

### 3-6-1 Variables on Both Sides of the Equation

$$\begin{array}{r} x - 8 = 12 \\ + 8 \quad + 8 \\ \hline x = 20 \end{array}$$

When a one step equation is solved, essentially the constants are sorted to one side of the equation and the variable to the other.  
Think of this as "moving" the constant 8 to the other side of the equation.

"Move" terms involving variables the same way.

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

Choose the term containing the variable with the smaller coefficient. This doesn't matter now, but will make things easier in other equations.

$$-8 = 2x + 2$$

Now there is only a two step equation to solve.

$$\begin{array}{r} -2 \quad -2 \\ \hline -10 = 2x \end{array}$$

$$-10 = 2x$$

$$\begin{array}{r} -10 \quad 2x \\ 2 \quad 2 \\ \hline -5 = x \end{array}$$

$$-5 = x$$

To solve equations with variables on both sides of the equal sign, first distribute.

$$2(3x - 8) - 5 + 7x = 8 - (2 - x) + 8x$$

Then combine like terms.

$$6x - 16 - 5 + 7x = 8 - 2 + x + 8x$$

Move all the variables to the same side.

$$13x - 21 = 9x + 6$$

Solve the two step equation.

$$\begin{array}{r} -9x \quad -9x \\ \hline 4x - 21 = 6 \end{array}$$

Subtract or add, and then divide.

$$4x - 21 = 6$$

$$\begin{array}{r} +21 \quad +21 \\ \hline 4x = 27 \end{array}$$

Every step isn't needed in every equation.

$$4x = 27$$

$$x = \frac{27}{4} = 6\frac{3}{4}$$

Practice:

a)  $5x - 8 = 7x + 3$

$2s - 8 = 3s + 9$

$50X - 80 = 70X + 30$

b)  $3d - 1 = 4d + 9$

$3s - 9 = 2s + 10$

$4L - 12 = 8 + 5L$

c)  $7x + 4 = 5x - 8$

$4s - 10 = s + 11$

$2K + 3 = 6K - 4$

d)  $6 - 5c = 2 + 9c$

$-11 + s = 4s + 12$

$4x - 10 = 10x + 4$

e)  $\frac{2x}{3} - \frac{7x}{4} - 8 = 2x - 7$

$-4\frac{2}{3} + x + 1\frac{7}{8} = 7x - 9$

$3\left(\frac{s}{5} - 12\right) + \frac{s}{4} = 15$

f)  $0.23x - 7x + 4 = 4x - 0.6 + 4x - 8$

$12x - (5 - 3x) = 7 - 9(2 - 3x)$

$\frac{3}{4}(8x - 16) + 7 = 3x - (2x - 4)$

g)  $4(2x - 8) = 3(2 - 3x)$

$3\frac{2}{3}x - 7 - 2\frac{5}{8}x = 3\frac{1}{2}\left(\frac{3}{4}x - 8\right)$

$3(2x - 8) + 4x = 5x - 8(2x - 1)$

h)  $5t - 3(2 - 7t) + 12 = 3t - (2 + t)$

$123 - 8(2x - 5) = 15(3x - 5) + 23$

$5(3x - 2) + 34x - 7 = 24x - 8$

$$\text{i) } 15 = -8 - 3x - (4x - 8(3 - x)) \quad 5x = 2 - (5 - x + 3(4 - x)) \quad 4 - 2x = 17x - 4(3x - 5)$$

$$\text{j) } 4(2x + 5) - 9x = -(4 - 12x) \quad 3\frac{1}{3} - \frac{7}{8} + 3x = 2x + \frac{7}{8} \quad 10x - 100 = 100x - 10$$

$$\text{k) } 3x - (2x + 7) = 4x + 2 \quad 8(5x - 2) = 5(2 - 3x)$$

$$\text{l) } 23x - (28x + 71) = 42x + 52 \quad 9x - 3x - 15 = 4x + 5(2x - 7)$$

$$\text{m) } 3x - (2x + 8) = 4(5x - 9) + 2 \quad 14x - 80 = 403x + 502$$

$$\text{n) } 3(2d - 7) - (8 - 8d) - 4d + 9 = 2 - (2 - 7d) - 4d \quad 5(2 - 7x) + 13x = 4x - 8 - (5x - 8)$$

$$\text{o) } 8t + 7(2t - 7) - 5t + 9 = 21 - (2t - 7) - 10t \quad 4(2z - 8) - (z - 9) = 8(8 - 7z)$$

$$\text{p) } 3 - 7[2 + 3(2x + 8)] = 7 - (3x - 9) \quad 5\{2 - [3b - 5(2b - 9)]\} = 3b - 10$$

$$\text{q) } 5 - (9 - 8x) - (3(2x - 5) - 2) = 7x - 5 \quad 8 - \{-[-(3x - 8)]\} = 2(4x - 5) - (2 - 3x)$$

$$\text{r) } 9 - \{5[3(2n - 8) - 4] + 5\} = 3n - 7(2n - 8) - (8 - n)$$

$$\text{s) } 2(3 - (4y + 8)) - (9 - 2(3y + 5)) = (2y - 8) - 8 - (5 - y) - 9y + 10$$

$$\text{t) } 7(8f - 5(2f - 8)) - (5 + 4(5f - 9)) + 5(f + 5) = 5(9f - (7 + 2(5f + 8)) + 12) + 15$$