

2.5 Solve Equations with Variables on Both Sides

COLLECT VARIABLES ON SAME SIDE!

1. $7 - 8x = 4x - 17$

$$\begin{array}{r}
 7 - 8x = 4x - 17 \\
 \hline
 \begin{array}{r}
 7 \\
 +17 \\
 \hline
 24 \\
 12
 \end{array}
 \quad = \quad
 \begin{array}{r}
 12x - 17 \\
 +17 \\
 \hline
 12x \\
 12
 \end{array}
 \end{array}$$

$2 = x$

2. $13 + 5g = 2g - 8$

$$\begin{array}{r}
 13 + 5g = 2g - 8 \\
 \hline
 \begin{array}{r}
 13 \\
 -13 \\
 \hline
 3g
 \end{array}
 \quad = \quad
 \begin{array}{r}
 -8 \\
 -13 \\
 \hline
 -21 \\
 3
 \end{array}
 \end{array}$$

$g = -7$

$$\begin{array}{r}
 3. \quad \frac{3}{5}x + 3 = \frac{1}{5}x - 7 \\
 \hline
 \begin{array}{r}
 -\frac{1}{5}x \\
 \hline
 \frac{2}{5}x + 3 = -7 \\
 \hline
 \frac{2}{5}x + 3 - 3 = -7 - 3 \\
 \frac{2}{5}x = -10 \\
 \frac{5}{2} \cdot \frac{2}{5}x = -10 \cdot \frac{5}{2} \\
 \hline
 x = -25
 \end{array}
 \end{array}$$

$$\begin{array}{l}
 5 \cdot \left(\frac{3}{5}x + 3 \right) = \left(\frac{1}{5}x - 7 \right) \cdot 5 \\
 3x + 15 = x - 35
 \end{array}$$

$$\begin{array}{r}
 4.5 \cdot \left(\frac{2}{5}n - 9 \right) = \left(7 - \frac{3}{5}n \right) \cdot 5 \\
 5 \cdot \frac{2}{5}n - 5 \cdot 9 = 5 \cdot 7 - 5 \cdot \frac{3}{5}n \\
 2n - 45 = 35 - 3n \\
 \hline
 -45 = 35 - 5n \\
 \hline
 -80 = -5n \\
 \hline
 16 = n
 \end{array}$$

$$\begin{array}{r}
 5. \quad 8 - \frac{1}{2}p = \frac{1}{4}p - 7 \\
 \quad \quad \quad + \frac{1}{2}p \quad \quad \quad + \frac{1}{2}p \\
 \hline
 \quad \quad \quad 8 = \frac{3}{4}p - 7 \\
 \quad \quad \quad +7 \quad \quad \quad +7 \\
 \hline
 \quad \quad \quad \frac{4}{3} \cdot 15 = \frac{3}{4}p \cdot \frac{4}{3} \\
 \quad \quad \quad \boxed{20 = p}
 \end{array}$$

$$\begin{array}{r}
 7. \quad 9p - 5 = \frac{1}{4}(16p + 60) \\
 \quad \quad \quad 9p - 5 = \frac{1}{4} \cdot 16p + \frac{1}{4} \cdot 60 \\
 \quad \quad \quad 9p - 5 = 4p + 15 \\
 \quad \quad \quad -4p \quad \quad \quad -4p \\
 \hline
 \quad \quad \quad 5p - 5 = 15 \\
 \quad \quad \quad +5 \quad \quad \quad +5 \\
 \hline
 \quad \quad \quad \frac{5p}{5} = \frac{20}{5} \\
 \quad \quad \quad \boxed{p=4}
 \end{array}$$

$$\begin{array}{l}
 6. \quad \frac{5}{6}x + 1 = \frac{1}{4} - \frac{1}{2}x \\
 \frac{3}{6} + \frac{1}{2}x \qquad \qquad \qquad \frac{1}{4} - \frac{1}{2}x \\
 \hline
 \frac{4}{3}x + 1 = \frac{1}{4} \\
 -1 \qquad \qquad \qquad -1 \quad \frac{4}{4} \\
 \hline
 \frac{3}{4} \cdot \frac{4}{3}x \qquad \qquad \qquad = -\frac{3}{4} \cdot \frac{3}{4} \\
 \boxed{x = -\frac{9}{16}}
 \end{array}$$

$$\begin{array}{l}
 8. \quad 8y - 6 = \frac{2}{3}(6y + 15) \\
 8y - 6 = \frac{2}{3} \cdot 6y + \frac{2}{3} \cdot 15 \\
 8y - 6 = 4y + 10 \\
 +6 \qquad \qquad \qquad +6 \\
 \hline
 8y \qquad \qquad \qquad = 4y + 16 \\
 -4y \qquad \qquad \qquad -4y \\
 \hline
 \frac{4y}{4} \qquad \qquad \qquad = \frac{16}{4} \\
 \boxed{y = 4}
 \end{array}$$

$$9. \quad 3x + 2 = \underline{x + 5} + \underline{2x}$$

$$\cancel{3x} + 2 = \cancel{3x} + 5$$

$$\hline$$

$$2 \neq 5$$

no solution

$$10. \quad 8 - 2(t + 1) = -3t + 1$$

$$\underline{8} - 2t + \underline{-2} = -3t + 1$$

$$6 - 2t = -3t + 1$$

$$\hline$$

$$6 = -t + 1$$

$$\hline$$

$$\underline{5} = \underline{-t}$$

$$\boxed{-5 = t}$$

$$\begin{array}{r}
 13. \quad 8x - 5(2 + x) = 2(x + 1) \\
 \underline{8x \quad -10 \quad -5x} \quad = \quad \underline{2x + 2} \\
 3x - 10 = 2x + 2 \\
 \underline{-2x \quad \quad \quad -2x} \\
 x - 10 = 2 \\
 \underline{\quad +10 \quad \quad +10} \\
 \boxed{x = 12}
 \end{array}$$

14. Let $x = \#$ of years
 A car dealership sold 78 new cars and 67 used cars this year. The number of new cars sold has been increasing by 6 cars each year. The number of used cars sold has been decreasing by 4 cars each year. If these trends continue, in how many years will the number of new cars sold is/ be twice the number of used cars sold?

$$\text{new cars} = 2 \cdot \text{old cars}$$

$$\begin{array}{r}
 78 + 6x = 2(67 - 4x) \\
 78 + 6x = 134 - 8x \\
 \underline{-6x \quad \quad \quad -6x} \\
 78 = 134 - 14x \\
 \underline{-134 \quad \quad \quad -134} \\
 -56 = -14x \\
 \underline{-14 \quad \quad \quad -14} \\
 4 = x
 \end{array}$$

4 years

15. Let $x = \#$ of days
 A music website sold 94 single songs and 67 albums today. The number of single downloads has been increasing by 22 each day. The number of album downloads has been decreasing by 5 each day. If these trends continue, in how many days will the number of single downloads ^{is} be ten times the number of album downloads?

$$\text{single downloads} = 10 \cdot \text{album downloads}$$

$$\begin{array}{r} 94 + 22x \\ 94 + 22x \\ - 22x \\ \hline 94 \\ - 670 \\ \hline -576 \\ - 72 \\ \hline \end{array} = \begin{array}{r} 10(67 - 5x) \\ = 670 - 50x \\ - 22x \\ \hline = 670 - 72x \\ - 670 \\ \hline = -72x \\ - 72 \\ \hline \end{array}$$

$$8 = x$$

8 days

16. $P = l + w + l + w$
 Find the perimeter of the square below.

$$P = 2l + 2w$$

$$P = 2(2x + 23) + 2(4x - 1)$$

$$P = 4x + 46 + 8x - 2$$

$$P = 12x + 44$$

