

# 1-2 Properties of Real Numbers

## Lesson Quiz: Part I

Consider the numbers  $3.\overline{1}$ ,  $\pi$ ,  $3$ , and  $3.5729$ .

1. Order the numbers from least to greatest.

**$3, 3.\overline{1}, \pi, 3.5729$**

2. Classify each number by the subsets of the real numbers to which it belongs.

Number	R	Q	Z	W	N	Irrational
3	X	X	X	X	X	
3.1	X	X				
$\pi$	X					X
3.5729	X	X				

## 1-2 Properties of Real Numbers

### Lesson Quiz: Part II

Use interval notation to represent each set of numbers.

3.  $-8 < x \leq -1$      **$(-8, -1]$**



**$[-5, 1)$  or  $[3, \infty)$**

5. Rewrite the set  $\{x \mid x = 5n, n \in \mathbb{N}\}$  in words.

**positive multiples of 5**

# **1-2** *Properties of Real Numbers*

Warm Up

Lesson Presentation

Lesson Quiz

## 1-2 Properties of Real Numbers

### Warm Up

Simplify.

1.  $-5+5$        $0$

2.  $-7\left(\frac{1}{-7}\right)$        $1$

3.  $\frac{1}{2}(3.62)$        $1.81$

4. Find 10% of \$61.70.       $\$6.17$

5. Find the reciprocal of  $-4$ .       $\frac{1}{-4}$

## **1-2** *Properties of Real Numbers*

### ***Objective***

Identify and use properties of real numbers.

## **1-2** *Properties of Real Numbers*

The four basic math operations are  $+$ ,  $-$ ,  $*$ ,  $\div$

subtraction is addition of the opposite and  
division is multiplication by the reciprocal, the  
properties of real numbers focus on addition  
and multiplication.

**1-2****Properties of Real Numbers****Properties Real Numbers****Identities and Inverses**

For all real numbers  $n$ ,

<b>WORDS</b>	<b>Additive Identity Property</b> The sum of a number and 0, the additive identity, is the original number.
<b>NUMBERS</b>	$3 + 0 = 3$
<b>ALGEBRA</b>	$n + 0 = 0 + n = n$

# 1-2 Properties of Real Numbers

## Properties Real Numbers

## Identities and Inverses

For all real numbers  $n$ ,

<b>WORDS</b>	<b>Multiplicative Identity Property</b> The product of a number and 1, the multiplicative identity, is the original number.
<b>NUMBERS</b>	$\frac{2}{3} \bullet 1 = \frac{2}{3}$
<b>ALGEBRA</b>	$n \bullet 1 = 1 \bullet n = n$

# 1-2 Properties of Real Numbers

## Properties Real Numbers

## Identities and Inverses

For all real numbers  $n$ ,

<b>WORDS</b>	<b>Additive Inverse Property</b> The sum of a number and its opposite, or additive inverse, is 0.
<b>NUMBERS</b>	$5 + (-5) = 0$
<b>ALGEBRA</b>	$n + (-n) = 0$

# 1-2 Properties of Real Numbers

## Properties Real Numbers

## Identities and Inverses

For all real numbers  $n$ ,

<b>WORDS</b>	<b>Multiplicative Inverse Property</b> The product of a nonzero number and its reciprocal, or multiplicative inverse, is 1.
<b>NUMBERS</b>	$8 \cdot \frac{1}{8} = 1$
<b>ALGEBRA</b>	$n \cdot \frac{1}{n} = 1 \quad (n \neq 0)$

## **1-2** *Properties of Real Numbers*

Recall from previous courses that the opposite of any number  $a$  is  $-a$  and the reciprocal of any nonzero number  $a$  is  $\frac{1}{a}$ .

## 1-2 Properties of Real Numbers

### Example 1A: Finding Inverses

Find the additive and multiplicative inverse of each number.

12

additive inverse:  $-12$

*The opposite of 12 is  $-12$ .*

**Check**  $-12 + 12 = 0$  ✓

*The Additive Inverse Property holds.*

multiplicative inverse:  $\frac{1}{12}$

*The reciprocal of 12 is  $\frac{1}{12}$ .*

**Check**  $12 \cdot \left(\frac{1}{12}\right) = 1$  ✓

*The Multiplicative Inverse Property holds.*

## 1-2 Properties of Real Numbers

### Check It Out! Example 1A

Find the additive and multiplicative inverse of each number.

**500**

additive inverse:  $-500$

*The opposite of 500 is  $-500$ .*

**Check**  $500 + (-500) = 0$  ✓

*The Additive Inverse Property holds.*

multiplicative inverse:  $\frac{1}{500}$

*The reciprocal of 500 is  $\frac{1}{500}$ .*

**Check**  $500 \cdot \left(\frac{1}{500}\right) = 1$  ✓

*The Multiplicative Inverse Property holds.*

# 1-2 Properties of Real Numbers

## Properties Real Numbers

## Addition and Multiplication

For all real numbers  $a$  and  $b$ ,

*Start*

<b>WORDS</b>	<b>Closure Property</b> The sum or product of any two real numbers is a real number
<b>NUMBERS</b>	$2 + 3 = 5$ $2(3) = 6$
<b>ALGEBRA</b>	$a + b \in \mathcal{R}$ $ab \in \mathcal{R}$

# 1-2 Properties of Real Numbers

## Properties Real Numbers

### Addition and Multiplication

For all real numbers  $a$  and  $b$ ,

<b>WORDS</b>	<b>Commutative Property</b> You can add or multiply real numbers in any order without changing the result.
<b>NUMBERS</b>	$7 + 11 = 11 + 7$ $7(11) = 11(7)$
<b>ALGEBRA</b>	$a + b = b + a$ $ab = ba$

# 1-2 Properties of Real Numbers

## Properties Real Numbers

### Addition and Multiplication

For all real numbers  $a$  and  $b$ ,

<b>WORDS</b>	<b>Associative Property</b> The sum or product of three or more real numbers is the same regardless of the way the numbers are grouped.
<b>NUMBERS</b>	$(5 + 3) + 7 = 5 + (3 + 7)$ $(5 \cdot 3)7 = 5(3 \cdot 7)$
<b>ALGEBRA</b>	$a + (b + c) = a + (b + c)$ $(ab)c = a(bc)$

# 1-2 Properties of Real Numbers

## Properties Real Numbers

### Addition and Multiplication

For all real numbers  $a$  and  $b$ ,

<b>WORDS</b>	<b>Distributive Property</b> When you multiply a sum by a number, the result is the same whether you add and then multiply or whether you multiply each term by the number and add the products.
<b>NUMBERS</b>	$5(2 + 8) = 5(2) + 5(8)$ $(2 + 8)5 = (2)5 + (8)5$
<b>ALGEBRA</b>	$a(b + c) = ab + ac$ $(b + c)a = ba + ca$

## **1-2** *Properties of Real Numbers*

### **Reading Math**

Based on the Closure Property, the real numbers are said to be *closed* under addition and closed under multiplication.

## 1-2 Properties of Real Numbers

### Example 2: Identifying Properties of Real Numbers

Identify the property demonstrated by each question.

A.  $2 \cdot 3.9 = 3.9 \cdot 2$

*Numbers are multiplied in any order without changing the results.*

Commutative Property of Multiplication

B.  $3(2\sqrt{8}) = (3 \cdot 2)\sqrt{8}$

*The numbers have been regrouped.*

Associative Property of Addition

**1-2****Properties of Real Numbers****Check It Out! Example 2**

**Identify the property demonstrated by each equation.**

**2a.**  $9\sqrt{2} = (\sqrt{2})9$

*Numbers are multiplied in any order without changing the results.*

Commutative Property of Multiplication

**2b.**  $9(12\pi) = (9 \cdot 12)\pi$

*The numbers have been regrouped.*

Associative Property of Multiplication

## 1-2 Properties of Real Numbers

### Example 3: Consumer Economics Application

Use mental math to find a 5% tax on a \$42.40 purchase.

**Think:** 10% of \$42.40

$$10\%(42.40) = 4.\overset{\curvearrowright}{2}40 = 4.24$$

*Move the decimal point left 1 place.*

**Think:**  $5\% = \frac{1}{2}(10\%)$

$$\frac{1}{2}(4.24) = 2.12$$

*5% is half of 10%, so find half of 4.24.*

A 5% tax on a \$42.40 is \$2.12.

## 1-2 Properties of Real Numbers

### Example 4A: Classifying Statements as Sometimes, Always, or Never True

**Classifying each statement as sometimes, always, or never true. Give examples or properties to support your answers.**

$$a \cdot b = a, \text{ where } b = 3$$

sometimes true

true example:  $0 \cdot 3 = 0$

false example:  $1 \cdot 3 \neq 1$

*True and false examples exist. The statement is true when  $a = 0$  and false when  $a \neq 0$ .*

**1-2****Properties of Real Numbers****Example 4B: Classifying Statements as Sometimes, Always, or Never True**

**Classifying each statement as sometimes, always, or never true. Give examples or properties to support your answers.**

$$3(a + 1) = 3a + 3$$

always true

*Always true by the  
Distributive Property.*

**1-2****Properties of Real Numbers****Check It Out! Example 4a**

**Classify each statement as sometimes, always, or never true. Give examples or properties to support your answer.**

$$a + (-a) = b + (-b)$$

*Always true by the Additive Inverse Property.*

## 1-2 Properties of Real Numbers

### Check It Out! Example 4b

Classify each statement as sometimes, always, or never true. Give examples or properties to support your answer.

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

sometimes true

true example:

$$\begin{aligned} 0 - (1 + 2) &= (0 - 1) + (0 - 2) \\ -3 &= -3 \end{aligned}$$

false example:

$$\begin{aligned} 1 - (2 + 3) &= (1 - 2) + (1 - 3) \\ -4 &\neq -3 \end{aligned}$$

*True and false examples exist. The statement is true when  $a = 0$ ,  $b = 1$ , and  $c = 2$ . False when  $a = 1$ ,  $b = 2$ , and  $c = 3$ .*

# 1-2 Properties of Real Numbers

## Lesson Quiz

Find the additive and multiplicative inverse of each number.

1.  $-15$     $15$ ;  $\frac{1}{-15}$

2.  $\frac{2}{7}$     $-\frac{2}{7}$ ;  $\frac{7}{2}$

Identify the property demonstrated by each question.

3.  $2 + \sqrt{3} = (\sqrt{3}) + 2$    Commutative Property of Addition

4.  $\pi \cdot (2 + \sqrt{8}) = (\pi \cdot 2) + (\pi \cdot \sqrt{8})$    Distributive Property

5. Use mental math to find a 15% tip for a \$ 64.20 bill.    $\$9.63$