1.7 Solve Absolute Value Equations and Inequalities

TEKS a.1, a.2, a.5, 2A.2.A

Before You solved linear equations and inequalities.

Now You will solve absolute value equations and inequalities.

Why? So you can describe hearing ranges of animals, as in Ex. 81.

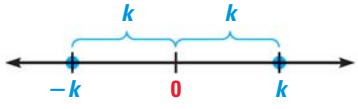
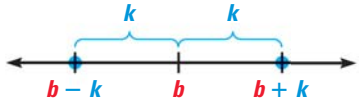
Key Vocabulary
- **absolute value**
- **extraneous solution**

Recall that the **absolute value** of a number x, written $|x|$, is the distance the number is from 0 on a number line. This understanding of absolute value can be extended to apply to simple absolute value equations.

$$|x| = \begin{cases} x, & \text{if } x \text{ is positive} \\ 0, & \text{if } x = 0 \\ -x, & \text{if } x \text{ is negative} \end{cases}$$

KEY CONCEPT *For Your Notebook*

Interpreting Absolute Value Equations

Equation	$\lvert x\rvert = \lvert x - 0\rvert = k$	$\lvert x - b\rvert = k$
Meaning	The distance between x and 0 is k.	The distance between x and b is k.
Graph		
Solutions	$x - 0 = -k$ or $x - 0 = k$ $x = -k$ or $x = k$	$x - b = -k$ or $x - b = k$ $x = b - k$ or $x = b + k$

EXAMPLE 1 Solve a simple absolute value equation

Solve $|x - 5| = 7$. Graph the solution.

Solution

$\lvert x - 5\rvert = 7$		Write original equation.
$x - 5 = -7$	or $x - 5 = 7$	Write equivalent equations.
$x = 5 - 7$	or $x = 5 + 7$	Solve for x.
$x = -2$	or $x = 12$	Simplify.

▶ The solutions are -2 and 12. These are the values of x that are 7 units away from 5 on a number line. The graph is shown below.