Complicated Equations and Your Graphing Calculator

One of the benefits of using a TI-83 or similar graphing calculator is the ability to enter an entire equation at once and get the answer in one step. But before you type the equation as it appears in your book or homework, it's important to understand how your calculator processes information.

As it should, your calculator utilizes the order of operations. Remember "Please excuse my dear Aunt Sally"? If not, you may want to Google "order of operations." According to mathematical conventions, we evaluate expressions in parenthesis first, then exponents, then multiplication and division, then addition and subtraction.

That's why entering an equation without giving thought to the order of operations will often give you the wrong answer. You have not properly communicated to your calculator what you want it to do. When you type 4+5/9, your calculator sees

$$4+\frac{5}{9}$$

and when you type 6.7x10^4/1.4x10^3, your calculator sees

$$\frac{6.7\text{x}10^4\text{x}10^3}{1.4}$$

The good news is most of these misunderstandings between you and your calculator can be fixed simply by adding parentheses. If you want your calculator to see

$$\frac{4+5}{9}$$

then type (4+5)/9. And if you want your calculator to see

$$\frac{6.7\text{x}10^4}{1.4\ \text{x}10^3}$$

then type 6.7x10^4/(1.4x10^3).

As the above examples indicate, you should insert parentheses around numerators that involve addition or subtraction, and around denominators that involve addition, subtraction, multiplication, or division. Also add parentheses around negative exponents – 10^(-6) – and around an expression raised to an exponent – (300000+6.674x10^6)^2. It's fine to have parentheses inside of parentheses – (0.003+4.6x10^(-4))^3 – just keep track of each set. **When in doubt, add parentheses!**

You may find the following practice problems helpful:

1. $F=\frac{Gm_1m_2}{r^2}$ where $m_1=M_E$, $m_2=115$kg, and $r = 2.00\text{x}10^4\text{m}+R_E$

2. $P=\frac{mgh}{t}$ where m=4.0kg, $h=1.4\text{x}10^3$m, and $t=5.7\text{x}10^{-4}$s

3. $\Sigma p= (m_1+m_2)v_f$ where $m_1=75$g, $m_2=2.3$kg, and $v_f=4.0$km/s

1. 1120N, to 3 significant figures, using values of G, M_E, and R_E from chapter 4 lecture notes
2. $9.8\text{x}10^6$W; This is the equation for the power outputted by scaling a vertical wall. Notice from your book that $W=kg*m^2/s^3$.
3. 9500kg*m/s; Be sure to convert g to kg and km/s to m/s! This is the equation for an inelastic collision of two objects of masses m_1 and m_2, where p is momentum. Notice there is no derived SI unit for momentum.