Algebra I

SECTION 2.5
PROPERTIES AND MENTAL COMPUTATION

OBJECTIVES: STATE AND APPLY THE COMMUTATIVE, ASSOCIATIVE, DISTRIBUTIVE AND OTHER PROPERTIES.

Warm-up

Evaluate

1. $44 + (36 + 32)$
2. $3(4 + 2)$
3. $5 - (6 + 2)$
4. $2 \cdot (25 \cdot 3)$
5. $4(9.5)$

Identity Property for Addition

For all real numbers a, $a + 0 = a$ and $0 + a = a$

Additive Inverse Property

For every real number a, there is exactly one real number –a such that $a + (-a) = 0$ and $-a + a = 0$

Identity Property for Multiplication

For all real numbers a, $a \cdot 1 = a$ and $1 \cdot a = a$

Multiplicative Inverse Property

For every nonzero real number a, there is exactly one number $\frac{1}{a}$ such that

$$a \gamma \frac{1}{a} = 1 \quad and \quad \frac{1}{a} \gamma \ a = 1$$

The number $\frac{1}{a}$ is called the reciprocal or multiplicative inverse of a.

Properties of Zero

Let a represent any real number

1. The product of any real number and zero is zero.

$$a \cdot 0 = 0 \text{ and } 0 \cdot a = 0$$

2. Zero divided by any nonzero real number is zero.

$$\frac{0}{a} = 0, \text{ where } a \neq 0$$

3. Division by zero is undefined (Division by zero is not possible)

Commutative Properties

Commutative Property of Addition

For all real numbers a and b:

$a + b = b + a$

Commutative Property of Multiplication

For all real numbers a and b:

$a \cdot b = b \cdot a$

Associative Properties

Associative Property of Addition

For all real numbers a, b, and c:

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

Associative Property of Multiplication

For all real numbers a, b, and c:

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

Distributive Property

The Distributive Property of Multiplication Over Addition and Subtraction

For all real numbers a, b, and c:

$$a(b+c) = ab + ac \text{ and } (b + c)a = ba + ca$$

And

$$a(b - c) = ab - ac \text{ and } (b - c)a = ba - ca$$

Properties of Equality

For all real numbers a, b, and c:

Reflexive Property	a = a (A number is equal to itself)
Symmetric Property	If a = b, then b = a
Transitive Property	If a = b and b = c, then a = c
Substitution Property	If a = b, then a can be replaced by b and b can be replaced by a

Practice: Name the property illustrated. Be specific.

1. $32 + 17 = 17 + 32$
2. $13 \cdot 21 - 13 \cdot 9 = 13(21 - 9)$
3. $6(4.7 - 2) = 6(4.7) - 6(2)$
4. $4(5x) = (4 \cdot 5)x$
5. $-8.2(2 + 5.3) = (2 + 5.3)(-8.2)$
6. $(6 - 3)5 = 6 \cdot 5 - 3 \cdot 5$
7. $46 + 12 = 12 + 46$
8. $23 + (17 + 34) = (23 + 17) + 34$
9. $4(2.3 + 4.9) = 4(2.3) + 4(4.9)$
10. $6(3x) = (6 \cdot 3)x$
11. $5 \cdot (12 \cdot 4) = 5 \cdot (4 \cdot 12)$
12. $6 \cdot 300 + 6 \cdot 80 = 6(300 + 80)$