multiplication

Canonical name	Multiplication
Date of creation	2013-03-22 16:35:37
Last modified on	2013-03-22 16:35:37
Owner	PrimeFan (13766)
Last modified by	PrimeFan (13766)
Numerical id	10
Author	PrimeFan (13766)
Entry type	Definition
Classification	msc 00A06
Classification	msc 11B25
Classification	msc 00A05
Related topic	Product
Related topic	ProductOfNegativeNumbers
Related topic	FactorsWithMinusSign

Multiplication is a mathematical operation in which two or more numbers are added up to themselves by a factor of other numbers. For example, $2 \times 3 = 2 + 2 + 2 = 3 + 3 = 6$. The numbers may be real, imaginary or complex, they may be integers or fractions. Among real numbers, if an odd number of multiplicands are negative, the overall result is negative; if an even number of multiplicands are negative, the overall result is positive. Two examples: $(-3) \times (-5) = 15$; $(-2) \times (-3) \times (-5) = (-30)$.

The usual operator is the cross with its four arms of equal length pointing northeast, northwest, southeast and southwest: $\times$. Other options are the central dot $\cdot$ and the tacit multiplication operator. In many computer programming languages the asterisk is often used as it is almost always available on the keyboard (Shift-8 in most American layouts, as well as dedicated key if the keyboard has a numeric keypad), and this is the operator likely to be used in a computer implementation of a reverse Polish notation calculator. In Mathematica, the space can sometimes function as a multiplication operator, but more experienced users warn novices not to rely on this feature.

Just as with addition, multiplication is commutative: $xyz = xzy = yxz$, etc.

The iterative operator is the Greek capital letter pi:

$$\prod_{i=1}^{n} a_i,$$

which is a compact way of writing $a_1 \times a_2 \times \ldots \times a_n$.

Multiplication of complex numbers is helped by the following identity: $(a + bi) \times (x + yi) = (ax - by) + (ay + bx)i$. To give three examples: $(17 + 29i)(11 + 38i) = -915 + 965i$ (the result has both real and imaginary parts), $(1 + 2i)(1 - 2i) = 5$ (the result is a real prime) and $(4 + 7i)(7 + 4i) = 65i$ (the result has only an imaginary part).