

1-4 Properties of Real Numbers

Commutative Property

Associative Property

Identity Property for Addition or Multiplication

Inverse Property for Addition or Multiplication

Zero Product Property

1-4 Properties of Real Numbers

$$a + b = b + a \text{ (Addition)}$$

$$a \cdot b = b \cdot a \text{ (Multiplication)}$$

$$3 + 2 = \underline{2} + \underline{3}$$

$$5 \cdot 7 = \underline{7} \cdot \underline{5}$$

$$17 + 8 + 3 = 17 + \underline{3} + \underline{8}$$

$$5 \cdot 18 \cdot 2 = 5 \cdot \underline{2} \cdot \underline{18}$$

"**CO**mmutative"
= **C**hange **O**rder

$$(a + b) + c = a + (b + c) \text{ (Addition)}$$

$$(a \cdot b) \cdot c = a \cdot (b \cdot c) \text{ (Multiplication)}$$

$$6 + (4 + 8) = (\underline{6} + \underline{4}) + 8$$

$$4 \cdot (5 \cdot 9) = (\underline{4} \cdot \underline{5}) \cdot \underline{9}$$

$$(4 + 2) + (-2) = 4 + (2 + (-2))$$

Associate with
Different **Groups**
= move parentheses

$$a + 0 = a \text{ (Addition)}$$

$$a \cdot 1 = a \text{ (Multiplication)}$$

$$975 + 0 = \underline{975}$$

$$0 + \underline{-7} = -7$$

$$5 + (-3 + 3) = \underline{5}$$

$$-28 \cdot \underline{1} = -28$$

$$\underline{3.75} \cdot 1 = 3.75$$

Add Zero to keep the
number's identity

OR

Multiply by One to keep the
number's identity

$$a + (-a) = 0$$

$$a \cdot \frac{1}{a} = 1$$

$$3 + \underline{-3} = 0$$

$$-7.5 + \underline{+7.5} = 0$$

$$2 \cdot \frac{1}{2} = \underline{1}$$

$$\frac{3}{4} \cdot \underline{\frac{4}{3}} = 1$$

Add a number to its
opposite, the answer is 0.

OR

Multiply a number by its
reciprocal, the answer is 1.

$$a \cdot 0 = 0$$

$$21 \cdot 0 = \underline{0}$$

$$-8 \cdot \underline{0} = 0$$

$$6 \cdot (-4 + 4) = \underline{0}$$

$$0 \cdot (793 \cdot 516) = \underline{0}$$

Zero Product =
Zero Times a number

12

Multiplication Property of -1 : The product of -1 and a is $-a$.

Ex. $-1 \cdot a = -a$ $-1 \cdot 9 = -9$

What property is illustrated by each statement?

A. $42 \cdot 0 = 0$

B. $(y + 2.5) + 28 = y + (2.5 + 28)$

C. $10x + 0 = 10x$

D. $4x \cdot 1 = 4x$

E. $x + (\sqrt{y} + z) = x + (z + \sqrt{y})$

Using Properties for Mental Calculations

A movie ticket costs \$7.75. A drink costs \$2.40. Popcorn costs \$1.25. What is the total cost for a ticket, a drink, and popcorn?

Use mental math.

$$\begin{aligned} (7.75 + 2.40) + 1.25 &= (2.40 + 7.75) + 1.25 \\ &= 2.40 + (7.75 + 1.25) \\ &= 2.40 + 9 \\ &= 11.40 \end{aligned}$$

Commutative Prop
of Addition
Associative Prop
of Addition
Simplify inside
parenthesis
Add

A can holds 3 tennis balls. A box holds 4 cans. A case holds 6 boxes. How many tennis balls are in 10 cases? Use mental math.

$$(3 \times 4 \times 6) \times 10$$

$$72 \times 10 = 720 \text{ tennis balls}$$

Writing Equivalent Expressions

Steps:

- 1) Group numbers that can be simplified
- 2) Use properties to group or reorder parts of the expression.

$$\begin{aligned} \text{A. } 5(3n) &= (5 \cdot 3)n && \text{Associative Prop. of Mult.} \\ &= 15n && \text{Simplify} \end{aligned}$$

$$\begin{aligned} \text{B. } (4 + 7b) + 8 &= (7b + 4) + 8 && \text{Commutative Prop. of Add.} \\ &= 7b + (4 + 8) && \text{Associative Prop. of Add.} \\ &= 7b + 12 && \text{Simplify} \end{aligned}$$

$$\begin{aligned} \text{C. } \frac{6x}{y} &= \frac{6x \cdot y}{1 \cdot y} && \text{Rewrite denominator using} \\ & && \text{Identity Property of Multiplication} \\ &= \frac{6x}{1} \cdot \frac{y}{y} && \text{Simplify} \\ &= 6x \cdot 1 && \text{Identity Property of multiplication} \\ &= 6x \end{aligned}$$