

# SOL 6.19 - Properties

- 6.19 The student will investigate and recognize
- the identity properties for addition and multiplication;
  - the multiplicative property of zero; and
  - the inverse property for multiplication.

## Understanding the Standard:

- Identity elements are numbers that combine with other numbers without changing the other numbers. The additive identity is zero (0). The multiplicative identity is one (1). There are no identity elements for subtraction and division.
- The additive identity property states that the sum of any real number and zero is equal to the given real number (e.g.,  $5 + 0 = 5$ ).
- The multiplicative identity property states that the product of any real number and one is equal to the given real number (e.g.,  $8 \cdot 1 = 8$ ).
- Inverses are numbers that combine with other numbers and result in identity elements. *of 0 + 1*
- The multiplicative inverse property states that the product of a number and its multiplicative inverse (or reciprocal) always equals one (e.g.,  $4 \cdot \frac{1}{4} = 1$ ).
- Zero has no multiplicative inverse.
- The multiplicative property of zero states that the product of any real number and zero is zero.
- Division by zero is not a possible arithmetic operation. Division by zero is undefined.

$$\frac{3}{0} = \text{error}$$

**Vocabulary:**

Commutative Property of Addition:

$$2.76 + 3 = 3 + 2.76$$

$$(a + 5) + 7 = (5 + a) + 7$$

*switching the order*

Commutative Property of Multiplication:

$$-8 \cdot \frac{2}{3} = \frac{2}{3} \cdot (-8)$$

$$y \cdot 9 = 9y$$

Associative Property of Addition:

$$(4 + 2) + 8 = 4 + (2 + 8)$$

$$x + (3x + \frac{1}{2}) = (x + 3x) + \frac{1}{2}$$

*pair have moved*

Associative Property of Multiplication:

$$(3 \cdot 1.5) \cdot 6 = 3 \cdot (1.5 \cdot 6)$$

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

Distributive Property

$$-4(2 + 3) = -4(2) + -4(3)$$

$$5 \cdot (y - 7) = (5 \cdot y) - (5 \cdot 7)$$

$$(2 \cdot \frac{1}{3}) + (2 \cdot 5) = 2(\frac{1}{3} + 5)$$

*x & + w/ ( )*

Multiplicative Property of Zero

$$0 = 8 \cdot 0$$

$$0 \cdot (-13) = 0$$

$$\frac{5}{6} \cdot 0 = 0$$

*x by 0*

Additive Identity Property

$$0.3 + 0 = 0.3$$

$$0 + (-7) = -7$$

$$\frac{4}{7} = 0 + \frac{4}{7}$$

$$w + 0 = w$$

*+ 0*

Multiplicative Identity Property

$$9 \cdot 1 = 9$$

$$1 \cdot (-10) = -10$$

$$\frac{3}{2} = \frac{3}{2} \cdot 1$$

*x by 1*

Additive Inverse Property

$$1.4 + (-1.4) = 0$$

$$(-9) + 9 = 0$$

$$0 = \frac{4}{7} + (-\frac{4}{7})$$

$$x + (-x) = 0$$

*all = 0*

Multiplicative Inverse Property

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

$$1 = (-\frac{1}{9}) \cdot -9$$

$$x \cdot \frac{1}{x} = 1 (x \neq 0)$$

*all = 1*

### Essential Understandings:

How are the identity properties for multiplication and addition the same? Different?

Same  $\rightarrow$  Identity property says what you put in you get out.

Different  $\rightarrow$   $\times 1$   $+ 0$  to get the identity

What is the result of multiplying any real number by zero?

product is always 0

Do all real numbers have a multiplicative inverse?

No, because 0 does not have a multiplicative inverse

$$\frac{0}{3} = 0$$

$$\frac{3}{0} = \text{error}$$

does not exist

### Essential Knowledge & Skills:

The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to

- Identify a real number equation that represents each property of operations with real numbers, when given several real number equations.
- Test the validity of properties by using examples of the properties of operations on real numbers.
- Identify the property of operations with real numbers that is illustrated by a real number equation.

NOTE: The commutative, associative and distributive properties are taught in previous grades.