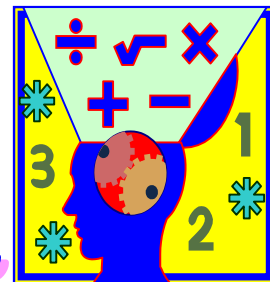


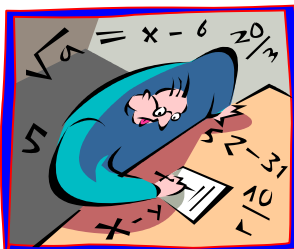
# Algebra Connections



Mr. Breitsprecher's Edition

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Web: [www.clubtnt.org/my\\_algebra](http://www.clubtnt.org/my_algebra)



## Combining Like Terms Simplifying Expressions

A term is a constant or a variable in an expression. In the equation  $12+3x+2x^2=5x-1$ ; 12,  $3x$ , and  $2x^2$  the terms. On the left are 12,  $3x$  and  $3x^2$ ; while the terms on the right are  $5x$ , and  $-1$ .

Combining *like terms* is a process used to simplify an expression or an equation by using addition/subtraction of the coefficients of the terms. Consider the expression below

$$5 + 7$$

By adding 5 and 7, you can easily find that the expression is equivalent to 12

### What Does Combining Like Terms Do?

Algebraic expressions can be simplified like the previous example by combining like terms. Consider the algebraic expression below:

$$12x + 7 + 5x$$

As you will soon learn,  $12x$  and  $5x$  are like terms. Therefore, the

coefficients 12 and 5 can be added. This is a simple example of combining like terms.

$$17x + 7$$

### What are Like Terms?

The key to using and understanding how to combine like terms is to recognize what like terms are and seeing when you have a pair of terms that are alike.

The following are like terms because each term consists of a variable,  $x$ , and a numeric coefficient.

$$2x, 45x, x, 0x, -26x, -x$$

Each of the following are like terms because they are all constants.

$$15, -2, 27, 9043, 0.6$$

Each of the following are like terms because they are all  $y^2$  with a coefficient.

$$3y^2, y^2, -y^2, 26y^2$$

For comparison, below are a few examples of unlike terms.

The following two terms both have a single variable with an exponent of 1, but the terms are not alike since different variables are used.

$$17x, 17z$$

Each  $y$  variable in the terms below has a different exponent, therefore these are unlike terms.

$$15y, 19y^2, 31y^5$$

Although both terms below have an  $x$  variable, only one term has the  $y$  variable, thus these are not like terms either.

$$19x, 14xy$$

Source: <http://www.algebrahelp.com>

## Combining Like Terms In an Expression

Consider the expression below:

$$5x^2 + 7x + 2 - 2x^2 + 7 + x^2$$

We will demonstrate how to simplify this expression by combining like terms. First, we identify sets of like terms. Both 2 and 7 are like terms because they are both constants. The terms  $5x^2$ ,  $-2x^2$ , and  $x^2$  are like terms because they each consist of a constant times  $x$  squared.

The coefficients of each set of like terms are added. The coefficients of the first set are the constants themselves, 2 and 7. When added the result is 9. The coefficients of the second set of like terms are 5, -2, and 1. Therefore, when added, the result is 4.

With the like terms combined, the expression becomes:

$$9 + 7x + 4x^2$$

The process of combining like terms is used to simplify expressions (above example) and to make equations easier to solve. The equation, which we will be simplifying and solving, is below:

$$x + 3x + 7 = 42 + x - 12$$

When combining like terms it is important to preserve the equality of the equation by only combining like terms on one side at a time. We will simplify the left hand side first. The first step is to find pairs of like terms; the second step is to add. The  $x$  and  $3x$  are like terms, so they are added resulting in  $4x$ . (HINT: when a variable such as  $x$  has no coefficient, its coefficient is 1, so  $x$  is the same as  $1x$ .) The 7 does not have a like term, so it is not changed. The equation now reads:

$$4x + 7 = 42 + x - 12$$

(continued on page 2)

The next step is to simplify the right hand side of the equation. This time there is no term which can be added with  $x$ , but there are two constants, which are like terms. The 42 and the -12 are added, resulting in 30. The equation now reads:

$$4x + 7 = x + 30$$

## Combining Like Terms: A Second Equation Example

The next example equation is shown below. Solving this equation will require both simplifying multiple signs and combining like terms.

$$-9 + 12x - 10 - 4x = 8x - 6x + 46 - (-1)$$

The first step to simplifying this equation is to simplify the double negative sign in front of the 1. The second negative sign cancels out the first one, so there are no signs left, meaning that the 1 is positive. Review the rules of multiple numbers with positive and negative signs if this concept is unfamiliar to you. When this step is completed, the equation becomes:

$$-9 + 12x - 10 - 4x = 8x - 6x + 46 + 1$$

We will start combining like terms on the left side with -9, a constant. The only other constant on the left side is -10, so we can add the two together as shown below. The sum of -9 and -10 is -19, thus the equation becomes:

$$-19 + 12x - 4x = 8x - 6x + 46 + 1$$

Next we will add together  $12x$  and  $-4x$  because they are like terms ( $x$  to the first power is the only variable in each). The resulting equation is shown below:

$$-19 + 8x = 8x - 6x + 46 + 1$$

Now that all like terms on the left side have been combined, we start working on the right side by adding the constants 46 and 1 to get 47.

$$-19 + 8x = 8x - 6x + 46 + 1$$

Then we add the  $8x$  and  $-6x$  to get  $2x$ . The resulting equation is:

$$8x - 19 = 2x + 47$$

Now, the equation can be solved using addition, subtraction, and division, following the rules for solving equations. Algebra Connections will review those steps in another issue.

## Combining Like Terms: Online Help

### Equation Practice Problems

Equations that require you to combine like terms before solving the equation.

<http://www.algebrahelp.com/lessons/simplifying/combiningliketerms/pgw1.htm>

### Equation Calculator

Will automatically combine like terms and solve the equation while showing all required work. (The equation calculator will not work with exponents.)

<http://www.algebrahelp.com/calculators/equation/calc.jsp>

### Combining Like Terms Calculator

Simplifies multiple signs and combines like terms in a given expression

<http://www.algebrahelp.com/calculators/expression/calc.jsp>

## Key Concepts: Equations

**Term.** A number or product of a number and variables raised to powers.

**Numerical Coefficient.** Numeric factor in a term.

**Like Terms.** Exact same variables to exact same powers (order does not matter)

**Unlike Terms.** NOT same variables to exact same powers (order does not matter)

**Combining Like Terms.** First, add coefficients of like terms and multiply by common variable factors. Then, simplify with the distributive property if possible and combine like terms.

**Linear Equation.** Written in  $Ax+B=C$  where A, B, and C are real numbers and A does not equal zero.

**Equivalent Equations.** Have same solution.

**Addition Property of Equality.** We can maintain equivalent equations by adding the same term to each side. i.e. if  $a=b$ , then  $(a+b)$  is equivalent to  $a+c=(b+c)$ .

**Simplifying Equations.** Combine like terms on 1 or both sides of equation BEFORE doing anything else. Then, put ALL terms with a variable on 1 side of the equation.

**Writing Equations.** If the sum of 2 numbers equals a 3rd number, then we can write that as  $a+b=c$  and simplify when solving for a by rewriting as  $a=c-b$ .

**Multiplication Property of Equity.** If a, b, and c are real numbers and c does not equal zero, then  $a=b$  and  $ac=bc$  are equivalent equations. (Note: we define division in terms of multiplication, therefore, the *multiplication property of equality* applies for division as well).

**Writing Equations.** The sum of 3 consecutive numbers would be written  $a+(a+1)+(a+2)$ . The sum of 3 consecutive odd numbers would be  $a+(a+2)+(a+4)$ .

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