Physics 235, Extra Credit Homework Set 01

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."

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Signature ____

Consider the simulation of projectile motion, demonstrated in lecture 2. The script of this simulation can be found at the following URL:

https://www.glowscript.org/#/user/wolfs/folder/Public/program/ProjectileMotionChapter2

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 actual program used in part e) or a glowscript link, the graphs, and your conclusions for each part via email to Professor Wolfs (wolfs@pas.rochester.edu). The name of the file with the program should be should be ExtraHW01Phy235XXYYYYYYYYY.py where XX is your last name and YYYYYYYY is your student id number and the subject of your email should start with ExtraHW01Phy235XXYYYYYYYYY where XX is your last name and YYYYYYYY is your student id number.