PHY 250L – Spring 2018
Python tutorial 3

Welcome back to the PHY 250L Python programming tutorial!

Things you should understand after week 3:

- numerical integration
- how to choose an appropriate integration step size
- the basics of VPython

Problems for 3.8.2018 The following problems should be completed and uploaded to Sakai by 09:45 on 3.8.2018. Each problem should correspond to its own python program (*i.e.*, each problem will correspond to a single file). The preferred names for the files are indicated in each problem.

1. `integ1.py`, 30 points
   Write a program that approximates the following three integrals using an integration resolution of $dx = 0.001$

   (a) $\int_0^4 (x^2-1)(x+1)(x+0.5)(3x-1)dx$

   (b) $\int_0^{10} \left(e^{0.1x}\sin(x)+1\right) dx$

   (c) $\int_0^{2\pi} \sinh(x)\tanh(x)\cosh(x)\,\mathrm{sech}(x)dx$

   Your program should print the integral values to screen.

2. `integ2.py`, 20 points
   For the function
   $$f(x) = \sinh(x)\tanh(x)\cosh(x)\,\mathrm{sech}(x) \tag{1}$$
   plot the function with its numerical integral (as was done in the python tutorial this week) for values of $x \in [0, 2\pi]$, using $dx = 0.001$.

3. `integ3.py`, 20 points
   For the function
   $$f(x) = \sinh(x)\tanh(x)\cosh(x)\,\mathrm{sech}(x) \tag{2}$$
   plot the value of the integral approximation on the domain $x \in [0, 2\pi]$ versus dx for the following dx values:
   $$dx = \frac{\pi}{2^n}, \text{ for } n = 1,\ 2, ...,\ 15 \tag{3}$$