

Algebraic Properties [Axioms]

2009 Mathematics Standards of Learning

The algebraic properties listed apply given a , b , and c are real numbers. This is not an exhaustive list of algebraic properties.

Field Properties

Property	Addition	Multiplication
Associative	$(a + b) + c = a + (b + c)$	$(ab)c = a(bc)$
Commutative	$a + b = b + a$	$ab = ba$
Identity	$a + 0 = a = 0 + a$	$a \cdot 1 = a = 1 \cdot a$
Inverse	$a + (-a) = 0 = (-a) + a$	$a \cdot \frac{1}{a} = 1 = \frac{1}{a} \cdot a$, if $a \neq 0$
Distributive	$a(b + c) = ab + ac$ and $ab + ac = a(b + c)$	

Properties of Equality and Inequality

Property	Equality	Inequality
Multiplicative Property of Zero	$a \cdot 0 = 0 = 0 \cdot a$	
Zero Product	If $ab = 0$, then $a = 0$ or $b = 0$.	
Reflexive	$a = a$	
Symmetric	If $a = b$, then $b = a$.	
Transitive	If $a = b$ and $b = c$, then $a = c$.	If $a > b$ and $b > c$, then $a > c$. If $a < b$ and $b < c$, then $a < c$.
Addition	If $a = b$, then $a + c = b + c$.	If $a < b$, then $a + c < b + c$. If $a > b$, then $a + c > b + c$.
Subtraction	If $a = b$, then $a - c = b - c$.	If $a < b$, then $a - c < b - c$. If $a > b$, then $a - c > b - c$.
Multiplication	If $a = b$, then $ac = bc$.	If $a < b$ and $c > 0$, then $ac < bc$. If $a < b$ and $c < 0$, then $ac > bc$. If $a > b$ and $c > 0$, then $ac > bc$. If $a > b$ and $c < 0$, then $ac < bc$.
Division	If $a = b$ and $c \neq 0$, then $\frac{a}{c} = \frac{b}{c}$.	If $a < b$ and $c > 0$, then $\frac{a}{c} < \frac{b}{c}$. If $a < b$ and $c < 0$, then $\frac{a}{c} > \frac{b}{c}$. If $a > b$ and $c > 0$, then $\frac{a}{c} > \frac{b}{c}$. If $a > b$ and $c < 0$, then $\frac{a}{c} < \frac{b}{c}$.
Substitution	If $a = b$, then b can be substituted for a in any equation or inequality.	