

## Section 1 – 2: Solving Literal Equations

Many formulas in math, science and business have with several variables in the same formula. You may be required to solve the equation for any one of the variables.

$$C = \frac{5}{9}(F - 32) \quad \text{Solve for F}$$

$$A = \frac{h}{2}(B + m) \quad \text{solve for B}$$

This means you must **get that variable alone on one side of the equation**. This can be done by the correct order of addition, subtraction, multiplication and division as listed below.

### Solving Equations for a given Variable in a Formula

Step 1. If there are fractions in the equation, **multiply each term of the equation** by the Lowest Common Denominator (LCD). This will give you an equation without any fractions.

Step 2. Perform any distributive operations in the equation.

Step 3. Note the side of the equation with the variable you want to solve for. Eliminate all the others on that side by adding or subtracting each term without that variable from both sides of the equation to them from the variable side.

Step 4. Divide both sides of the equation by any factors with the variable.

Step 5. If there is a negative sign in the denominator of the answer multiply the numerator and denominator of the answer by  $-1$ .

#### Example 1

Solve for x

$$2x - 5y = -8y + 7$$

$$2x - 5y = -8y + 7 \quad \text{add } 5y \text{ to both sides}$$
$$+ 5y \quad + 5y$$

$$2x = 3y + 7$$

divide both sides by 2

$$\frac{2x}{2} = \frac{3y + 7}{2}$$

$$x = \frac{3y + 7}{2} \quad \text{or} \quad x = \frac{3y}{2} + \frac{7}{2}$$

#### Example 2

Solve for y

$$-2(x + 4y) = -(2y - 3) \quad \text{distribute}$$

$$-2x - 8y = -2y + 3$$

$$-2x - 8y = -2y + 3 \quad \text{add } 8y \text{ to both sides}$$
$$+ 8y \quad + 8y$$

$$-2x = 6y + 3$$

divide both sides by  $-2$

$$\frac{-2x}{-2} = \frac{6y + 3}{-2}$$

multiply top and bottom by  $-1$

$$x = \frac{-6y - 3}{2} \quad \text{or} \quad x = \frac{-3y}{2} + \frac{3}{2}$$

**Example 3**Solve for  $F$ 

$$C = \frac{5}{9}(F - 32)$$

$$(9)C = \frac{5}{9}(F - 32)(9) \text{ multiply both sides by 9}$$

$$9C = 5(F - 32)$$

$$9C = 5(F - 32) \text{ distribute the 5}$$

$$9C = 5F - 160$$

$$9C = 5F - 160 \text{ add 160 to both sides}$$

$$+160 \quad +160$$

$$9C + 160 = 5F$$

divide both sides by 5

$$\frac{9C + 160}{5} = \frac{5F}{5}$$

$$\frac{9C + 160}{5} = F$$

**Example 4**Solve for  $B$ 

$$A = \frac{h(B + b)}{2}$$

$$(2)A = \frac{h(B + b)}{2}(2) \text{ multiply both sides by 2}$$

$$2A = h(B + b)$$

$$2A = h(B + b) \text{ distribute the h}$$

$$2A = hB + hb$$

$$2A = hB + hb \text{ subtract } hb \text{ from both sides}$$

$$-hb \quad -hb$$

$$2A - hb = hB$$

divide both sides by h

$$\frac{2A - hb}{h} = \frac{hB}{h}$$

$$\frac{2A - hb}{h} = B$$

### Example 5

Solve for y

$$(y + 5) = \frac{-2}{3}(x + 6) \text{ multiply each side by 3}$$

$$3(y + 5) = -2(x + 6) \text{ distribute}$$

$$3y + 15 = -2x - 12$$

$$3y + 15 = -2x - 12 \text{ subtract 15 from both sides}$$
$$\begin{array}{r} -15 \\ -15 \end{array}$$

$$3y = -2x - 27$$

divide both sides by 3

$$\frac{3y}{3} = \frac{-2x}{3} - \frac{27}{3}$$

$$y = \frac{-2}{3}x - 9$$

### Example 6

Solve for x

$$\frac{4x}{3} + \frac{3y}{2} = \frac{y}{6} - \frac{2}{3} \text{ multiply by the LCD 6}$$

$$6^2 \cdot \frac{4x}{3^1} + 6^3 \cdot \frac{3y}{2^1} = 6^1 \cdot \frac{y}{6^1} - 6^2 \cdot \frac{2}{3^1}$$

$$8x + 9y = y - 4$$

$$-8x + 9y = y - 4 \text{ subtract 9y from both sides}$$
$$\begin{array}{r} -9y \\ -9y \end{array}$$

$$-8x = -7y - 4$$

divide both sides by -8

$$\frac{-8x}{-8} = \frac{-7y - 4}{-8}$$

multiply top and bottom by -1

$$x = \frac{7y + 4}{8} \text{ or } x = \frac{7y}{8} + \frac{1}{2}$$