

2.5 Solve Equations with Variables on Both Sides

COLLECT VARIABLES ON SAME SIDE!

$$\begin{array}{r} \downarrow \\ 1. \quad 7 - 8x = 4x - 17 \\ \quad \quad \quad +8x \quad +8x \\ \hline \quad 7 \quad \quad = 12x - 17 \\ +17 \quad \quad \quad \quad +17 \\ \hline \quad \frac{24}{12} \quad \quad = \frac{12x}{12} \\ \hline \quad \boxed{2 = x} \end{array}$$

$$\begin{array}{r} 2. \quad 13 + 5g = +2g - 8 \\ \quad \quad \quad -2g \quad -2g \\ \hline +13 + 3g = \quad -8 \\ -13 \quad \quad \quad \quad -13 \\ \hline \quad \frac{3g}{3} = \quad \frac{-21}{3} \\ \hline \quad \boxed{g = -7} \end{array}$$

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

$$\begin{array}{r}
 4. \quad +\frac{2}{5}n - 9 = 7 - \frac{3}{5}n \\
 \underline{-\frac{2}{5}n} \qquad \qquad \qquad \underline{-\frac{2}{5}n} \\
 -9 = +7 - 1n \\
 \qquad \underline{-7} \qquad \qquad \underline{-7} \\
 -16 = -1n \\
 \underline{-1} \qquad \qquad \underline{-1} \\
 \boxed{16 = n}
 \end{array}$$

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

$$\begin{array}{r}
 6. \quad \frac{5}{6}x + 1 = \frac{1}{4} - \frac{1}{2}x \\
 \quad \quad \quad \underline{+\frac{1}{2}x} \quad \quad \quad \underline{+\frac{1}{2}x} \\
 \quad \quad \quad \frac{4}{3}x + 1 = \frac{1}{4} \\
 \quad \quad \quad \quad \quad \underline{-1} \quad \quad \quad \underline{-1} \\
 \quad \quad \quad \underline{\frac{4}{3}x} = \underline{-\frac{3}{4}} \\
 \quad \quad \quad \underline{\frac{4}{3}} \quad \quad \quad \underline{\frac{4}{3}} \\
 \quad \quad \quad \boxed{x = -\frac{9}{16}}
 \end{array}$$

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

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

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

$$\begin{array}{r} 3x + 2 = +3x + 5 \\ \underline{-3x \quad -3x} \\ 2 = 5 \end{array}$$

False

no solution

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

$$\begin{array}{r} \boxed{8} - 2t - 2 = -3t + 1 \\ 6 - 2t = -3t + 1 \\ \underline{\quad +3t \quad +3t} \\ +6 + 1t = 1 \\ \underline{-6 \quad -6} \\ t = -5 \end{array}$$

$t = -5$

$$\begin{array}{r}
11. \quad 5 + 2(k + 4) = 5(k - 3) + 10 \\
\hline
\underline{5} \quad + 2k \quad + 8 \quad = \quad \underline{5k} \quad - 15 \quad + 10 \\
\phantom{\underline{5}} \quad 13 + 2k \quad = \quad 5k - 5 \\
\phantom{\underline{5}} \quad \quad - 2k \quad \quad \quad \quad - 2k \\
\hline
13 \quad = 3k - 5 \\
+5 \quad + 5 \\
\hline
18 \quad = 3k \\
3 \quad 3 \\
\hline
\boxed{6 = k}
\end{array}$$

$$\begin{array}{r}
12. \quad 2(h + 6) - 8 = 2h + 4 \\
\hline
2h + 12 - 8 = 2h + 4 \\
+ 2h + 4 = +2h + 4 \\
- 2h \quad \quad - 2h \\
\hline
4 = 4 \quad \text{True} \\
\text{all real numbers} \leftarrow
\end{array}$$