

1-3 Basic Properties of Real Numbers

Properties of Equality (for all real numbers a , b , and c)

Reflexive property

$$a = a$$

Symmetric property

$$\text{If } a = b, \text{ then } b = a$$

Transitive property

$$\text{If } a = b \text{ \& } b = c, \text{ then } a = c$$

Addition property

$$\text{If } a = b, \text{ then } a + c = b + c$$

Multiplication property

$$\text{If } a = b, \text{ then } a \cdot c = b \cdot c$$

Ex 1) What property is illustrated by the statements below?

a) If $y + 7 = 10$, then $2(y+7) = 20$

Multiplication prop.

b) If $x = y + 3$ and $y + 3 = 5$, then $x = 5$

Transitive property

c) If $a = b + c$, then $b + c = a$

Symmetric property

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Properties of Real Numbers:

Closure Property: $a + b$ and $a \cdot b$ are unique real numbers

Commutative Properties: $a + b = b + a$, and $a \cdot b = b \cdot a$

Associative Properties:

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

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

Identity Properties:

$$\text{Additive Identity: } a + 0 = a \quad \text{and } 0 + a = a$$

$$\text{Multiplicative Identity: } a \cdot 1 = a \quad \text{and } 1 \cdot a = a$$

Inverse Properties:

Property of Opposites: $a + (-a) = 0$ and $(-a) + a = 0$

Property of Reciprocals: $a \cdot (1/a) = 1$ and $(1/a) \cdot a = 1$

Distributive Property:

$a(b + c) = ab + ac$ and $(b + c)a = ba + ca$

Ex 2) Simplify:

a) $7 + 11 + 13 + 19$

$$(7 + 13) + (11 + 19)$$

$$20 + 30$$

$$\textcircled{50}$$

b) $26 + 8y + 14$

$$(26 + 14) + 8y$$

$$\textcircled{40 + 8y}$$

Ex 3) Simplify: $16(4xy^2)(5z^3)$

$$16 \cdot (4 \cdot 5) xy^2 z^3$$

$$16 \cdot 20 xy^2 z^3$$

$$320 xy^2 z^3$$

Name the property used in each step of simplifying: $\frac{1}{3}(1+3t)$

1) $\frac{1}{3}(1+3t) = \frac{1}{3} \cdot 1 + \frac{1}{3} \cdot 3t$ Distributive

2) $= \frac{1}{3} \cdot 1 + (\frac{1}{3} \cdot 3)t$ Associative prop. of mult.

3) $= \frac{1}{3} \cdot 1 + 1 \cdot t$ Property of Reciprocals

4) $= \frac{1}{3} + t$ Identity property of multiplication

5) $\therefore \frac{1}{3}(1+3t) = \frac{1}{3} + t$ Transitive property of equality