

Properties for Addition

The CLOSURE property for Addition	For all real numbers a and b : $a + b$ is a unique real number
	$\forall a, b \in \mathfrak{R}, \exists! c \in \mathfrak{R}; (a + b = c)$
The ASSOCIATIVE property for Addition	For all real numbers a , b , and c : $(a + b) + c = a + (b + c)$
	$\forall a, b, c \in \mathfrak{R}; (a + b) + c = a + (b + c)$
The COMMUTATIVE property for Addition	For all real numbers a and b : $a + b = b + a$
	$\forall a, b \in \mathfrak{R}; a + b = b + a$
IDENTITY Property of Addition (0 is the Additive Identity)	There is a unique real number 0 such that for every real number a , $a + 0 = a$ and $0 + a = a$.
	$\forall a \in \mathfrak{R}; (a + 0 = a) \wedge (0 + a = a)$
Property of OPPOSITES	For every real number a , there is a unique real number $-a$ such that $a + (-a) = 0$ and $(-a) + a = 0$
	$\forall a \in \mathfrak{R}, \exists! (-a); (a + (-a) = 0) \wedge ((-a) + a = 0)$

Definition of Subtraction

Definition of Subtraction	For all real numbers a and b , the difference $a - b$ is defined by $a - b = a + (-b)$ to subtract b , add the opposite of b .
	$\forall a, b \in \mathfrak{R}; a - b = a + (-b)$

Axioms for Addition

Sample Quiz on Axioms for Addition

1. Find a solution set for $x + 4 = 7$

$x + 4 = 7$	Given
$(x + 4) + -4 = 7 + -4$	
$x + (4 + -4) = 7 + -4$	
$x + 0 = 7 + -4$	
$x = 7 + -4$	
$x = 3$	

2. Find a solution set for $x - 3 = 7$

$x - 3 = 7$	Given
$x + -3 = 7$	
$(x + -3) + 3 = 7 + 3$	
$x + (-3 + 3) = 7 + 3$	
$x + 0 = 7 + 3$	
$x = 7 + 3$	
$x = 10$	

3. Find a solution set for $x - 4 = -3$

$x - 4 = -3$	Given
$x + -4 = -3$	
$(x + -4) + 4 = -3 + 4$	
$x + (-4 + 4) = -3 + 4$	
$x + 0 = -3 + 4$	
$x = -3 + 4$	
$x = 1$	

4. Find a solution set for $-3 + x = -1$

$-3 + x = -1$	Given
$x + -3 = -1$	
$(x + -3) + 3 = -1 + 3$	
$x + (-3 + 3) = -1 + 3$	
$x + 0 = -1 + 3$	
$x = -1 + 3$	
$x = 2$	

Axioms for Addition

5. Find a solution set for $-3 = -2 + x$

$-3 = -2 + x$	Given
$-2 + x = -3$	
$x + -2 = -3$	
$(x + -2) + 2 = -3 + 2$	
$x + (-2 + 2) = -3 + 2$	
$x + 0 = -3 + 2$	
$x = -3 + 2$	
$x = -1$	

Quiz on Axioms for Addition

1. Find a solution set for $x + 4 = 7$

$x + 4 = 7$	Given
$(x + 4) + -4 = 7 + -4$	
$x + (4 + -4) = 7 + -4$	
$x + 0 = 7 + -4$	
$x = 7 + -4$	
$x = 3$	

2. Find a solution set for $x - 3 = 7$

$x - 3 = 7$	Given
$x + -3 = 7$	
$(x + -3) + 3 = 7 + 3$	
$x + (-3 + 3) = 7 + 3$	
$x + 0 = 7 + 3$	
$x = 7 + 3$	
$x = 10$	

3. Find a solution set for $x - 4 = -3$

$x - 4 = -3$	Given
$x + -4 = -3$	
$(x + -4) + 4 = -3 + 4$	
$x + (-4 + 4) = -3 + 4$	
$x + 0 = -3 + 4$	
$x = -3 + 4$	
$x = 1$	

Axioms for Addition

4. Find a solution set for $-3 + x = -1$

$-3 + x = -1$	Given
$x + -3 = -1$	
$(x + -3) + 3 = -1 + 3$	
$x + (-3 + 3) = -1 + 3$	
$x + 0 = -1 + 3$	
$x = -1 + 3$	
$x = 2$	

5. Find a solution set for $-3 = -2 + x$

$-3 = -2 + x$	Given
$-2 + x = -3$	
$x + -2 = -3$	
$(x + -2) + 2 = -3 + 2$	
$x + (-2 + 2) = -3 + 2$	
$x + 0 = -3 + 2$	
$x = -3 + 2$	
$x = -1$	