EXAMPLE 2 Solve an absolute value equation

Solve $|x - 3| = 8$.

Solution

Rewrite the absolute value equation as two equations. Then solve each equation separately.

AVOID ERRORS You cannot add 3 to each side of $|x - 3| = 8$. In other words, the equations $|x - 3| = 8$ and $|x| = 11$ are *not* equivalent.

$|x - 3| = 8$ — Write original equation.

$x - 3 = 8$ *or* $x - 3 = -8$ — Rewrite as two equations.

$x = 11$ *or* $x = -5$ — Add 3 to each side.

▶ The solutions are 11 and −5. Check your solutions.

CHECK

$|x - 3| = 8$ — Write original inequality.

$|11 - 3| \stackrel{?}{=} 8$ — Substitute for x.

$|8| \stackrel{?}{=} 8$ — Subtract.

$8 = 8$ ✓ — Simplify. The solution checks.

$|x - 3| = 8$ — Write original inequality.

$|-5 - 3| \stackrel{?}{=} 8$ — Substitute for x.

$|-8| \stackrel{?}{=} 8$ — Subtract.

$8 = 8$ ✓ — Simplify. The solution checks.

REWRITING EQUATIONS To solve an absolute value equation, you may first need to rewrite the equation in the form $|ax + b| = c$.

EXAMPLE 3 Rewrite an absolute value equation

Solve $3|2x - 7| - 5 = 4$.

Solution

First, rewrite the equation in the form $|ax + b| = c$.

$3|2x - 7| - 5 = 4$ — Write original equation.

$3|2x - 7| = 9$ — Add 5 to each side.

$|2x - 7| = 3$ — Divide each side by 3.

Next, solve the absolute value equation.

$|2x - 7| = 3$ — Write absolute value equation.

$2x - 7 = 3$ *or* $2x - 7 = -3$ — Rewrite as two equations.

$2x = 10$ *or* $2x = 4$ — Add 7 to each side.

$x = 5$ *or* $x = 2$ — Divide each side by 2.

▶ The solutions are 5 and 2.

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✓ GUIDED PRACTICE for Examples 2 and 3

Solve the equation.

2. $|r - 7| = 9$ **3.** $2|s| + 4.1 = 18.9$ **4.** $4|t + 9| - 5 = 19$