Literal Equations

A **literal equation** is an equation with more than one variable. Often we will see these as formulae.

Examples:

F = ma (Physics, force = mass*acceleration)

P = 2l + 2w (perimeter of a rectangle, Perimeter = 2*length + 2*width)

$E = mc^2$ (Physics, energy = m*(speed of light squared))

$\frac{KE}{mole} = \frac{3}{2}RTn$ (Chemistry, Kinetic Energy per mole)

$h = v_{0y}t - \frac{1}{2}gt^2$ (Physics, basic motion equation, we will use this in later chapters!)

How to Solve Formulae, Literal Equations and other equations for a given variable:

1.) Is the variable in the denominator of a fraction
   a. Yes, multiply both sides of the equation by the LCD of the fractions containing the required variable – often the easiest method is to multiply the whole equation by the product of all denominators clearing ALL fractions.
   b. No or no fractions go to step 2.

2.) Move all the terms containing the given variable to one side of the equation and everything else to the other side.
   a. It may be necessary to use the distributive property to get the variable out of parenthesis.

3.) Simplify each side as much as possible.

4.) Is the given variable in more than one term that cannot be combined
   a. No, go to step 5.
   b. Yes, Factor the required variable out of every term possible.
      i. If you only have a product of factors left go to step 5
      ii. If you have additional terms you may need to double check your work or start again.

5.) Divide both sides of the equation by the "coefficient" of the given variable to get it by itself.

Examples:

Solve for t: A = P + Prt

A = P + Prt - P - P A – P = Prt	t is not in the denominator, so the next step is to get the t term by itself. Subtract P from both sides.
$\frac{A-P}{\Pr} = \frac{\Pr t}{\Pr}$	Now divide both sides by the coefficient of t, which is Pr.
$\frac{A-P}{\Pr} = t$	This the simple interest formula, plus the principle to

Solve for B, $T = \frac{2U}{B+E}$

$(B+E)T = (B+E)\frac{2U}{B+E}$	B is in the denominator, so multiply both sides of the equation by (B + E). Distribute the (B + E)
$BT + ET = 2U$	
$BT + ET - ET = 2U - ET$	Next, we subtract ET from both sides, so BT is by itself.
$\frac{BT}{T} = \frac{2U - ET}{T}$	Finally we divide both sides by T for the final answer.
$B = \frac{2U - ET}{T}$	

Solve for y, $x = \frac{y-5}{y+2}$	y is in the denominator so we need to multiply both sides of the equation by (y + 2).
$(y+2)x = \frac{y-5}{y+2}(y+2)$	Distribute on the left and cancel on the right.
xy + 2x = y – 5 - y – 2x - y – 2x xy – y = - 2x – 5	Next we want all y terms on the left & the other terms on the right.
(x – 1)y = -2x – 5	On the left, y is a common factor so we can factor it out (undo the distributive law).
$\frac{(x-1)y}{(x-1)} = \frac{2x-5}{(x-1)}$	Now the coefficient of y (x – 1) is easy to divide out. Remember the whole right side needs to be divided by it!
$y = \frac{2x-5}{(x-1)}$	

Solve for R_2, $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$, LCD $= RR_1R_2$

R_2 is in the denominator so we multiply by the LCD = $R_1R_2R_3$.

$$(RR_1R_2)\frac{1}{R} = (RR_1R_2)\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$$

Next, we distribute and simplify.

$$R_1R_2 = (RR_1R_2)\frac{1}{R_1} + (RR_1R_2)\frac{1}{R_2}$$

$$R_1R_2 = RR_2 + RR_1$$

We want all the terms with R_2 on one side of the equation, so we subtract RR_2 from both sides.

$$R_1R_2 - RR_2 = RR_2 - RR_2 + RR_1$$

$$(R_1 - R)R_2 = RR_1$$

Next we factor out the R_2.

$$\frac{(R_1 - R)R_2}{(R_1 - R)} = \frac{RR_1}{(R_1 - R)}$$

Divide by the coefficient of R_2, which in this case is $(R_1 - R)$.

$$R_2 = \frac{RR_1}{(R_1 - R)}$$