
Algebraic Expressions
May 21
The Philomath Club

Algebraic expressions are the mathematical statement that we get when operations such as addition, subtraction, multiplication, division, etc. are operated upon on variables and constants.

For example, let us assume that James and Natalie were playing with matchsticks and thought of forming number patterns using them. James took four matchsticks and formed the number 4. Natalie added three more matchsticks to form a pattern with two 4's. They realized that they can keep on adding 3 matchsticks in each round to make one extra "four". From this, they concluded that they need 4+ 3(n-1) sticks, in general, to make a pattern with n number of 4's. Here, 4+ 3(n-1) is called an algebraic expression.

What are Algebraic Expressions?

An algebraic expression (or) a variable expression is a combination of terms by the operations such as addition, subtraction, multiplication, division, etc. For example, let us have a look at the expression 5x + 7. Thus, we can say that 5x + 7 is an example of an algebraic expression. Here are more examples:

5x + 4y + 10

2x^2y - 3xy^2

2(-a + 4b) + 6ab

What is an Algebraic Expression

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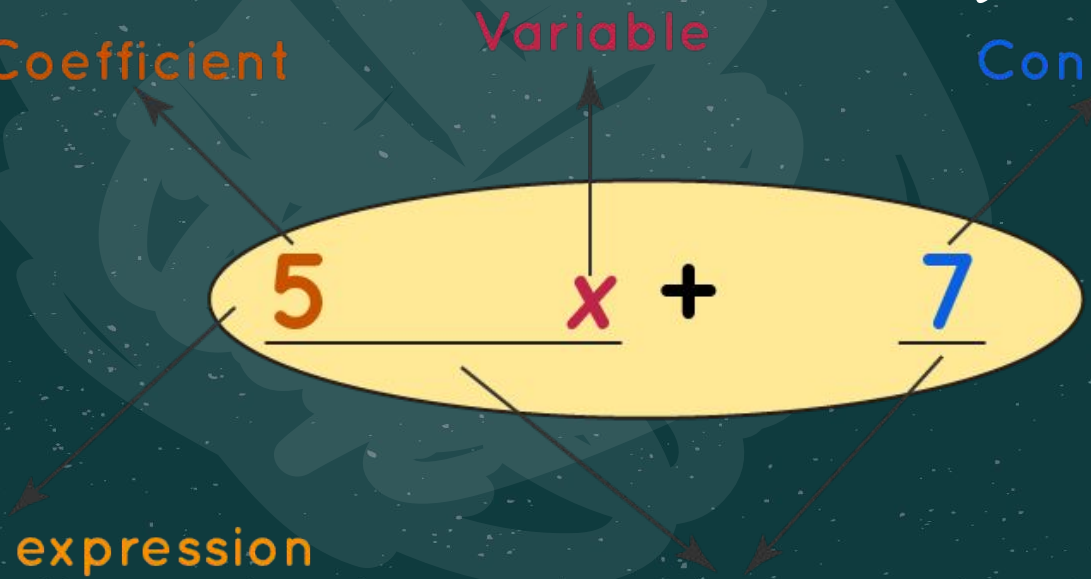

STUDY HARD!

In mathematics,

- a symbol that doesn't have a fixed value is called a variable. It can take any value. In the above example that involved matchsticks, n is a variable and in this case, it can take the values 1,2,3,... Some examples of variables in Math are a,b, x, y, z, m, etc.
- On the other hand, a symbol that has a fixed numerical value is called a constant. All numbers are constants. Some examples of constants are 3, 6, -(1/2), $\sqrt{5}$, etc.

$\sqrt{123}$

- A term is a variable alone (or) a constant alone (or) it can be a combination of variables and constants by the operation of multiplication or division. Some examples of terms are $3x^2$, $-(2y/3)$, $\sqrt{(5)}x$, etc.
- Here, the numbers that are multiplying the variables are 3, -2/3, and 5. These numbers are called coefficients.

+ × ÷

Variables, Constants, and Terms

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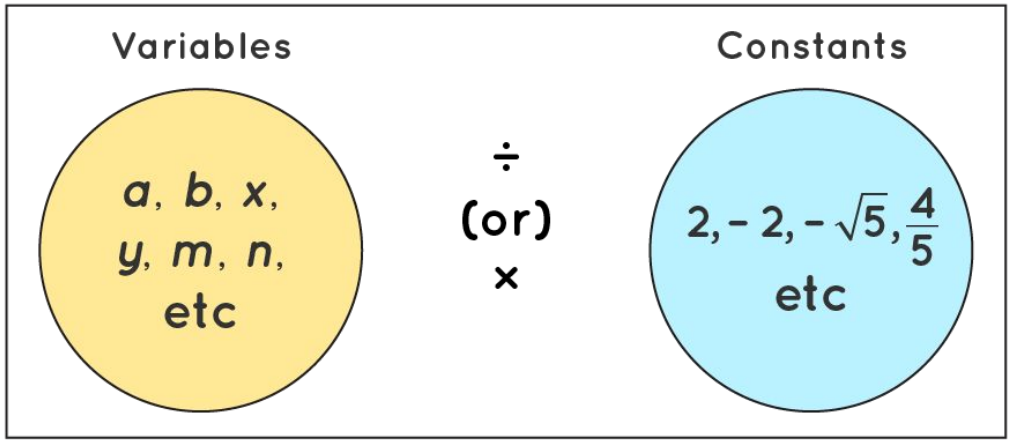
Terms



1. Variables are terms.
2. Constants are terms.
3. Variables and constants with × (or) ÷ symbols in between them are terms

Like And Unlike Algebraic Terms

Like Terms	Unlike Terms
$2x + 19x$	$2x + 19a$
$4w - 10w$	$4w - 10w^2$
$14.2r - 12r$	$12r - 12s$
$32a^2 + 9a^2$	$32a^2 + 9a^3$
$8y + 5y$	$8y + 5$

Simplifying the expression

Simplifying Algebraic Expressions

To simplify an algebraic expression, we just combine the like terms. Hence, the like variables will be combined together. Now, out of the like variables, the same powers will be combined together. For example, let us take an algebraic expression and try to reduce it to its lowest form in order to understand the concept better. Let our expression be:

$x^3 + 3x^2 - 2x^3 + 2x - x^2 + 3 - x$

$= (x^3 - 2x^3) + (3x^2 - x^2) + (2x - x) + 3$

$= -x^3 + 2x^2 + x + 3$

Hence, the algebraic expression $x^3 + 3x^2 - 2x^3 + 2x - x^2 + 3 - x$ simplifies to $-x^3 + 2x^2 + x + 3$.

Adding

- $(x^2 + 2x + 3) + (2x^2 - 3x) = (x^2 + 2x^2) + (2x + (-3x)) + 3 = 3x^2 - x + 3$
- $(1.5ab + 3) + (2.5ab - 2) = (1.5ab + 2.5ab) + (3 + (-2)) = 4ab + 1$

Subtracting

- $(3x^2 - 5x) - (x^2 - 2x + 2) = (3x^2 - 5x) + (-x^2 + 2x - 2) = (3x^2 - x^2) + (-5x + 2x) - 2 = 2x^2 - 3x - 2$
- $(3ab + 4) - (2ab - 4) = (3ab + 4) + (-2ab + 4) = (3ab - 2ab) + (4 + 4) = ab + 8$

Multiplying

- $ab\,(2ab + 3) = 2a^2b^2 + 3ab$
- $(x + 1)\,(x + 2) = x^2 + x + 2x + 2 = x^2 + 3x + 2$

Dividing

- $2x^2 / (2x^2 + 4x) = (2x^2) / [2x (x + 2)] = x / (x + 2)$
- $(x^2 + 5x + 4) / (x + 1) = [(x + 4) (x + 1)] / (x + 1) = x + 4$

Formulas

- $(a + b)^2 = a^2 + 2ab + b^2$
- $(a - b)^2 = a^2 - 2ab + b^2$
- $(a + b)(a - b) = a^2 - b^2$
- $(x + a)(x + b) = x^2 + x(a + b) + ab$
- $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$
- $(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$
- $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

Converting into equations

The sum of 3 and 4 gives 7

In math: $3+4=7$

Converting into equations

Translate the sentence into an algebraic equation: The product of 8 and 7 is 56.

In math: $8 \times 7 = 56$

Converting into equations

A number when added with 10 gives 102.
Find the number.

Math: $x + 10 = 102$. So $x = 102 - 10 = 92$

Thankyou :)