

CSU200 Discrete Structures Professor Fell 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 used operations that were not mentioned in the field axioms but that can be easily defined in terms of $+$ and \times . Here are some operations we commonly use on real numbers.

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

Division: x/y means $x(1/y)$.

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.