

## PHYSICS 486 Homework Project #2

due date: Friday, April 25

Problem statement: Consider two identical objects that start at the same height above the floor. One object is dropped, but the other is launched horizontally. Including air resistance, which object hits the ground first?

Quantify how the time difference between the two objects hitting the ground depends on launch speed, initial height, and the object mass. Use a speed-independent drag coefficient,  $C=0.5$ . Explore at least three orders of magnitude in each relevant dimension. An example you could start with would be a 100 kg sphere with a cross-sectional area of  $A = 0.1 \text{ m}^2$  launched from a height of 10,000 m with  $v_x=10 \text{ m/s}$ . Density of air is  $\rho=1.225 \text{ kg/m}^3$ .

Write-up: Your write-up for this problem should be a 3-4 page PDF document with no more than 4 figures. Check your numerical solutions by reducing the drag coefficient to zero. Also, provide a conceptual reasoning about the dependence of time difference on the various parameters.

Submission: Please submit your code and the pdf write-up in Canvas by 5pm on the due date.