

6.5

Solve Absolute Value Equations

Goal • Solve absolute value equations.

Your Notes

VOCABULARY

Absolute value equation

Absolute deviation

SOLVING AN ABSOLUTE VALUE EQUATION

The equation $|ax + b| = c$ where $c \geq 0$ is equivalent to the statement _____ or _____.

Example 1 Solve an absolute value equation

Solve $|x - 9| = 2$.

Solution

$$|x - 9| = 2$$

Write original equation.

$$x - 9 = 2 \quad \text{or} \quad x - 9 = -2$$

Rewrite as two equations.

$$x = \underline{\hspace{2cm}} \quad \text{or} \quad x = \underline{\hspace{2cm}}$$

Add $\underline{\hspace{1cm}}$ to each side.

The solutions are _____ and _____. Check your solution.

CHECK

$$|x - 9| = 2$$

$$|x - 9| = 2$$

Write original equation.

$$|\underline{\hspace{1cm}} - 9| = 2$$

$$|\underline{\hspace{1cm}} - 9| = 2$$

Substitute for x .

$$|\underline{\hspace{1cm}}| = 2$$

$$|\underline{\hspace{1cm}}| = 2$$

Subtract.

$$\underline{\hspace{2cm}} \checkmark$$

$$\underline{\hspace{2cm}} \checkmark$$

Simplify. Solution checks.

Your Notes

Example 2 Rewrite an absolute value equation

Solve $4|2x + 8| + 6 = 30$.

Solution

First, rewrite the equation in the form _____.

$$4|2x + 8| + 6 = 30$$

Write original equation.

$$4|2x + 8| = \underline{\hspace{2cm}}$$

Subtract $\underline{\hspace{1cm}}$ from each side.

$$|2x + 8| = \underline{\hspace{2cm}}$$

Divide each side by $\underline{\hspace{1cm}}$.

Next, solve the absolute value equation.

$$|2x + 8| = \underline{\hspace{2cm}}$$

Write absolute value equation.

$$2x + 8 = \underline{\hspace{2cm}} \quad \text{or} \quad 2x + 8 = \underline{\hspace{2cm}}$$

Rewrite as two equations.

$$2x = \underline{\hspace{2cm}} \quad \text{or} \quad 2x = \underline{\hspace{2cm}}$$

Subtract $\underline{\hspace{1cm}}$ from each side.

$$x = \underline{\hspace{2cm}} \quad \text{or} \quad x = \underline{\hspace{2cm}}$$

Divide each side by $\underline{\hspace{1cm}}$.

Remember to check your solutions in the original equation for accuracy.

✓ Checkpoint Solve the equation.

1. $|x + 6| = 11$

2. $3|5x - 10| + 6 = 21$

Your Notes

Example 3 *Decide if an equation has no solutions*

Solve $|7x - 3| + 8 = 5$, if possible.

Solution

$$|7x - 3| + 8 = 5 \quad \text{Write original equation.}$$

$$|7x - 3| = \underline{\hspace{2cm}} \quad \text{Subtract } \underline{\hspace{1cm}} \text{ from each side.}$$

The absolute value of a number is never $\underline{\hspace{2cm}}$. So, there are no solutions.

Example 4 *Use absolute deviation*

The absolute deviation of x from 10 is 1.8. Find the values of x that satisfy this requirement.

Solution

$$\begin{array}{ccc} \text{Absolute deviation} & = & |x - \text{given value}| \\ \downarrow & & \downarrow \quad \downarrow \\ \underline{\hspace{2cm}} & = & |x - \underline{\hspace{2cm}}| \end{array}$$

$\underline{\hspace{2cm}}$

Write original equation.

$$\underline{\hspace{2cm}} = x - \underline{\hspace{2cm}} \quad \text{or} \quad \underline{\hspace{2cm}} = x - \underline{\hspace{2cm}}$$

Rewrite as two equations.

$$\underline{\hspace{2cm}} = x \quad \text{or} \quad \underline{\hspace{2cm}} = x$$

Add $\underline{\hspace{1cm}}$ to each side.

So, x is $\underline{\hspace{2cm}}$ or $\underline{\hspace{2cm}}$.

✓ Checkpoint Complete the following exercise.

Homework

3. Find the values of x that satisfy the definition of absolute value for a given value of -13.6 and an absolute deviation of 2.8 .