PHYC 2050 - Assignment #1

Due: Wednesday, 20 January 2010, at the beginning of class

Your assignment should be printed out using the printer in Dunn 208 (or any other printer at your disposal). Show and fully explain all of your work. Note that all plots are expected to have labels.

Hint: The questions below will require you to read some of the python, numpy, and matplotlib/pylab documentation. See the class Web site for links to pages of interest.

1) Python has a complex number type.

a) Show how to write the complex number *3+4i* in python.

b) Explain the result obtained when you apply the built-in function *abs()* to the complex number *3+4i*.

c) Euler's formula is

$$e^{ix} = \cos(x) + i\sin(x)$$

Verify that this formula is satisfied using the appropriate functions in numpy.

2) Use numpy to calculate the natural, base-2 and base-10 logarithms of the range of integers from 1 to 10.

3) An important function in physics and mathematics is the factorial function. The factorial function is defined as

$$n! = 1 \times 2 \times 3 \times \ldots \times n$$

For large n the Stirling approximation (http://en.wikipedia.org/wiki/Stirling%27s_approximation) is often used:

$$\ln(n!) \approx n \ln n - n + \frac{1}{2}\ln(2\pi n) + \frac{1}{12n}$$

a) Write a function that returns the factorial calculated using the standard definition. This can be done using functions from numpy (no for loops, etc, please). The function should work for both integer values and arrays of integer values. Test your

function out on the numbers from 0 to 10. Confirm with a calculator that your function produces the correct results.

b) Write a function that returns the *n!* using Stirling's approximation.

c) Calculate the relative error in Stirling's approximation for the integers 0 through 100. Plot your results on a graph using a logarithmic y-axis.