

The Real Number Properties Algebra 1

Many of the most important tools of algebra are dependent upon properties that the real numbers (in partnership with the four basic operations of addition, subtraction, multiplication, and division) possess. These properties are shown below.

If a , b , and c are real numbers then the following properties hold:

$$(1) a + b = b + a \quad \text{and} \quad a \cdot b = b \cdot a \quad \text{Commutative}$$

$$(2) a + (b + c) = (a + b) + c \quad \text{and} \quad a \cdot (b \cdot c) = (a \cdot b) \cdot c \quad \text{Associative}$$

$$(3) a \cdot (b + c) = a \cdot b + a \cdot c \quad \text{Distributive}$$

THE REAL NUMBER PROPERTIES

Exercise #1: Which of the following equations illustrates the distributive property?

$$(1) (-2) + 7 = 7 + (-2) \quad (3) 5(12) = 5(10) + 5(2)$$

$$(2) 3 + (5 + 2) = (3 + 5) + 2 \quad (4) 5 \cdot 3 = 3 \cdot 5$$

Exercise #2: Which of the following properties is illustrated in the equation $(3 + 5) + 7 = 7 + (3 + 5)$?

$$(1) \text{Distributive} \quad (3) \text{Commutative}$$

$$(2) \text{Associative} \quad (4) \text{Inverse}$$

Exercise #3: Give an numerical example to show that subtraction is not a commutative operation.

Exercise #4: What other operation, like subtraction, is not commutative? Justify.

Exercise #5: For each of the following mathematical equations, fill in the number or variable that makes the statement true. Then, identify which property you applied.

(a) $5 + (-3) = (-3) +$ _____

(b) $4(2x - 5) = 8x -$ _____

(c) $7 + (6 + 2) = (7 +$ _____ $) + 2$ _____

Identity Elements and Properties for Addition and Multiplication – For both multiplication and addition there is one number that is unique because it doesn't change another number when operated with. These elements are called **identities**.

Exercise #6:

(a) What is the **identity element for addition**? In other words, what number can be added to a given number without changing that given number? Explain.

(b) What is the **identity element for multiplication**? Explain.

Exercise #7: Justify each statement shown below with a real number property. This process is called combining like terms.

(1) $3x + 4y + 7x + 2y = 3x + 7x + 4y + 2y$ (1) _____

(2) $3x + 7x + 4y + 2y = (3 + 7)x + (4 + 2)y$
 $= 10x + 6y$ (2) _____

Name: _____

Date: _____

The Real Number Properties Algebra 1 Homework

Skills

1. Which of the following equations illustrates the commutative property of multiplication?

(1) $5 \cdot (3 \cdot 2) = (5 \cdot 3) \cdot 2$

(3) $7 + x = x + 7$

(2) $xy = yx$

(4) $3(2x - 4) = 6x - 12$

2. Which of the following equations illustrates the distributive property?

(1) $4(5x - 2) = 20x - 8$

(3) $3 + (2 + 7) = (3 + 2) + 7$

(2) $4x \cdot 3x = 4 \cdot 3 \cdot x \cdot x$

(4) $5(x - 7) = (x - 7)5$

3. Which of the following properties is illustrated by the statement $7 + (-3) = (-3) + 7$?

(1) Distributive Property

(3) Commutative Property of Addition

(2) Associative Property

(4) Commutative Property of Multiplication

4. Which of the following equations illustrates the identity property of multiplication?

(1) $x = x + 0$

(3) $x = 1x$

(2) $2x + y = y + 2x$

(4) $4(3x - 2) = 12x - 8$

5. For each of the following mathematical equations, fill in the blank and then state the property used to justify your answer.

(a) $2(x + 7) = 2x + \underline{\hspace{2cm}}$

(b) $5x + (2x + 3y) = (5x + \underline{\hspace{2cm}}) + 3y$

(c) $2x + 7 + 5x - 3 = 2x + \underline{\hspace{2cm}} + 7 - 3$

(d) $y = 2x = 2x + \underline{\hspace{2cm}}$

(e) $\underline{\hspace{2cm}}(6x + 2) = 6x + 2$

6. Place parentheses in each statement to make it true. There may be more than one correct answer.

(a) $5 + 3 \div 2 = 4$

(b) $10 - 3 - 4 - 2 = 5$

(c) $3 \times 4 + 5 \div 3 = 9$

(d) $2 \times 8 \div 2 + 2 = 4$

Reasoning

7. Justine and Clara are having an argument. Justine claims that division is commutative just like multiplication. Clara claims it is not. Who is correct? Justify.

8. The following mathematical sentence illustrates adding two fractions with unlike denominators.

What property can be used to justify multiplying the second fraction by $\frac{2}{2}$? Explain.

$$\frac{5}{6} + \frac{2}{3} = \frac{5}{6} + \frac{2}{2} \cdot \frac{2}{3}$$

$$= \frac{5}{6} + \frac{4}{6}$$

$$= \frac{9}{6}$$

9. Justify each statement shown below with a real number property.

(1) $(x+4)(x-3) = x(x+4) - 3(x+4)$ (1) _____

(2) $x(x+4) - 3(x+4) = x^2 + 4x - 3x - 12$ (2) _____

(3) $x^2 + 4x - 3x - 12 = x^2 + (4-3)x - 12$ (3) _____
 $= x^2 + 1x - 12$

(4) $x^2 + 1x - 12 = x^2 + x - 12$ (4) _____