

### ASE 211 Homework 13

Due: Friday, Dec. 8 at 12:00 p.m.

The motion of an object (a baseball for example), subjected to the forces of gravity and air resistance proportional to velocity, can be described by the system of ODEs:

$$\begin{aligned}x''(t) &= -cv(t)x'(t) \\ y''(t) &= -cv(t)y'(t) - g\end{aligned}$$

where the speed of the object is  $v = \sqrt{(x')^2 + (y')^2}$ ,  $g = 32ft/s^2$  and  $c = 0.002$  for a baseball. Use the 2nd order Runge-Kutta method to solve this system and answer the question: does the ball clear a fence which is 400 ft from home plate and 10 ft tall if the initial conditions are  $x(0) = y(0) = 0$ ,  $x'(0) = y'(0) = 100ft/s$ ? What if  $x'(0) = 160$  and  $y'(0) = 83ft/s$ ?

Plot  $x$  and  $y$  versus  $t$  and  $x$  vs.  $y$ .

Hand in all m-files.