2.5

Play Ball!

Absolute Value Equations and Inequalities

LEARNING GOALS

In this lesson, you will:

- Understand and solve absolute values.
- Solve linear absolute value equations.
- Solve and graph linear absolute value inequalities on number lines.
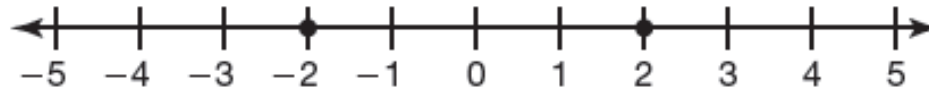- Graph linear absolute values and use the graph to determine solutions.

KEY TERMS

- opposites
- absolute value
- linear absolute value equation
- linear absolute value inequality
- equivalent compound inequalities

PROBLEM 1 **Opposites Attract? Absolutely!**

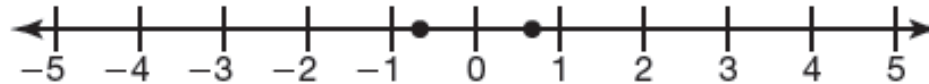1. Analyze each pair of numbers and the corresponding graph.
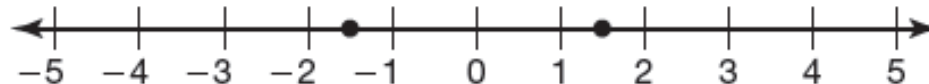
   a. −2 and 2

   b. $-\frac{2}{3}$ and $\frac{2}{3}$

   c. −1.5 and 1.5

   How far is each number from "0" on the number line?

2. Describe the relationship between the two numbers.

   The 2 numbers are OPPOSITES, one is positive (+) & one is negative (−).

3. What do you notice about the distance each point lies away from zero on each number line?

   Each pair of numbers is the SAME distance from 0.

Two numbers that are an equal distance, but are in different directions, from zero on the number line are called **opposites**. The **absolute value** of a number is its distance from zero on the number line.

4. Write each absolute value.

a. $|-2| = \underline{2}$ $\qquad$ $|2| = \underline{2}$

b. $\left|-\dfrac{2}{3}\right| = \underline{\dfrac{2}{3}}$ $\qquad$ $\left|\dfrac{2}{3}\right| = \underline{\dfrac{2}{3}}$

c. $|-1.5| = \underline{1.5}$ $\qquad$ $|1.5| = \underline{1.5}$

> How can you use each corresponding graph in Question 1 to verify your answers?

5. What do you notice about each set of answers for Question 4?

The absolute value sign makes all the numbers POSITIVE.

6. Determine the value of each. Show your work.

a. $|3 - 8|$

$|-5| = 5$

b. $|3| - |8|$

$3 - 8 = -5$

c. $|4(5)|$

$|20| = 20$
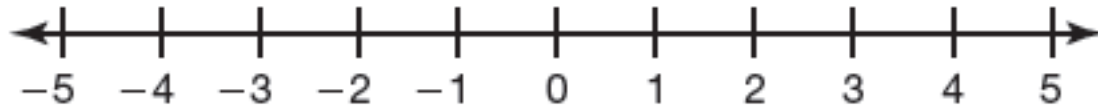
d. $|-4| \cdot |5|$

$4 \cdot 5 = 20$

e. $\left|\dfrac{12}{-3}\right|$

$|-4| = 4$

f. $\dfrac{|12|}{|-3|}$

$\dfrac{12}{3} = 4$

7. Determine the solution(s) to each equation.

a. $x = 5$

$x = 5$
There is 1 solution.

b. $|x| = 5$

$x = 5$ or $x = -5$
There are 2 solutions.

c. $|x| = -5$

No solution.
Absolute values cannot
be negative since distance
is always positive.

d. $|x| = 0$

$x = 0$
There is only 1 solution.

Use the number line as a tool to think about each solution.

6. Solve each linear absolute value equation. Show your work.

a. $|x + 7| = 3$

$x + 7 = 3$ $x + 7 = -3$

$\underline{\quad -7 \quad -7}$ $\underline{\quad -7 \quad -7}$

$x = -4$ $x = -10$

b. $|x - 9| = 12$

$x - 9 = 12$ $x - 9 = -12$

$\underline{\quad +9 \quad +9}$ $\underline{\quad +9 \quad +9}$

$x = 21$ $x = -3$

c. $|3x + 7| = -8$

No solution. Linear absolute values will never equal a negative number.

d. $|2x + 3| = 0$

$2x + 3 = 0$

$\underline{\quad -3 \quad -3}$

$2x = -3$

$x = -\dfrac{3}{2}$