3.3 Solving Multi-Step Equations

Goals • Use two or more transformations to solve an equation.
• Use multi-step equations to solve real-life problems.

Example 1 *Solving a Linear Equation*

Solve $\frac{1}{2}x - 7 = -10$.

To isolate the variable, undo the _____ and then the

_____.

$$\frac{1}{2}x - 7 = -10$$ Write original equation.

$$\frac{1}{2}x - 7 + \underline{\ \ } = -10 + \underline{\ \ }$$ Add ___ to each side.

$$\frac{1}{2}x = \underline{\ \ \ }$$ Simplify.

$$\underline{\ \ }\left(\frac{1}{2}x\right) = \underline{\ \ }(\underline{\ \ \ })$$ Multiply each side by ___ .

$$x = \underline{\ \ \ }$$ Simplify.

Example 2 *Combining Like Terms First*

Solve $8x - 5x + 16 = -29$.

Solution

$$8x - 5x + 16 = -29$$ Write original equation.

$$\underline{\ \ \ } + 16 = -29$$ Combine like terms.

$$\underline{\ \ \ } + 16 - \underline{\ \ \ } = -29 - \underline{\ \ \ }$$ Subtract ____ from each side.

$$\underline{\ \ \ } = \underline{\ \ \ \ }$$ Simplify.

$$\frac{\underline{\ \ \ \ }}{\underline{\ \ \ \ }} = \frac{}{\underline{\ \ \ \ \ }}$$ Divide each side by ___ .

$$x = \underline{\ \ \ \ }$$ Simplify.

Example 3 — *Using the Distributive Property*

Solve $9x - 5(x + 6) = -10$.

Solution

Method 1
Show All Steps

$$9x - 5(x + 6) = -10$$

$$9x - \underline{\hspace{1.5cm}} = -10$$

$$\underline{\hspace{1.5cm}} = -10$$

$$\underline{\hspace{2cm}} = -10 \ \underline{\hspace{1cm}}$$

$$\frac{\underline{\hspace{0.8cm}}}{} = \frac{\underline{\hspace{0.8cm}}}{}$$

$$= $$

$$\frac{\underline{\hspace{1cm}}}{\underline{\hspace{1cm}}}$$

$$x = \underline{\hspace{0.8cm}}$$

Method 2
Do Some Steps Mentally

$$9x - 5(x + 6) = -10$$

$$9x - \underline{\hspace{1.5cm}} = -10$$

$$\underline{\hspace{1.5cm}} = -10$$

$$\underline{\hspace{0.8cm}} = \underline{\hspace{0.8cm}}$$

$$x = \underline{\hspace{0.6cm}}$$

Example 4 — *Multiplying by a Reciprocal First*

Solve $24 = \dfrac{3}{4}(x + 7)$.

Solution

It is easier to solve this equation if you don't distribute $\dfrac{3}{4}$.

$$24 = \frac{3}{4}(x + 7) \qquad \text{Write original equation.}$$

$$\underline{\hspace{1cm}} \cdot 24 = \underline{\hspace{1cm}} \left(\frac{3}{4}\right)(x + 7) \qquad \text{Multiply by reciprocal of } \underline{\hspace{1cm}}.$$

$$\underline{\hspace{0.8cm}} = \underline{\hspace{1.2cm}} \qquad \text{Simplify.}$$

$$\underline{\hspace{0.8cm}} = x \qquad \text{Subtract } \underline{\hspace{0.6cm}} \text{ from each side.}$$

✔ *Checkpoint* **Solve the equation.**

1. $3 - 4x = 19$	**2.** $40 = 29 + \dfrac{1}{3}x$	**3.** $7(x - 1) = 49$
4. $-2(3 - x) = 30$	**5.** $\dfrac{2}{5}(x + 23) = 8$	**6.** $16 = -\dfrac{4}{7}(x - 19)$
7. $\dfrac{3}{2}x + x = -15$	**8.** $\dfrac{5x}{2} + 10 = 15$	**9.** $-6 = 10 - \dfrac{x}{3}$