



# 1.4. Advanced Algebra

## Solving Absolute Value Equations

DATE: 10/3

Target 2A. Utilize a graph to illustrate the solution set of an absolute value inequality.



### Evaluate an Expression with Absolute Value

1. Evaluate  $1.4 + |5y - 7|$  if  $y = -3$ .

$$\begin{aligned}
 & 1.4 + |5(-3) - 7| \\
 &= 1.4 + |-15 - 7| \\
 &= 1.4 + |-22| \\
 &= 1.4 + 22 = 23.4
 \end{aligned}$$

2. Evaluate  $2.7 + |6 - 2x|$  if  $x = 4$ .

$$\begin{aligned}
 & 2.7 + |6 - 2(4)| \\
 &= 2.7 + |6 - 8| \\
 &= 2.7 + |-2| = 2.7 + 2 = 4.7
 \end{aligned}$$

### Solve an Absolute Value Equation

3. Solve  $|x - 18| = 5$ . Check your solutions.

$$\begin{aligned}
 |x - 18| = 5 &\Rightarrow x - 18 = 5 \quad \text{OR} \quad x - 18 = -5 \\
 \begin{array}{r} x - 18 = 5 \\ +18 \quad +18 \\ \hline x = 23 \end{array} &\quad \text{OR} \quad \begin{array}{r} x - 18 = -5 \\ +18 \quad +18 \\ \hline x = 13 \end{array}
 \end{aligned}$$

∴ the solution is  $\{23, 13\}$ .

\* Always do the opposite on second eq.

CHECK IN ORIGINAL EQUATION

$ x - 18  = 5$ $ 13 - 18  = 5$ $ -5  = 5$ $5 = 5$ True ✓	$ x - 18  = 5$ $ 23 - 18  = 5$ $ 5  = 5$ $5 = 5$ True ✓
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4. Solve  $|x + 6| = 3x - 2$ . Check your solutions.

Ex:  
 $|-3| = 3$   
 $|5| = 5$   
 \* Recall the absolute value of a positive or negative # is always POSITIVE  
 It's the distance from 0 on a number line

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4. Solve  $|x + 6| = 3x - 2$ . Check your solutions. ← we took opposite

$$|x+6| = 3x-2 \Rightarrow \begin{array}{l} x+6 = 3x-2 \\ -x \quad -x \\ \hline 6 = 2x-2 \\ +2 \quad +2 \\ \hline 8 = 2x \\ \frac{8}{2} = \frac{2x}{2} \\ 4 = x \end{array} \text{ OR } \begin{array}{l} x+6 = -3x+2 \\ +3x \quad +3x \\ \hline 4x+6 = 2 \\ -6 \quad -6 \\ \hline 4x = -4 \\ \frac{4x}{4} = \frac{-4}{4} \\ x = -1 \end{array}$$

only  
Sol is  $\{4\}$

CHECK:

$ x+6  = 3x-2$	$ x+6  = 3x-2$
$ 4+6  = 3(4)-2$	$ -1+6  = 3(-1)-2$
$ 10  = 12-2$	$5 \neq -5$
$10 = 10 \checkmark$	<del>FALSE</del>
TRUE	

5. Solve  $|5x - 6| + 9 = 0$ . Check your solutions.

$$|5x-6| = -9 \quad ? \quad \text{No solution } \emptyset$$

Why? B/c the distance (which is always positive) from 0 on the number line cannot be -9.

1-6 part 3 2013-14 - Microsoft Word

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Evaluate each expression if  $a = -5$ ,  $b = 6$ ,  $c = 2.8$ .

$$1. |-3a| = |-3(-5)| \\ = |15| = 15$$

$$2. |2b - 15| \\ = |2(6) - 15| \\ = |12 - 15| = |-3| = 3$$

$$3. 6 - |3c + 7| \\ = 6 - |3(2.8) + 7| \\ = 6 - |8.4 + 7| = 6 - |15.4| = 6 - 15.4 = -9.4$$

$$4. |a - b| - |10c - a| \\ = |-5 - (6)| - |10(2.8) - (-5)| \\ = |-11| - |28 + 5| = 11 - |33| = 11 - 33 = -22$$

Solve each equation. Check your solutions.

$$5. |y + 9| = 21$$

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Solve each equation. Check your solutions.

$$5. |y + 9| = 21 \Rightarrow y + 9 = 21 \text{ or } y + 9 = -21$$

$$\begin{array}{r} -9 \quad -9 \\ \hline y = 12 \end{array} \quad \downarrow \quad \begin{array}{r} -9 \quad -9 \\ \hline y = -30 \end{array}$$

CHECK:

$$|12 + 9| = 21$$

$$|21| = 21$$

$$21 = 21 \checkmark$$

True

$$|-30 + 9| = 21$$

$$|-21| = 21$$

$$21 = 21 \checkmark$$

True

$\therefore$  Solution is  $\{12, -30\}$ .

$$6. \frac{2|b + 4|}{2} = \frac{48}{2} \text{ (hint: divide both sides of the equation by two.)}$$

$$|b + 4| = 24 \Rightarrow b + 4 = 24 \text{ or } b + 4 = -24$$

$$\begin{array}{r} -4 \quad -4 \\ \hline b = 20 \end{array} \quad \downarrow \quad \begin{array}{r} -4 \quad -4 \\ \hline b = -28 \end{array}$$

CHECK:

$$2 \cdot |20 + 4| = 48$$

$$2 \cdot |24| = 48$$

$$\checkmark 2 \cdot 24 = 48$$

$$48 = 48$$

True

$$2 \cdot |-28 + 4| = 48$$

$$2 \cdot |-24| = 48$$

$$2 \cdot 24 = 48$$

$$48 = 48 \checkmark$$

True

$\therefore$  Solution is  $\{20, -28\}$ .