vocabulary of Algebra (4 of 4)

**Conjugate** – Given an expression with exactly two terms being added or subtracted, its conjugate is an expression with the same terms but the plus or minus in the middle of these terms is changed to the opposite one.

Example: Given  $-5x - 9$ , its conjugate is  $-5x + 9$ .

**Simplify:** The word "simplify" takes on many meanings in mathematics. The word could mean to add and subtract; to multiply and divide; to combine like terms; etc. We must figure out its meaning from the make-up of the given mathematical expression.

Example: "simplify  $2x + 3x$ " means the same as "add  $2x + 3x$ ".

# Example 1: Use Algebra Vocabulary

a. Name the variables in the expression  $6x + 10y - 9$ .

The variables are  $x$  and  $y$ .

b. Which one is the expression?  $5x + 8y$  or  $5x + 8y = 6$

The expression is  $5x + 8y$ .

Please note that in the terms above, there is an assumed multiplication sign between the number and the variable, for example  $5x$  or  $8y$ .



## Example 2: Use Algebra Vocabulary

Evaluate the expression  $7 + 5x$  for  $x = 6$

$$7 + 5x =$$

$$= 7 + 5(6) \quad \text{replaced } x \text{ with } 6$$

$$= 7 + 30 \quad \text{evaluated the multiplication}$$

$$= 37 \quad \text{evaluated the addition}$$

## Example 3: Use Algebra Vocabulary

a. Name the *terms* in the expression  $7x + 9y - 3$ .

The terms are  $7x$ ,  $9y$ , and  $-3$ .

b. Name the *coefficients* in the expression  $6x + y$ .

The coefficients are 6 and 1.

c. Name the *constant term* in the expression  $5x - 6$ .

The constant term is  $-6$ .

d. Name all *factors* of 36 .

The numbers 1, 2, 3, 4, 6, 9, 12, 36 are factors of 36 because they all divide into 36 without a remainder.

e. Name the *like terms* in the expression  $2x + y - 3x$ .

The like terms are  $2x$  and  $-3x$ .

## Example 4: Use Algebra Vocabulary

- a. Find the conjugate of  $-3 + x$ .

Given is an expression with exactly two terms. Its conjugate is an expression with the same terms but the arithmetic operator in the middle of these terms is changed to the opposite one. That is, we will change the arithmetic operator from  $+$  to  $-$  to get

$$-3 - x$$

- b. Find the conjugate of  $2x - 3$ .

Given is an algebraic expression with exactly two terms. Its conjugate is an expression with the same terms but the arithmetic operator in the middle of these terms is changed to the opposite one. That is, we will change the arithmetic operator from  $-$  to  $+$  to get

$$2x + 3$$

## Example 5: Use Algebra Vocabulary

Simplify  $4xy + 2x + 6xy - 3x + 9y$ .

Here “simplify” means to combine like terms. We know that like terms have the same variable factors. Let’s use different colors to illustrate the various like terms.

$$4xy + 2x + 6xy - 3x + 9y$$

We add (or subtract) the coefficients of the like terms and keep the variables the same.

$$\text{That is, } (4 + 6)xy + (2 - 3)x + 9y = 10xy - x + 9y.$$

## Example 6: Use Algebra Vocabulary

Simplify  $ab - 3ab + 9a - 3a + b - 4b + 11$ .

Here “simplify” means to combine like terms. We know that like terms have the same variable factors. Let’s use different colors to illustrate the various like terms.

$$ab - 3ab + 9a - 3a + b - 4b + 11$$

Notice that we can combine  $ab$ -terms,  $a$ -terms, and  $b$ -terms by combining their coefficients.

$$\text{That is, } (1 - 3)ab + (9 - 3)a + (1 - 4)b + 11$$

$$\text{which combines to } -2ab + 6a - 3b + 11.$$

## 2. The Distributive Property (Memorize!)

The *Distributive Property* states the following:

Given any terms  $a$ ,  $b$ , and  $c$ , then  $a(b + c) = ab + ac$ .

Please note that there is an assumed multiplication sign between “a” and the parentheses.

## Example 7: Use the Distributive Property

Utilize the *Distributive Property* given  $3(2x + 5)$ .

We are going to use the *Distributive Property* as follows:

$$3(2x + 5) = 3(2x) + 3(5)$$

Please note that under multiplication, say  $3(2x)$ , we multiply constants/coefficients with constants/coefficients and variables with variables. Therefore, when we carry out the multiplication  $3(2x)$  as follows  $3 \cdot 2 \cdot x = 6x$ .

We find that  $3(2x + 5)$  equals  $6x + 15$ .

## Example 8: Use the Distributive Property

Utilize the *Distributive Property* given  $-3(7p - 4)$ .

We are going to use the *Distributive Property* as follows:

$$-3(7p - 4) = -3(7p) - 3(-4)$$

We carry out the multiplications by multiplying like factors as follows:

$$-21p + 12$$



## Example 9: Use the Distributive Property

Simplify  $7(4a + 3) - 2(a + 1)$ .

Here simplify means to use the *Distributive Property* and then combine like terms. Often, we must figure out its meaning from the make-up of the mathematical expression we are asked to "simplify."

$$7(4a + 3) - 2(a + 1)$$

$$= 28a + 21 - 2a - 2$$

$$= 26a + 19$$

used the *Distributive Property* and multiplied all terms by 7 and  $-2$  respectively  
combined like terms

## Example 10: Use the Distributive Property

Simplify  $-(4x - 7) - (x + 1)$ .

Here simplify means to use the *Distributive Property* and then combine like terms. Often, we must figure out its meaning from the make-up of the mathematical expression we are asked to "simplify."

Please note the minus signs in front of both parentheses! This is actually a  $-1$ . It means that you are supposed to be multiplying all terms within the parentheses by  $-1$ !

$$-(4x - 7) - (x + 1)$$

$$= -4x + 7 - x - 1$$

$$= -5x + 6$$

used the *Distributive Property* and multiplied all terms by  $-1$

combined like terms