## KEY CONCEPT

## Solving an Absolute Value Equation

Use these steps to solve an absolute value equation $|a x+b|=c$ where $c>0$.
STEP 1 Write two equations: $a x+b=c$ or $a x+b=-c$.
STEP 2 Solve each equation.
STEP 3 Check each solution in the original absolute value equation.

## EXAMPLE 2 Solve an absolute value equation

Solve $|5 x-10|=45$.

$$
\left.\begin{array}{rlrll}
|5 x-10| & =45 & & & \text { Write original equation. } \\
5 x-10=45 & \text { or } & 5 x-10=-45 & & \text { Expression can equal } 45 \text { or }-45 . \\
5 x & =55 & \text { or } & 5 x & =-35
\end{array}\right) \text { Add } 10 \text { to each side. } .
$$

- The solutions are 11 and -7 . Check these in the original equation.

CHECK

$$
\begin{aligned}
|5 x-10| & =45 \\
|5(11)-10| & \stackrel{?}{=} 45 \\
|45| & \stackrel{?}{=} 45 \\
45 & =45
\end{aligned}
$$

$$
\begin{aligned}
|5 x-10| & =45 \\
|5(-7)-10| & \stackrel{?}{=} 45 \\
|-45| & \stackrel{?}{=} 45 \\
45 & =45
\end{aligned}
$$

## AVOID ERRORS

Always check your solutions in the original equation to make sure that they are not extraneous.

EXTRANEOUS SOLUTIONS When you solve an absolute value equation, it is possible for a solution to be extraneous. An extraneous solution is an apparent solution that must be rejected because it does not satisfy the original equation.

## EXAMPLE 3 Check for extraneous solutions

Solve $|2 x+12|=4 x$. Check for extraneous solutions.

$$
\begin{aligned}
|2 x+12| & =4 x & & & & \text { Write original equation. } \\
2 x+12 & =4 x & \text { or } & 2 x+12=-4 x & & \text { Expression can equal } 4 \boldsymbol{x} \text { or }-4 \boldsymbol{x} . \\
12 & =2 x & \text { or } & 12=-6 x & & \text { Subtract } 2 \boldsymbol{x} \text { from each side. } \\
6 & =x & \text { or } & -2=x & & \text { Solve for } \boldsymbol{x} .
\end{aligned}
$$

Check the apparent solutions to see if either is extraneous.
CHECK

$$
\begin{aligned}
|2 x+12| & =4 x & |2 x+12| & =4 x \\
\mid 2(6)+12 & \stackrel{?}{=} 4(6) & |2(-2)+12| & \stackrel{?}{=} 4(-2) \\
|24| & \stackrel{?}{=} 24 & |8| & \stackrel{?}{=}-8 \\
24 & =24 \checkmark & 8 & \neq-8
\end{aligned}
$$

The solution is 6 . Reject -2 because it is an extraneous solution.

