

Algebraic Properties of Equality

Addition Property of Equality	If $a = b$, then $a + c = b + c$
Subtraction Property of Equality	If $a = b$, then $a - c = b - c$
Multiplication Property of Equality	If $a = b$, then $a \cdot c = b \cdot c$
Division Property of Equality	If $a = b$, then $\frac{a}{c} = \frac{b}{c}$
Distributive Property of Multiplication (over addition or over subtraction)	$a(b+c) = ab + ac$ $a(b-c) = ab - ac$
Substitution Property of Equality	If $a = b$, then b can be substituted for a in any equation or expression.
Reflexive Property of Equality	For any real number, $a = a$
Symmetric Property of Equality	If $a = b$ then $b = a$
Transitive Property of Equality	If $a = b$ and $b = c$, then $a = c$

- F 1. If $5 = x$, then $x = 5$.
- C 2. If $a = b$, then $2a = 2b$.
- F 3. $m = n$, so $n = m$
- E 4. $7 = 7$
- A 5. If $a = b$, then $a + 8 = b + 8$
- I 6. $9(x + y) = 9x + 9y$
- G 7. If $x = 3$ and $3 = y$, then $x = y$
- H 8. $p = q$ and $q = -1$, so $p = -1$
- D 9. If $3x = 27$, then $x = 9$
- D 10. If $a = b$ and $c \neq 0$
then $\frac{a}{c} = \frac{b}{c}$
- H 11. If $a = b$, then b can be substituted for a in any expression.
- B 12. If $a = b$, then $a - c = b - c$.

- A) Addition Property of Equality
- B) Subtraction Property of Equality
- C) Multiplication Property of Equality
- D) Division Property of Equality
- E) Reflexive Property of Equality
- F) Symmetric Property of Equality
- G) Transitive Property of Equality
- H) Substitution Property of Equality
- I) Distributive Property of Equality

Solve the equation. Show all the steps and write a justification for each step.

$$\frac{1}{5}(a + 10) = -3$$

$$\frac{1}{5}a + \frac{1}{5}(10) = -3$$

distributive

$$\frac{1}{5}a + 2 = -3$$

substitution
(simplify/combine like terms)

$$\frac{1}{5}a + 2 - 2 = -3 - 2$$

subtraction

$$\frac{1}{5}a = -5$$

substitution

$$5\left(\frac{1}{5}a\right) = -5(5)$$

multiplication

$$a = -25$$

substitution

$$\frac{1}{5}a + 2 = -3$$

$$\frac{1}{5}a = -5$$

$$a = -25$$

distributive property

subtraction property

multiplication property