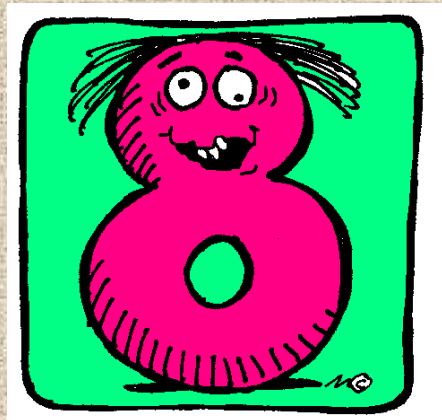


# RATIONAL NUMBERS



**STANDARD:** *Apply algebraic order of operations and the commutative, associative, and distributive properties to evaluate expressions: and justify each step in the process.*

***Student Objective:***

- Students will apply order of operations to solve problems with rational numbers and apply their properties, by performing the correct operations, using math facts skills, writing reflective summaries, and scoring 80% proficiency

# Essential Questions:

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- How do you know if a number is a rational number?
- What are the properties used to evaluate rational numbers?

# Two Kinds of Real Numbers

- Rational Numbers
- Irrational Numbers



# Rational Numbers

- A rational number is a real number that can be written as a ratio of two integers.
- A rational number written in decimal form is terminating or repeating.

## EXAMPLES OF RATIONAL NUMBERS

- 16
- $\frac{1}{2}$
- 3.56
- -8
- 1.3333...
- $-\frac{3}{4}$

To write a fraction as a decimal, divide the numerator by the denominator. You can use long division.

**numerator**  

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**denominator**

**denominator** ) **numerator**

## Example : Writing Fractions as Decimals

Write the fraction as a decimal.

$$\frac{11}{9}$$

$$\begin{array}{r} 1.\overline{2} \\ 9 \overline{) 11.0} \\ \underline{-9} \phantom{0} \downarrow \\ 20 \\ \underline{-18} \\ 2 \end{array}$$

*The pattern repeats.*

### Writing Math

A repeating decimal can be written with a bar over the digits that repeat. So  $1.2222\ldots = 1.\overline{2}$ .

The fraction  $\frac{11}{9}$  is equivalent to the decimal  $1.\overline{2}$ .

## Example: Writing Fractions as Decimals

Write the fraction as a decimal.

$$\frac{7}{20}$$

$$\begin{array}{r} 0.35 \\ 20 \overline{) 7.00} \\ \underline{-0} \phantom{0} \\ 70 \\ \underline{-60} \\ 100 \\ \underline{-100} \\ 0 \end{array}$$

*This is a terminating decimal.*

*The remainder is 0.*

The fraction  $\frac{7}{20}$  is equivalent to the decimal 0.35.

# Rational Numbers

Natural Numbers - Natural counting numbers.

1, 2, 3, 4 ...

Whole Numbers - Natural counting numbers and zero.

0, 1, 2, 3 ...

Integers - Whole numbers and their opposites.

... -3, -2, -1, 0, 1, 2, 3 ...

Rational Numbers - Integers, fractions, and decimals.

**Ex:**

-0.76, -6/13, 0.08, 2/3

# Rational Numbers on a Number Line

Integers

Whole Numbers

Natural Numbers



Negative  
numbers

Positive  
numbers

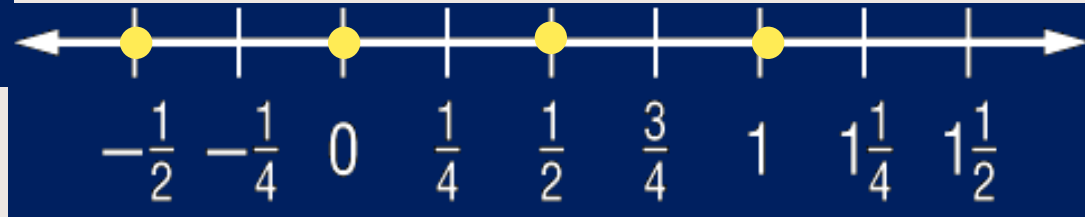
Zero is neither  
negative nor positive



# Graph Numbers on a Number Line

Draw the graph of  $\left\{-\frac{1}{2}, 0, \frac{1}{2}, 1\right\}$

Answer:



## Graph Numbers on a Number Line

**Graph  $\{-1.5, 0, 1.5, \dots\}$ .**

**Answer:**



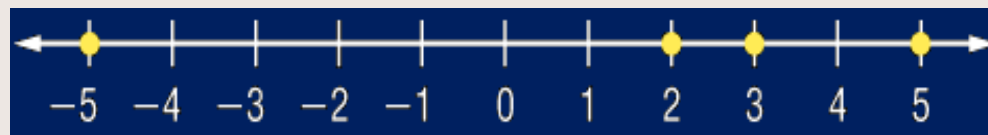
## Your Turn

### Graph Numbers on a Number Line

**Graph each set of numbers.**

a.  $\{-5, 2, 3, 5\}$

**Answer:**



b.  $\left\{-\frac{1}{4}, \frac{1}{2}, \frac{7}{4}, 2\right\}$

**Answer:**



# Properties

A property is something that is true for all situations.

# Four Properties

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- 1. Distributive**
- 2. Commutative**
- 3. Associative**
- 4. Identity properties of one and zero**

## PROPERTIES OF ADDITION AND MULTIPLICATION

| Words                                                                                                                                  | Numbers                                                                                                             | Algebra                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| <b>Commutative Property</b><br>You can add numbers in any order. You can multiply numbers in any order.                                | $3 + 4\frac{1}{2} = 4\frac{1}{2} + 3$ $2 \cdot 17 = 17 \cdot 2$                                                     | $a + b = b + a$ $ab = ba$                                               |
| <b>Associative Property</b><br>When you are only adding or only multiplying, changing the grouping will not affect the sum or product. | $(6 + 8) + 9 = 6 + (8 + 9)$ $\left(2 \cdot \frac{1}{8}\right) \cdot 16 = 2 \cdot \left(\frac{1}{8} \cdot 16\right)$ | $(a + b) + c = a + (b + c)$ $(a \cdot b) \cdot c = a \cdot (b \cdot c)$ |

# Distributive Property

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$$A(B + C) = AB + AC$$

$$4(3 + 5) = 4 \times 3 + 4 \times 5$$

# Commutative Property of addition and multiplication

Order doesn't matter

$$A \times B = B \times A$$

$$A + B = B + A$$

# Associative Property of multiplication and Addition

**Associative Property  $\rightarrow (a \cdot b) \cdot c = a \cdot (b \cdot c)$**

**Example:  $(6 \cdot 4) \cdot 3 = 6 \cdot (4 \cdot 3)$**

**Associative Property  $\rightarrow (a + b) + c = a + (b + c)$**

**Example:  $(6 + 4) + 3 = 6 + (4 + 3)$**

# Identity Properties

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If you add 0 to any number, the number stays the same.

$$A + 0 = A \quad \text{or} \quad 5 + 0 = 5$$

If you multiply any number times 1, the number stays the same.

$$A \times 1 = A \quad \text{or} \quad 5 \times 1 = 5$$

## Example 1: Identifying Properties of Addition and Multiplication

Name the property that is illustrated in each equation.

A.  $(-4) \cdot 9 = 9 \cdot (-4)$

$$(-4) \cdot 9 = 9 \cdot (-4)$$

*The order of the numbers changed.*

Commutative Property of Multiplication

B.  $\left(5 + \frac{3}{4}\right) + \frac{1}{4} = 5 + \left(\frac{3}{4} + \frac{1}{4}\right)$

$$\left(5 + \frac{3}{4}\right) + \frac{1}{4} = 5 + \left(\frac{3}{4} + \frac{1}{4}\right)$$

*The factors are grouped differently.*

Associative Property of Addition

