Project 1 : Taylor Polynomials and Mathematica

1. Find a computer with *Mathematica* 7 installed, or install it on your own computer from Colby's license server. You can find instructions here:
http://www.colby.edu/administration_cs/its/support/keyserver_access.cfm

2. Wolfram's website has many online *Mathematica* tutorials:
http://www.wolfram.com/broadcast/#Tutorials-GS
Go there and
a) watch "Hands-On Start to *Mathematica* -- Part I". You should have *Mathematica* open and running while you watch and you should follow the instructions in the video guide.
b) watch "Hands-On Start to *Mathematica* -- Part II" from minute 7 to minute 15:45 (or the whole thing if you wish.)
(You do not need to turn anything in for these first two questions.)

- **Do the following in *Mathematica* and turn in a printout with your inputs and outputs. You may turn in a cleaned up version -- you don't need to show mistakes or false starts. You will probably want to make good use of the "Classroom Assistant".**

3. Plot the graph of the function ln(1 + x) for x ∈ (-1,1.5). (Note: *Mathematica* uses "Log" instead of "ln".)
4. Adjust your plot so that the graph is a thick red line. Resize the plot so that it takes up most of the horizontal width of the page.
5. Define a function f(x) = x - $\frac{x^2}{2}$
6. Calculate f(.98). You should do this by using the function definition from part 5.
7. Calculate the difference between ln(1.98) and f(.98). What is the significance of this number?
8. Plot both ln(1 + x) and f(x) on the same set of axes. Make both lines thick and of very different colors. Make the graph as large as is reasonable.
9. Define the following function and (in *Mathematica*) write a sentence describing what the function is:

$g[n\_,x\_] := \sum_{i=1}^{n} \frac{(-1)^{i-1}}{i} x^i$

10. Write and evaluate:

```
g[2,x]
```

Explain what this is.
11. Write and evaluate:

```
g[3,0.5]
```

Explain what this is.
12. We will now make a list of these functions as follows. Enter, evaluate, and explain the expression:

```
p = Table[g[n,x],{n,1,5}]
```

13. Our goal is to plot the functions in the list *p* on the same plot as the function ln(1+x). To do this, it is convenient to add ln(1 + x) to the list *p* as follows. Enter and evaluate this expression:

```
p = Append[p,Log[1+x]]
```

14. Plot all the functions in the list *p* for x ∈ (-1,1.5). Use Tooltip so that if the mouse is scrolled over a graph, the name of the function being graphed is displayed.
15. Write a sentence or two explaining the mathematical significance of the graph from 14.
16. Plot the functions Log[1 + x] - g[n,x] for *n* from 1 to 5 and x between -1 and 1.5. Be sure the plots are are all on the same graph. Does this confirm your explanation in 15?