Physics 4350 Computational Physics
Problem Set #2

1. Write a program that uses the Euler method to calculate the terminal velocity of a bicycle rider with air resistance, given that the rider produces power at a rate of 400 Watts, has a cross sectional area of 0.4 m^2, a mass of 65 kg. Assume that the air density is 1.3 kg/m^3, and that the constant C=1/2. The core of the program is the velocity increment:

$$v_{i+1} = v_i + \frac{P}{m v_i}\Delta t - \frac{C \rho A v_i^2}{2m}\Delta t$$

Give the rider an initial velocity of 1 m/s, and use a time step of 0.1 s. When the rider's speed changes by less than 0.0001 m/s, consider this the terminal velocity. Plot the rider's speed along with the speed the rider would attain if there were no air resistance. What is the terminal velocity in m/s? Do not guess from the graph. Give the result up to two decimal places.

2. **Error of numerical derivatives.** Garcia chapter 2. Problem 2.
3. **Range interpolation for *balle* program.** Garcia chapter 2. Problem 3.
4. **Galileo's experiment.** Garcia chapter 2. Problem 6. How far apart are the balls (*units of meters please)* when the larger one strikes the ground?