Algebraic Manipulation of Variables

In Physics, calculations are often done in variable form without numbers. The algebraic manipulation is exactly the same as you have done hundreds (if not thousands) of times. It looks more challenging as there are more letters than you typically deal with in math classes. This may take some getting used to, but it is more of a practice issue rather than a knowledge issue. The reason it is done this way is that the letters take less time to write than the numbers. And, since many things cancel out, it is easier to work quickly in letters to find the simplified equation that will solve for the desired variable. Then as a final step, numbers are inserted and the answer is calculated. The problems on the next page do not ask for this final step. It is the easy part. When the numbers are inserted it will look just like problem number 1 above. You have already practiced this.

Problem Set: Manipulate the equations so that they solve for the variable indicated in the right hand column.

Example: $Tp = 2\pi\sqrt{\frac{\ell}{g}} \rightarrow T_p^2 = 2^2\pi^2\left(\sqrt{\frac{\ell}{g}}\right)^2 \rightarrow T_p^2 = 4\pi^2\frac{\ell}{g} \rightarrow \frac{gT_p^2}{T_p^2} = 4\pi^2\frac{\ell g}{gT_p^2}$	$g = \frac{4\pi^2\ell}{T_p^2}$
a. $\sin\theta_C = \frac{n_2}{n_1}$	$\theta =$
b. $U_S = \frac{1}{2}kx^2$	$x =$
c. $F_g = G\frac{m_1m_2}{r^2}$	$r =$
d. $mgh = \frac{1}{2}mv^2$	$v =$
e. $B = \frac{\mu_0 I}{2\pi r}$	$r =$
f. $x_m = \frac{m\lambda L}{d}$	$d =$
g. $v^2 = v_0^2 + 2a(x - x_0)$	$a =$
h. $pV = nRT$	$T =$
i. $qv = \frac{1}{2}mv^2$	$v =$
j. $ma = \frac{mv^2}{r}$	$v =$
k. $y_m = \frac{mL\lambda}{w}$	$\lambda =$
l. $f = \frac{1}{2L}\sqrt{\frac{F_T}{\mu}}$	$\mu =$