Skill check:
Write the sentence as an inequality.
Graph the inequality

A number d is more than 0 and less than 10

Vocabulary:

Absolute Value Inequality:

is an inequality that contains an absolute value expression.

Absolute Deviation:

of a number x from a given value is the absolute value of the difference of x and the given value

$$\text{absolute deviation} = |x - \text{given value}|$$

EXAMPLE 1 Solving Absolute Value Inequalities

Solve each inequality. Graph each solution, if possible.

a. $|x + 7| \leq 2$

b. $|8x - 11| < 0$

SOLUTION

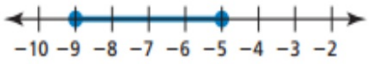
a. Use $|x + 7| \leq 2$ to write a compound inequality. Then solve.

$x + 7 \geq -2$ *and* $x + 7 \leq 2$ Write a compound inequality.

$-7 \quad -7 \qquad -7 \quad -7$ Subtract 7 from each side.

$x \geq -9$ *and* $x \leq -5$ Simplify.

▶ The solution is $-9 \leq x \leq -5$.



b. By definition, the absolute value of an expression must be greater than or equal to 0. The expression $|8x - 11|$ cannot be less than 0.

▶ So, the inequality has no solution.

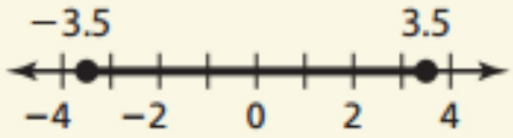
Solve the inequality. Graph the solution, if possible.

1. $|x| \leq 3.5$

2. $|k - 3| < -1$

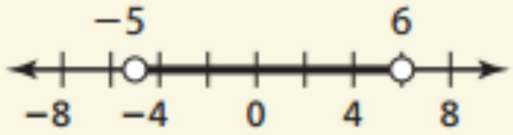
3. $|2w - 1| < 11$

1. $-3.5 \leq x \leq 3.5$



2. no solution

3. $-5 < w < 6$



EXAMPLE 2 Solving Absolute Value Inequalities

Solve each inequality. Graph each solution.

a. $|c - 1| \geq 5$ **b.** $|10 - m| \geq -2$ **c.** $4|2x - 5| + 1 > 21$

SOLUTION

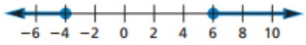
a. Use $|c - 1| \geq 5$ to write a compound inequality. Then solve.

$c - 1 \leq -5$ *or* $c - 1 \geq 5$ — Write a compound inequality.

$+1 \quad +1$ $\qquad$ $+1 \quad +1$ — Add 1 to each side.

$c \leq -4$ *or* $c \geq 6$ — Simplify.

▶ The solution is $c \leq -4$ *or* $c \geq 6$.



b. By definition, the absolute value of an expression must be greater than or equal to 0. The expression $|10 - m|$ will always be greater than -2.

▶ So, all real numbers are solutions.

c. First isolate the absolute value expression on one side of the inequality.

$4|2x - 5| + 1 > 21$ — Write the inequality.

$-1 \quad -1$ — Subtract 1 from each side.

$4|2x - 5| > 20$ — Simplify.

$\frac{4|2x - 5|}{4} > \frac{20}{4}$ — Divide each side by 4.

$|2x - 5| > 5$ — Simplify.

Then use $|2x - 5| > 5$ to write a compound inequality. Then solve.

$2x - 5 < -5$ *or* $2x - 5 > 5$ — Write a compound inequality.

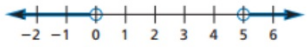
$+5 \quad +5$ $\qquad$ $+5 \quad +5$ — Add 5 to each side.

$2x < 0$ $\qquad$ $2x > 10$ — Simplify.

$\frac{2x}{2} < \frac{0}{2}$ $\qquad$ $\frac{2x}{2} > \frac{10}{2}$ — Divide each side by 2.

$x < 0$ *or* $x > 5$ — Simplify.

▶ The solution is $x < 0$ *or* $x > 5$.



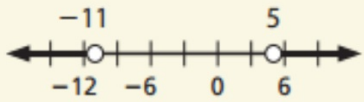
Solve the inequality. Graph the solution.

4. $|x + 3| > 8$

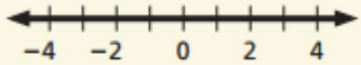
5. $|n + 2| - 3 \geq -6$

6. $3|d + 1| - 7 \geq -1$

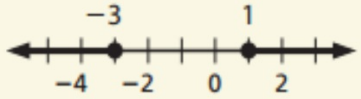
4. $x < -11$ *or* $x > 5$



5. all real numbers



6. $d \leq -3$ *or* $d \geq 1$



EXAMPLE 3 Modeling with Mathematics

You are buying a new computer. The table shows the prices of computers in a store advertisement. You are willing to pay the mean price with an absolute deviation of at most \$100. How many of the computer prices meet your condition?

Computer prices	
\$890	\$750
\$650	\$370
\$660	\$670
\$450	\$650
\$725	\$825