Properties of Real Numbers

Let a, b, and c represent any real numbers. Then the following properties are always true.

Commutative Properties for Addition and Multiplication:
(Order does not matter in addition and multiplication.)

$$a + b = b + a$$

$$a \cdot b = b \cdot a$$

Associative Properties for Addition and Multiplication:
(Grouping does not matter in addition and multiplication.)

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

$$a \cdot (b \cdot c) = (a \cdot b) \cdot c$$

Identity Properties:
Zero is the additive identity:

$$a + 0 = a = 0 + a$$

One is the multiplicative identity:

$$a \cdot 1 = a = 1 \cdot a$$

Inverse Properties:
Every real number has an additive inverse:

$$a + (-a) = 0 \text{ or } a - a = 0$$

Every real number (except zero) has a multiplicative inverse:

$$a \cdot \frac{1}{a} = 1 = \frac{1}{a} \cdot a$$

Distributive Property:
(Converts between multiplication and addition.)

$$a(b + c) = ab + ac$$

$$ab + ac = a(b + c)$$