

Variables & Expressions

A *variable* is a letter (or identifier) that stands an unspecified value from a set. The set of possible values for the variable is called the *domain* of the variable.

An *expression* is a combination of variables, constants, and operators (and parentheses if necessary) that represents a number. To *evaluate* an expression, you must substitute a number for each variable.

Examples:

Evaluate: $x^2 + 3x - 17$ at $x = 2$.

$$x^2 + 3x - 17 = 2^2 + 3 \times 2 - 17 = 4 + 6 - 17 = -7.$$

Evaluate: $x^2 + y^3 - xy + 2$ at $x = 3$ and $y = 5$.

$$x^2 + y^3 - xy + 2 = 3^2 + 5^3 - 3 \times 5 + 2 = 3 \times 3 + 5 \times 5 \times 5 - 3 \times 5 + 2 = 9 + 125 - 15 + 2 = 121.$$

The expressions above use the exponentiation operation as well as $+$ and \times . Here are some operations we commonly use on real numbers.

Subtraction:

$x - y$ means $x + (-y)$.

Where $-y$ is the unique number such that $y + -y = 0$.

Division:

x/y means $x \times (1/y)$.

Where $1/y$ is the unique number such that $y \times (1/y) = 1$.

Exponentiation:

x^n means x times itself n times.

When we evaluate an arithmetic expression, we adhere to the following sequence of operations:

1. Evaluate anything in parentheses first.
2. Perform all exponentiation next.
3. Do all multiplication and division from left to right.
4. Do all addition and subtraction from left to right.

This material is based of section 1-3 of "Algebra and Trigonometry: Functions and Applications" by Paul A.Foerster, Addison-Wesley, 1980.