3.4 Solve Equations with Variables on Both Sides

TEKS A.4.A, A.4.B, A.7.B

Before You solved equations with variables on one side.

Now You will solve equations with variables on both sides.

Why? So you can find the cost of a gym membership, as in Ex. 52.

Key Vocabulary
- **identity**

Some equations have variables on both sides. To solve such equations, you can collect the variable terms on one side of the equation and the constant terms on the other side of the equation.

EXAMPLE 1 Solve an equation with variables on both sides

Solve $7 - 8x = 4x - 17$.

$7 - 8x = 4x - 17$	Write original equation.
$7 - 8x + 8x = 4x - 17 + 8x$	Add $8x$ to each side.
$7 = 12x - 17$	Simplify each side.
$24 = 12x$	Add 17 to each side.
$2 = x$	Divide each side by 12.

ANOTHER WAY
You could also begin solving the equation by subtracting $4x$ from each side to obtain $7 - 12x = -17$. When you solve this equation for x, you get the same solution, 2.

▶ The solution is 2. Check by substituting 2 for x in the original equation.

CHECK

$7 - 8x = 4x - 17$	Write original equation.
$7 - 8(2) \stackrel{?}{=} 4(2) - 17$	Substitute 2 for x.
$-9 \stackrel{?}{=} 4(2) - 17$	Simplify left side.
$-9 = -9$ ✓	Simplify right side. Solution checks.

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EXAMPLE 2 Solve an equation with grouping symbols

Solve $9x - 5 = \frac{1}{4}(16x + 60)$.

$9x - 5 = \frac{1}{4}(16x + 60)$	Write original equation.
$9x - 5 = 4x + 15$	Distributive property
$5x - 5 = 15$	Subtract $4x$ from each side.
$5x = 20$	Add 5 to each side.
$x = 4$	Divide each side by 5.