Write the following text on the front cover of your homework assignment and sign it. If the text is missing, 20 points will be subtracted from your homework grade.

Honor Pledge for Graded Assignments

"I affirm that I have not given or received any unauthorized help on this assignment, and that this work is my own."

_____

_____

_____

Signature _____

Consider the simulation of projectile motion, demonstrated in lecture 2. The script of this simulation, Phy235-ProjectileMotion, can be found in the following glowscript folder:

https://www.glowscript.org/#/user/wolfs/folder/Public/

Use this script as your starting point to complete the following tasks:

a. First consider pure projectile motion in vacuum (turn the dragg force off and set the angle to 60°). Compare the difference between the analytical solution and the numerical solution as function of stepsize dt. Make a plot of this difference as function of dt. Based on this plot, determine an optimum value of dt to run the simulation. Note: you need to make sure you pick the proper range of dt values.

b. Repeat the study carried out in part a) for two different launch angles (45° and 30°) and determine if your optimum choice of dt is angle dependent.

c. Now turn on the drag force ($k = 0.005$) and set the launch angle to 60°. When we include the drag force, we can no longer compare obtain an analytical solution and we have to determine the optimum dt in a different way. One possible approach is to look at the point of impact and determine how the point of impact depends on dt. Make a graph of the impact point as function of dt. Based on this plot, determine an optimum value of dt to run the simulation. Note: you need to make sure you pick the proper range of dt values.

d. Repeat the study carried out in part c) for two different values of the drag constant ($k = 0.01$ and $k = 0.05$) and determine if your optimum choice of dt is different for different drag constants.

e. Set the drag constant to $k = 0.005$ and set the launch angle to 60°. Add a constant thrust force F to the projectile, directed in the direction of motion and acting between time $t = 0$ and time $t = T$, to the counter the effect of the drag force. What combination(s) of thrust force F and thrust time T brings the projectile to the impact point it would reach when the only force acting on it would be gravitational force?

Submit the URL of your programs for parts a), b), c), d), and e) via email to Professor Wolfs (wolfs@pas.rochester.edu). Make sure that your programs are in a public folder. In addition, submit a pdf file with your observations, addressing the questions raised in the problem. The name of the pdf file should be should be ExtraHW01Phy235XXYYYYYYYY.pdf where XX is your last name and YYYYYYYY is your student id number and the subject of your email should start with ExtraHW01Phy235XXYYYYYYYY where XX is your last name and YYYYYYYY is your student id number.