

The Properties

The Properties for Addition

The Commutative Property

The **order** of the terms doesn't affect the sum.

Example: $a + b = b + a$

Note: Generally subtraction is not commutative.

The Associative Property

The grouping of the terms doesn't affect the sum.

Example: $a + (b + c) = (a + b) + c$

Note: Generally subtraction is not associative.

The Additive Inverse Property

The term, which when added to an expression, allows the sum to be replaced by 0.

Example: The additive inverse of a is $-a$ since
 $a + -a = 0$

Note: Notice $-a$ is positive if a is negative.

The Additive Identity Property

0 is the additive identity. The sum of an expression and 0 can be replaced by the expression itself.

Example: $a + 0 = a$

The Properties for Multiplication

The Commutative Property

The order of the factors doesn't affect the product.

Example: $a \times b = b \times a$

Note: Generally division is not commutative.

The Associative Property

The grouping of the factors doesn't affect the product.

Example: $(a \times b) \times c = a \times (b \times c)$

Note: Generally division is not associative.

The Multiplicative Inverse Property

The factor, which when multiplied to an expression, allows the expression to be replaced by 1.

Example: The multiplicative inverse of a is $\frac{1}{a}$, (as long as a isn't 0).

The Multiplicative Identity Property

1 is the multiplicative identity. The product of 1 and another factor can be replaced by the other factor.

Example: $a(1) = a$

The Distributive Property of Multiplication Over Addition

A sum of terms, each with a common factor, can be replaced by the product of the common factor and the sum of the remaining factors.

Example: $a(b) + a(c) = (b + c)a = a(b + c)$

The Property of Equality

If two expressions are equal, then operating on both in the same way results in two expressions that are equal.

Note: It's not helpful to divide both expressions by 0 (the expressions become undefined) or to multiply both expressions by 0 (the resulting equation isn't equivalent).