Math 111 Calculation Errors

In helping students with the chapter 2 homework, I have noticed a few recurring calculation mistakes. The vast majority of the students in the class are correctly calculating, but there is a significant number (probably about 30-40%) of the class that is making one or more type of significant calculation error somewhere in their homework. My goal is to address some of these issues here:

Comment 1: Negatives, squaring and notation:
The biggest recurring mistakes I have seen have to do with squaring negatives. Here is a quick example of everything you need to know:

$$5^2 = 25 \quad \text{and} \quad (-5)^2 = 25 \quad \text{and} \quad -5^2 = -25.$$

In other words, if a negative number is being square (for example if you plug a negative into a function that has squaring), then the negative is squared. However, if the negative is on the outside, then you do NOT square the negative (You are just subtracting a value that happens to be squared).
Let's consider the two related mistakes I have seen in the homework:

- Assume you are solving $2x^2 - 8x + 5 = 0$. So you will have $a = 2$, $b = -8$, and $c = 5$ in the QUADRATIC FORMULA. The quadratic formula looks like $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$.
  My question for you is: If $b = -8$ and you are going to compute b^2 in the quadratic formula, will you get a negative or positive?
  Here you are "plugging in" the value -8 for b and you are then squaring.
  So you will get $b^2 = (-8)^2 = 64$. It will be positive!!. Here is what it all will look like (I won't finish the calculation, I just wanted to talk about the square): $x = \frac{-(-8) \pm \sqrt{(-8)^2-4(2)(5)}}{2(2)} = \frac{8 \pm \sqrt{64-40}}{4}$.
- Assume you are given that $P(x) = -x^2 + 1632x - 51000$ and you find the vertex occurs at $x = 816$ and you need to find the value of the function at this value of x (this is straight from the homework and a commonly asked question in office hours this last week). Okay, let's plug in $x = 816$ and we get $P(816) = -(816)^2 + 1632(816) - 51000$.
  My question to you is: Will $-(816)^2$ be negative or positive?
  Note that the negative is on the OUTSIDE, it is NOT being squared. So you will still have a negative!! You will get $-(816)^2 + 1632(816) - 51000 = -665856 + 1331712 - 51000 = 614856$.

Comment 2: Unless otherwise specified, **keep ALL your digits until the very end of the problem**.
Here is a big example to explain this:
Assume you are trying to evaluate the function $y = 60x - 4x^2$ at the value $x = \frac{7}{3} = 2.33333\ldots$.
And assume the problem says give a final answer correct to two digits after the decimal.
Here is my question for you: Should you start by rounding to 2.33 or should you wait to round?
You have to keep ALL your digits until the end. Just for comparison see that:

$$\text{INCORRECT WORK: } 60(2.33) - 4(2.33)^2 = 118.0844$$

$$\text{CORRECT WORK: } 60(2.333333\cdots) - 4(2.33333\cdots)^2 = 118.222\cdots$$

The correct final answer rounds to 118.22, if you had rounded at the beginning of the problem you would have gotten 118.08 which is quite a bit off (if this final answer was in hundreds of Items, then that would mean you were off by 14 items, I call that quite significant). Get in the habit of keeping all your units unless otherwise specified! This will be even more important in the last two weeks of the course (if you round too early in those problems, you can get answers that are off by thousands of dollars).

Comment 3: **Remember parentheses when you plug into your calculator!**. Here are two examples of things I have seen typed into calculators this week:

$$6 \div 2 \times 3 = 9 \qquad \text{and} \qquad 6 \div (2 \times 3) = 1.$$

Assume you know that $a = 3$ and $b = -6$ and you are to compute $x = -\frac{b}{2a} = -\frac{(-6)}{2(3)}$. Something like this you should do in your head and you should know the answer is 1. But if you did type it into your calculator, then you MUST put parentheses around the denominator!! You would type it in like the SECOND example above. Let me show you the two main examples that have been coming up in your homework:

- Vertex Formula: $x = -\frac{b}{2a}$ should be typed into your calculator as follows $-b \div (2 \times a)$. (Notice the parentheses).

- Quadratic Formula: $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ should be typed into your calculator as follows:
  $(-b + \sqrt{(b^2 - 4 \times a \times c)}) \div (2 \times a)$ and $(-b - \sqrt{(b^2 - 4 \times a \times c)}) \div (2 \times a)$.
  For the quadratic formula, I showed in class and in review sheets that it is best to NOT plug this all into your calculator at once. Instead it is a good idea to do your work in steps (See my 2.1 review for several fully worked examples of this method):
  Step 1: Compute $b^2 - 4ac$, then take the square root and write this number on a piece of paper.
  Step 2: Compute $2a$, then write this down on a piece of paper.
  Step 3: Now compute $\frac{(-b+\sqrt{b^2-4ac})}{(2a)}$ and $\frac{(-b-\sqrt{b^2-4ac})}{(2a)}$.

Comment 4: **ALWAYS check your final answers!!!** You should know your answer is correct before you type it into webassign. And if you do this, then you will know if you made any one of the silly mistakes mentioned in this review sheet. There are two situations where we have been solving (and in both situations we can easily check our work). Here are those two situations:

- If you are solving $60x - 3x^2 = 5x + 100$, then subtract appropriately to get one side zero. Then use the quadratic formula. When you are all done you will get two values of x.
  Then CHECK YOUR WORK. Take each value of x and plug it back in to the original equation you were trying to solve. You see that $60x - 3x^2$ and $5x + 100$ give the same values. If they do, then you KNOW you are correct. And if they don't, then you KNOW you are incorrect and you can go find your error. Always check in this way!

- If you are trying to solve for q and p in a system like (1) $p^2 + 8q = 1600$ and (2) $600 - p^2 + 10q = 0$. As we have discussed, solve for one variable in one of the equation (for example you could get $8q = 1600 - p^2$, then write $q = 200 - \frac{1}{8}p^2$). Then substitute this into the second equation. After a bit more work, when you are all done, you will have found a value of q and a value of p.
  Then CHECK YOUR WORK. Go back to the original equations. Plug in p and q to $p^2 + 8q = 1600$ (if you don't get 1600 then you know you are wrong). You also need to check $600 - p^2 + 10q = 0$ (if you don't get zero, then you know you are wrong). If both check out then you KNOW with certainty you are right!