

## Section 2 – 5: Solving For Variables In Formulas

There are many areas in math, science and business where you will work with an equation that contains several variables. These equations are called formulas. A formula is often stated as a single variable on the left of an equal sign the right side of the equation has several different variables that describe how the single variable on the left is related to the variables on the right side of the equation.

The area of  
a triangle

The annual interest paid  
on money in a bank account

The perimeter of  
a rectangle

$$A = \frac{1}{2}BH$$

$$I = PRT$$

$$P = 2L + 2W$$

You may be required to solve for one of the variables on the right to find a formula for a different variable. This means getting a selected variable on the right side of the equation alone with all the other parts being moved to the left side. 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

1. If there is a fraction in the equation, **Multiply each term of the equation by the Lowest Common Denominator (LCD)**. This will give you an equation without any fractions.
2. Distribute if there is a distribute operation in the equation.
3. Find the side of the equation with the variable you want to solve for. Add or subtract all the terms without that variable from both sides of the equation to eliminate them from the variable side.
4. Divide both sides of the equation by any factors with the variable.
5. If there is a negative sign in the denominator multiply the numerator and denominator by  $-1$ .

#### Example 1

Solve for  $D$

$$H = 3DM$$

$H = 3DM$  divide both sides by  $3M$

$$\frac{H}{3M} = \frac{3DM}{3M}$$

$$\frac{H}{3M} = \frac{3DM}{3M} \text{ cancel the 3 and the M}$$

$$\frac{H}{3M} = D$$

#### Example 2

Solve for  $A$

$$W = A - 2B + 4C$$

$$W = A - 2B + 4C \text{ add } 2B \text{ to both sides}$$

$$+2B \quad +2B$$

$$W + 2B = A + 4C \text{ subtract } 4C \text{ from both sides}$$

$$W + 2B = A + 4C$$

$$-4C \quad -4C$$

$$W + 2B - 4C = A$$

### Example 3

Solve for  $S$

$$A = 3B + 2S$$

$$\begin{array}{r} A = 3B + 2S \text{ subtract } 3B \text{ from both sides} \\ -3B \quad -3B \end{array}$$

$$A - 3B = 2S \text{ divide both sides by } 2$$

$$\frac{A - 3B}{2} = \frac{2S}{2}$$

$$\frac{A - 3B}{2} = S$$

### Example 5

Solve for  $x$

$$y = -5x + 7$$

$$\begin{array}{r} y = -5x + 7 \text{ subtract } 7 \text{ from both sides} \\ -7 \quad \quad -7 \end{array}$$

$$y - 7 = -5x \text{ divide both sides by } -5$$

$$\frac{y - 7}{-5} = \frac{-5x}{-5}$$

$$\frac{y - 7}{-5} = x \text{ multiply the answers numerator and denominator by } -1$$

$$\frac{(-1)(y - 7)}{(-1)(-5)} = x$$

$$\frac{-y + 7}{5} = x$$

### Example 4

Solve for  $M$

$$W = -7A + 3M$$

$$\begin{array}{r} W = -7A + 3M \text{ add } 7A \text{ to both sides} \\ 7A \quad 7A \end{array}$$

$$W + 7A = 3M \text{ divide both sides by } 3$$

$$\frac{W + 7A}{3} = \frac{3M}{3}$$

$$\frac{W + 7A}{3} = M$$

### Example 6

Solve for  $y$

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

$$\begin{array}{r} -8x - 4y = -9 \text{ add } 8x \text{ to both sides} \\ +8x \quad \quad +8x \end{array}$$

$$-4y = -8x - 9 \text{ divide both sides by } -4$$

$$\frac{-4y}{-4} = \frac{8x - 9}{-4}$$

$$y = \frac{8x - 9}{-4} \text{ multiply the answers numerator and denominator by } -1$$

$$y = \frac{(-1)(8x - 9)}{(-1)(-4)}$$

$$y = \frac{-8x + 9}{4}$$

**Example 7**

Solve for B

$$C = \frac{5}{3} AB$$

$$(3)C = (3)\frac{5}{3} AB \text{ multiply both sides by 3}$$

$$3C = AB$$

$$3C = AB \text{ divide both sides by } A$$

$$\frac{3C}{A} = \frac{AB}{A}$$

$$\frac{3C}{A} = B$$

**Example 8**

Solve for B

$$y = \frac{2B-3}{4}$$

$$(4)y = (4)\frac{2B-3}{4} \text{ multiply both sides by 4}$$

$$4y = 2B - 3 \text{ add 3 to both sides}$$

$$+3 \qquad +3$$

$$4y + 3 = 2B \text{ divide both sides by 2}$$

$$\frac{4y+3}{2} = \frac{2B}{2}$$

$$\frac{4y+3}{2} = B$$

**Example 9**Solve for  $B$ 

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

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

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

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

$$9C = 5F - 160$$

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

$$+160 \quad +160$$

$$9C + 160 = 5F \text{ divide both sides by 5}$$

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

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

**Example 10**Solve for  $B$ 

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

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

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

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

$$2A = hB + hb$$

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

$$-hb \quad -hb$$

$$2A - hb = hB \text{ divide both sides by h}$$

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

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