

2.4 Solving Multi-Step Equations

Undo the operations in reverse order...
in other words, work backwards.

- Combine like terms, if possible.
- Undo any grouping symbols.
- Undo addition/subtraction.
- Undo multiplication/division.

Solve.

$$\begin{array}{r}
 1. \quad \underline{3x} - 10 - \underline{8x} = 20 \\
 \underline{-5x} \quad \underline{-10} = 20 \\
 \quad \quad \quad +10 \quad +10 \\
 \hline
 \underline{-5x} \quad \quad = \underline{30} \\
 \underline{-5} \quad \quad \quad \underline{-5} \\
 \hline
 \boxed{x = -6}
 \end{array}$$

$$\begin{array}{r}
 2. \quad \underline{9x} + 37 + \underline{1x} = -13 \\
 \underline{10x} + \underline{37} = -13 \\
 \quad \quad \quad \underline{-37} \quad \underline{-37} \\
 \hline
 \underline{10x} \quad \quad = \underline{-50} \\
 \underline{10} \quad \quad \quad \underline{10} \\
 \hline
 \boxed{x = -5}
 \end{array}$$

Solve.

$$\begin{array}{r}
 3. \quad 7x + 2(x + 6) = 39 \\
 \underline{7x + 2x + 12 = 39} \\
 9x + 12 = 39 \\
 \quad \quad \quad \cancel{-12} \quad \quad \cancel{-12} \\
 \hline
 \frac{9x}{9} = \frac{27}{9} \\
 \boxed{x = 3}
 \end{array}$$

$$\begin{array}{r}
 4. \quad 4x - 7(x - 2) = 26 \\
 \underline{4x - 7x + 14 = 26} \\
 -3x + 14 = 26 \\
 \quad \quad \quad \cancel{-14} \quad \quad \cancel{-14} \\
 \hline
 \frac{-3x}{-3} = \frac{12}{-3} \\
 \boxed{x = -4}
 \end{array}$$

Solve.

$$\begin{array}{r}
 5. \quad 3(w + 4) + 2w = 27 \\
 \underline{3w + 12 + 2w = 27} \\
 5w + 12 = 27 \\
 \quad \quad \quad \cancel{-12} \quad \quad \cancel{-12} \\
 \hline
 \frac{5w}{5} = \frac{15}{5} \\
 \boxed{w = 3}
 \end{array}$$

$$\begin{array}{r}
 6. \quad 6g - 2(g + 5) = -34 \\
 \underline{6g - 2g - 10 = -34} \\
 4g - 10 = -34 \\
 \quad \quad \quad \cancel{+10} \quad \quad \cancel{+10} \\
 \hline
 \frac{4g}{4} = \frac{-24}{4} \\
 \boxed{g = -6}
 \end{array}$$

Solve.

$$\begin{array}{r}
 7. \quad \frac{3}{2}(3p + 5) = -24 \\
 \frac{3}{2} \cdot 3p + \frac{3}{2} \cdot 5 = -24 \\
 \frac{9}{2}p + \frac{15}{2} = -24 \\
 \phantom{\frac{9}{2}p} - \frac{15}{2} - \frac{15}{2} \\
 \hline
 \frac{9}{2}p = -\frac{63}{2} \\
 \frac{9}{2}p \phantom{-\frac{63}{2}} \frac{9}{2} \\
 \hline
 p = -7
 \end{array}$$

$$\begin{array}{r}
 8. \quad -\frac{4}{5}(6m - 1) = -34 \\
 -\frac{4}{5} \cdot 6m + \frac{4}{5} \cdot 1 = -34 \\
 -\frac{24}{5}m + \frac{4}{5} = -34 \\
 \phantom{-\frac{24}{5}m} - \frac{4}{5} - \frac{4}{5} \\
 \hline
 -\frac{24}{5}m = -\frac{174}{5} \\
 \frac{-24}{5}m \phantom{-\frac{174}{5}} \frac{-24}{5} \\
 \hline
 m = \frac{29}{4}
 \end{array}$$

Solve.

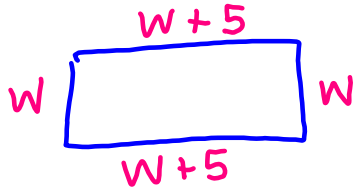
$$\begin{array}{r}
 9. \quad 8.9 + 1.2(3a - 1) = 14.9 \\
 8.9 + 3.6a - 1.2 = 14.9 \\
 + 7.7 + 3.6a = 14.9 \\
 - 7.7 - 7.7 \\
 \hline
 3.6a = 7.2 \\
 \frac{3.6a}{3.6} = \frac{7.2}{3.6} \\
 a = 2
 \end{array}$$

$$\begin{array}{r}
 10. \quad 4.1d - 2(1.3d - 4) = 0.5 \\
 4.1d - 2.6d + 8 = 0.5 \\
 1.5d + 8 = 0.5 \\
 - 8 - 8 \\
 \hline
 1.5d = -7.5 \\
 \frac{1.5d}{1.5} = \frac{-7.5}{1.5} \\
 d = -5
 \end{array}$$

11. Define a variable, write an equation, & solve.

Let $w = \text{width}$ $l = w + 5$

The length of a rectangle is 5 more add 5 to width than its width. The perimeter of the rectangle is 74 feet. Find the length and width of the rectangle.



width = 16 ft
length = $w + 5$
 = $16 + 5$
 = 21 ft

$$P = l + w + l + w$$

$$* P = 2l + 2w *$$

$$74 = 2(w + 5) + 2w$$

$$74 = 2w + 10 + 2w$$

$$74 = 4w + 10$$

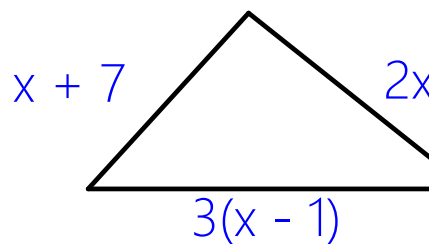
$$\begin{array}{r} 74 \\ -10 \\ \hline 64 \end{array} = \begin{array}{r} 4w \\ -10 \\ \hline 4w \end{array}$$

$$\frac{64}{4} = \frac{4w}{4}$$

$$16 = w$$

12. Write an equation & solve.

Find the value of x if the perimeter of the triangle below is 76 cm.



$$P = \text{side 1} + \text{side 2} + \text{side 3}$$

$$76 = (x + 7) + (2x) + 3(x - 1)$$

$$76 = x + 7 + 2x + 3(x - 1)$$

$$76 = \boxed{x + 7} + 2x + \boxed{3x - 3}$$

$$76 = 6x + 4$$

$$\begin{array}{r} 76 \\ -4 \\ \hline 72 \end{array} = \begin{array}{r} 6x \\ -4 \\ \hline 6x \end{array}$$

$$\frac{72}{6} = \frac{6x}{6}$$

$$\boxed{12} = x$$