# Midterm Project

## Calculation And Simulation Of A Golf Ball's Trajectory

1. A golf ball moves according to the parametric functions
$$x = 32t$$
$$y = 42t - 4.9t^2$$
where horizontal distance $x$ and altitude $y$ are in meters, and time $t$ in seconds, and where air resistance to the movement is not taken into account.

a) Determine the initial velocity (both magnitude and direction) of the ball. (5%)

b) Calculate both the maximum altitude $y_{max}$ and maximum horizontal distance $x_{max}$ that the ball can reach, and the time for the ball to reach $x_{max}$. (10%)

2. If air resistance is taken into account to some extent for the horizontal movement but ignored for the vertical movement, as is reflected in the following parametric functions
$$x = 32t - 0.1t^2$$
$$y = 42t - 4.9t^2$$

a) Determine the maximum altitude $y_{max}$ and maximum horizontal distance $x_{max}$ that the ball can reach. (5%)

b) Calculate both the velocity and acceleration (both magnitude and direction) of the ball at the moment hitting ground (assuming level terrain). (5%)

3. Demonstration — Write a program using a language of your choice to simulate the ball's trajectory in both conditions: when air resistance is considered and when is not. (50%)

4. Demonstration — At the time of demonstration you will be provided with another set of parametric functions. You will run the same program to demonstrate the trajectory of the movement. (25%)

## Note

a) Solutions to Q1 and Q2, which include necessary calculation processes, are required to be submitted as paper work. The paper work is due Oct. 18.
b) Demonstration to be carried out on Oct. 18. Code submittal not required.

*Numerical Methods, Scott Zhang, October 10, 2012*