Homework Due Monday September 11

1. In mathematics the word ***proportional*** means "is a constant multiple of". That is $f(x)$ and $g(x)$ are proportional iff there is a constant C so that $f(x) = Cg(x)$. The constant C is called the ***constant of proportionality***. For example the area of a circle is proportional to the square of its radius and the constant of proportionality is π. That is if A is the area and r is the radius, so that the square of the radius is r^2, then $A = \pi r^2$. Likewise the area A of a triangle is proportional to the product of its base b height h. That is $A = Cbh$. And we know from high school geometry that the constant of proportionality is $C = \frac{1}{2}$. As practice in using this language answer the following:

   (a) The cost C of a box of chocolates is directly propositional to its weight W. Write a formula relating C and W. (Note that in this problem you should call the constant of proportionality something other than C.)
   Answer: _____

   (b) The energy E of a bullet is proportional to product of its mass m the square of its speed v.
   Answer: _____

   (c) The rate of change T' of the temperature T is proportional to the difference of T with the temperature of the air which is measured to be 70°F.
   Answer: _____

2. This is an exercise on using zooming in on a graph to solve equations. To do this you will need to use Maple or a graphing calculator. I will list the commands that are needed to this using Maple. (But everything you need to do this is on the worksheet `day1.ms`)
   Problem: Find the solution to $x^5 + 3x^2 - 3 = 0$ to two decimal places.
   We do this in several steps (but you only have to write down the last step).

   (a) First to save typing we give the function $x^5 + 3x^2 - 3$ the name f. To do this in Maple the command is $f := x^5 + 3 * x^2 - 3$; Then to solve the equation $f = 0$ we want to see where this function crosses the x-axis. So plot the function on some "large" interval to get a first idea of what it looks like. Let's start with the interval $[-2, 2]$. The Maple command to plot f on this interval is plot(f , $x = -2 \,..\, 2$);

   (b) Now that you have an idea of what the function looks like change the interval form $[-2, 2]$ to a smaller interval near where the function crosses the x-axis. This will give you a better idea where the solution to $f = 0$ is. Now make the interval smaller yet to get an even better idea of where the solution is. Keep doing this until you have the answer correct to two decimal places.

   (c) Now write your answer. As I said in class I want all (or at least most) answers in the form of a sentence. In this problem if you just give the answer without putting in a sentence you will get no credit. Here is what the answer should read like: *I graphed the function* $f = x^5 + 3x^2 - 3$ *on the interval* $x =$ ____

to $x =$ ____ *and from this graph I saw that it crossed the* x*-axis at* $x =$ ____ *accurate to two decimal places.* **Do not** just fill in the blanks in the above. Write out the entire thing yourself on a new piece of paper.

3. Using the method of the last problem solve the equation $t = \cos(t)$ for the root in the interval $[0, 2]$ accurate to two decimal places. Again your answer should be in the form of a sentence. **Remark:** If you do this on a graphing calculator be sure that it is in *radian* mode and not *degree* mode.

4. Also due are the problems assigned in class. That is problems 15, 16, 17, and 20ab on pages 19–21 of the text.