

Helpful Hints for J.2 – Properties of Real Numbers

The real numbers have actions or operations they can perform. These are referred to as Properties. You may be familiar with many of these properties as you use them frequently in arithmetic problems. It is important for you to learn and use their proper names.

As each property is presented, a definition in mathematical notation will be provided along with an example that will illustrate the given property. The definitions will use letters or variables to indicate that any real number can be represented in the property.

IDENTITY PROPERTIES: This name “identity” comes from the fact that when we perform an operation on a number, the number does not change; it holds its identity.

IDENTITY PROPERTY OF ADDITION

For all real numbers a ,

$$a + 0 = a$$

(The sum of any real number and zero is the original real number.)

Example:

$$7 + 0 = 7$$

IDENTITY PROPERTY OF MULTIPLICATION

For all real numbers a ,

$$a \cdot 1 = a$$

(The product of any real number and one is the original real number.)

Example:

$$3 \cdot 1 = 3$$

INVERSE PROPERTIES:

INVERSE PROPERTY OF ADDITION

For all real numbers a ,

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

(The sum of any number and its inverse is zero.)

Example:

$$5 + (-5) = 0$$

INVERSE PROPERTY OF MULTIPLICATION

For all real numbers a ,

$$a \cdot \left(\frac{1}{a}\right) = 1, \quad a \neq 0$$

(The product of any non-zero real number and its inverse is one.)

Example:

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

COMMUTATIVE PROPERTIES:

COMMUTATIVE PROPERTY OF ADDITION

For all real numbers a and b ,

$$a + b = b + a$$

(The order in which two numbers are added does not change the sum.)

Example:

$$2 + 9 = 9 + 2$$

COMMUTATIVE PROPERTY OF MULTIPLICATION

For all real numbers a and b ,

$$a \cdot b = b \cdot a$$

(The order in which two numbers are multiplied does not change the product.)

Example:

$$6 \cdot 8 = 8 \cdot 6$$

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ASSOCIATIVE PROPERTIES:

ASSOCIATIVE PROPERTY OF ADDITION

For all real numbers a , b , and c ,

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

(The way in which numbers are grouped when added does not change the sum.)

Example:

$$1 + (4 + 7) = (1 + 4) + 7$$

$$1 + 11 = 5 + 7$$

$$12 = 12$$

ASSOCIATIVE PROPERTY OF MULTIPLICATION

For all real numbers a , b , and c ,

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

(The way in which numbers are grouped when multiplying does not change the product.)

Example:

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

$$3 \cdot 10 = 6 \cdot 5$$

$$30 = 30$$

DISTRIBUTIVE PROPERTY:

DISTRIBUTIVE PROPERTY

For all real numbers a , b , and c ,

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

(To multiply the sum by a number, multiply each part of the sum by the number outside the parentheses.)

Example:

$$5(2x + 3) = 10x + 15$$