Solving Literal Equations

A **Literal Equation** is an equation containing more than one variable. We can solve a literal equation for any one variable in terms of the others. For example, if we wish to solve $x - y = b$ for x, we will need to add y to each side of the equation in order to isolate x:

$$x - y = b$$
$$x - y + y = b + y$$
$$x = b + y$$

Example: Solve $AC = V$ for A. Divide both sides of the equation by C in order to isolate A:

$\frac{AC}{C} = \frac{V}{C}$ Cancel the C's on the left side of the equal sign.

$$A = \frac{V}{C}$$

Example: Solve $2x + y = 5$ for y:

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

Example: Solve $2x + 3y = 6$ for y:

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

Note: This answer could also be written as

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

Example: Solve $4(2x - 3b) = 7x + 5b$ for x:

$$4(2x - 3b) = 7x + 5b$$
$$8x - 12b = 7x + 5b$$
$$8x - 7x - 12b = 7x - 7x + 5b$$
$$x - 12b = 5b$$
$$x - 12b + 12b = 5b + 12b$$
$$x = 17b$$

Example: Solve the following equation for y:

$$\frac{x}{5}+\frac{y}{3}=\frac{1}{5}$$ Multiply every term by the LCD, 15.

$$3x+5y=3$$
$$3x-3x+5y=3-3x$$
$$5y=3-3x$$
$$\frac{5y}{5}=\frac{3-3x}{5}$$
$$y=\frac{3-3x}{5}$$

Example: Solve the following equation for h:

$$V=\pi r^2 h$$
$$\frac{V}{\pi r^2}=\frac{\pi r^2 h}{\pi r^2}$$
$$\frac{V}{\pi r^2}=h$$

Exercises: Solve the following equations for the indicated variable.

1. $A=LW$ for L
2. $I=prt$ for r
3. $P=2L+2W$ for W
4. $x+y=5$ for x
5. $3x+y=7$ for y
6. $ax+by=c$ for y
7. $A=\frac{a+b}{2}$ for a
8. $A=\pi r^2$ for π
9. $V=\frac{1}{3}\pi r^2 h$ for h
10. $4x+3a=3x-2a$ for x
11. $3(x+2y)=4$ for x
12. $6(x+3y)=-5$ for y
13. $\frac{a}{3}+\frac{y}{3}=p$ for y
14. $\frac{1}{2}(p-q)=m$ for q
15. $\frac{3}{4}(2x+y)=\frac{1}{2}$ for y

Answers:

1. $L=\frac{A}{W}$
2. $r=\frac{I}{pt}$
3. $W=\frac{P-2L}{2}$
4. $x=5-y$
5. $y=7-3x$
6. $y=\frac{c-ax}{b}$
7. $a=2A-b$
8. $\pi=\frac{A}{r^2}$
9. $h=\frac{3V}{\pi r^2}$
10. $x=-5a$
11. $x=\frac{4-6y}{3}$
12. $y=\frac{-5-6x}{18}$
13. $y=3p-a$
14. $q=p-2m$
15. $y=\frac{2-6x}{3}$