

Properties of Real Numbers

Property	Rule	Example
Commutative Property of Addition	$a + b = b + a$	$2 + 3 = 3 + 2$
Commutative Property of Multiplication	$a \cdot b = b \cdot a$	$2 \cdot 3 = 3 \cdot 2$
Associative Property of Addition	$(a + b) + c = a + (b + c)$	$2 + (3 + 4) = (2 + 3) + 4$
Associative Property of Multiplication	$(a \cdot b) \cdot c = a \cdot (b \cdot c)$	$2 \cdot (3 \cdot 4) = (2 \cdot 3) \cdot 4$
Distributive Property	$a(b + c) = ab + ac$	$2(3 + 4) = 2 \cdot 3 + 2 \cdot 4$
Additive Identity Property	$a + 0 = a$	$3 + 0 = 3$
Multiplicative Identity Property	$a \cdot 1 = a$	$3 \cdot 1 = 3$
Additive Inverse Property	$a + (-a) = 0$	$3 + (-3) = 0$
Multiplicative Inverse Property	$a \cdot \left(\frac{1}{a}\right) = 1, \quad a \neq 0$	$3 \cdot \left(\frac{1}{3}\right) = 1$

Identify the property of real numbers that is illustrated by each statement.

- $3\frac{1}{2} + 7 = 7 + 3\frac{1}{2}$ _____
- $\frac{2}{3} \cdot \frac{3}{2} = 1$ _____
- $(17 \cdot \frac{1}{2}) \cdot 4 = 17 \cdot (\frac{1}{2} \cdot 4)$ _____
- $-40 + 0 = -40$ _____
- $3\pi + (-3\pi) = 0$ _____

A **binary operation**, such as addition or subtraction, works on exactly two elements of a set at a time. The elements may be the same.

If the outcome of the binary operation is always a member of the original set, then the set is said to be **closed** under the operation. (If an element outside the set is produced, then the operation is *not closed*.)

Under which of the four basic arithmetic operations (addition, subtraction, multiplication, and division) is each of the following sets closed?

1. the integers _____
2. $\{0, \frac{1}{2}, 1, 2\}$ _____
3. $\{1, 3, 5, 7, \dots\}$ _____
4. $\{-1, 0, 1\}$ _____
5. $\{1\}$ _____
6. {all rational numbers except 0} _____
7. $\{0, \frac{1}{2}, 1, 1\frac{1}{2}, 2, 2\frac{1}{2}, \dots\}$ _____