

## Lesson 1-4

### Example 1 Evaluate an Expression with Absolute Value

Evaluate  $10 - |2a + 7|$  if  $a = -1.5$ .

$$\begin{aligned} 10 - |2a + 7| &= 10 - |2(-1.5) + 7| && \text{Replace } a \text{ with } -1.5. \\ &= 10 - |-3 + 7| && \text{Simplify } 2(-1.5) \text{ first.} \\ &= 10 - |4| && \text{Add } -3 \text{ and } 7. \\ &= 10 - 4 && |4| = 4 \\ &= 6 && \text{Subtract.} \end{aligned}$$

The value is 6.

### Example 2 Solve an Absolute Value Equation

Solve  $-10|b + 3| = -40$ . Check your solutions.

First, divide both sides by  $-10$ .

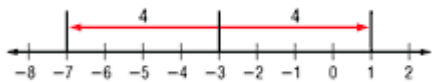
$$|b + 3| = 4$$

$$\begin{array}{ll} \text{Case 1} & a = b \\ & b + 3 = 4 \\ & b + 3 - 3 = 4 - 3 \\ & b = 1 \end{array} \quad \text{or} \quad \begin{array}{ll} \text{Case 2} & a = -b \\ & b + 3 = -4 \\ & b + 3 - 3 = -4 - 3 \\ & b = -7 \end{array}$$

$$\begin{array}{ll} \text{CHECK} & -10|b + 3| = -40 \\ & -10|1 + 3| \stackrel{?}{=} -40 \\ & -10|4| \stackrel{?}{=} -40 \\ & -40 = -40 \checkmark \\ & \text{(check.gif)} \end{array} \quad \begin{array}{ll} & -10|b + 3| = -40 \\ & -10|-7 + 3| \stackrel{?}{=} -40 \\ & -10|-4| \stackrel{?}{=} -40 \\ & -10(4) \stackrel{?}{=} -40 \\ & -40 = -40 \checkmark \end{array}$$

The solutions are  $-7$  or  $1$ . Thus, the solution set is  $\{-7, 1\}$ .

On the number line, we can see that each answer is 4 units away from  $-3$ .



### Example 3 No Solution

Solve  $|-3c + 8| + 15 = 7$ .

$$\begin{aligned} |-3c + 8| + 15 &= 7 && \text{Original equation} \\ |-3c + 8| &= -8 && \text{Isolate the absolute value expression by subtracting 15 from each side.} \end{aligned}$$

This sentence is *never* true, so the solution set is  $\emptyset$ .

**Example 4 One Solution**Solve  $|n - 9| = 5n + 6$ . Check your solutions.

$$\begin{aligned} \text{Case 1} \quad a &= b \\ n - 9 &= 5n + 6 \\ -9 &= 4n + 6 \\ -15 &= 4n \\ -\frac{15}{4} &= n \end{aligned}$$

$$\begin{aligned} \text{or} \quad \text{Case 2} \quad a &= -b \\ n - 9 &= -(5n + 6) \\ n - 9 &= -5n - 6 \\ -9 &= -6n - 6 \\ -3 &= -6n \\ \frac{1}{2} &= n \end{aligned}$$

There appear to be two solutions,  $-\frac{15}{4}$  or  $\frac{1}{2}$ .**CHECK**

$$\begin{aligned} |n - 9| &= 5n + 6 \\ \left| -\frac{15}{4} - 9 \right| &\stackrel{?}{=} 5 \left( -\frac{15}{4} \right) + 6 \\ \left| -\frac{15}{4} - 9 \right| &\stackrel{?}{=} -\frac{75}{4} + 6 \\ \left| -12\frac{3}{4} \right| &\stackrel{?}{=} -12\frac{3}{4} \\ 12\frac{3}{4} &\neq -12\frac{3}{4} \end{aligned}$$

$$\begin{aligned} |n - 9| &= 5n + 6 \\ \left| \frac{1}{2} - 9 \right| &\stackrel{?}{=} 5 \left( \frac{1}{2} \right) + 6 \\ \left| \frac{1}{2} - 9 \right| &\stackrel{?}{=} \frac{5}{2} + 6 \\ \left| -8\frac{1}{2} \right| &\stackrel{?}{=} 8\frac{1}{2} \\ 8\frac{1}{2} &= 8\frac{1}{2} \quad \checkmark \end{aligned}$$

Since  $12\frac{3}{4} \neq -12\frac{3}{4}$ , the only solution is  $\frac{1}{2}$ . Thus, the solution set is  $\left\{ \frac{1}{2} \right\}$ .