Section 1.9 Properties of Real Numbers

# Objective 1: Using the Commutative and Associative Properties

In this section, we will look at properties of real numbers. Throughout this section, the variables used represent real numbers.

We know that order does not matter when adding numbers. For example, we know that

.

This property is called the **commutative property of addition**.

We also know that order does not matter when multiplying numbers. For example, we know that

.

This property is called the **commutative property of multiplication**.

**Commutative Properties:**

|  |  |
| --- | --- |
| Addition |  |
| Multiplication |  |

Use a commutative property to rewrite each expression.

|  |  |
| --- | --- |
| a. \_\_\_\_\_\_\_\_\_\_\_ | b. \_\_\_\_\_\_\_\_\_\_\_ |

Now let’s look at grouping numbers. Consider the expression . We know that when we add three numbers, the way in which they are grouped does not change the sum. Two ways of finding the sum are shown below.

The fact that illustrates the **associative property of addition**.

The same is true for multiplication. For example, . This is the **associative property of multiplication**.

**Associative Properties:**

|  |  |
| --- | --- |
| Addition |  |
| Multiplication |  |

Use an associative property to rewrite each expression.

|  |  |
| --- | --- |
| c. \_\_\_\_\_\_\_\_\_\_\_ | d. \_\_\_\_\_\_\_\_\_\_\_ |

Use the commutative and associative properties as needed to simplify each expression.

|  |  |
| --- | --- |
| e.  | f.  |

# Objective 2: Using the Distributive Property

The **distributive property of multiplication over addition** allows us to write a product as a sum or a sum as a product. Consider the expression . We could evaluate the expression as follows:

,

or we could distribute the to each term in the parentheses as shown below. The resulting expression is equivalent to the original expression and evaluates to . This is an example of the distributive property.



**Distributive Property of Multiplication Over Addition:**

Use the distributive property to rewrite the expression without parentheses.

|  |  |
| --- | --- |
| a.  | b.  |

Use the distributive property to rewrite the expression without parentheses. Then, simplify if possible.

|  |  |
| --- | --- |
| c.  | d.  |

Use the distributive property to rewrite the sum as a product.

|  |  |
| --- | --- |
| e.  | f.  |

# Objective 3: The Identity Properties

The number is called the identity for addition because when is added to any real number, the result is the same real number.

The number is called the identity for multiplication because when a real number is multiplied by , the result is the same real number.

**Identity Properties for Addition and Multiplication:**

|  |  |
| --- | --- |
| Addition |  |
| Multiplication |  |