ENG-101
Intro Computing Engineers Homework 7

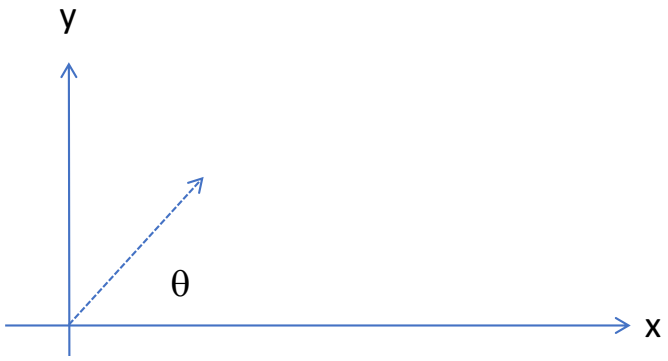
Question 1 (20 Points)

Projectile trajectories using equations for ideal projectile motion are:

$$y(t) = y_o - \frac{1}{2}gt^2 + (v_o sin(\theta_o))t$$

$$x(t) = x_o + (v_o cos(\theta_o))t$$

where $y(t)$ is the vertical distance, $x(t)$ is the horizontal distance traveled by the projectile in meters, g is the acceleration due to Earth's gravity $= 9.8\ m/s^2$, and t is in time in seconds.



Let us assume that the initial velocity of the projective is $v_o = 50.75\ m/s$ and the projectile's launch angle is $\theta_o = \frac{5\pi}{12}$ radians. The initial vertical and horizontal positions of the projectile are given by $y_o = 0$ m and $x_o = 0$ m, respectively.

Write a well-documented MATLAB script *projectile.m* that plots y vs. t and x vs. t in two separate graphs, for time between 0 and 10 seconds, at an increment of 100 ms. Use the subplot function in your answer. Provide appropriate titles to the graphs and label the axes accordingly. Also, make sure that grid lines are visible. Finally, make sure the distance scale displays distances from 0 to 150 meters. Use the data cursor to identify the maximum height for the projectile and record it as a comment in *projectile.m*. Submit the graph as a pdf file titled *projectileGraph1.pdf*.

Construct a new figure *projectileGraph2.pdf* that depicts y vs. x, using graphs, titles and labels. Submit the graph with your solution.

Extend your solution by submitting another well-documented MATLAB script *projectile2.m* that creates the graphs described above depicting the projectile launch angles $\theta_o = \frac{5\pi}{12}$, $\theta_1 = \frac{5\pi}{12} - 0.255$, and $\theta_2 = \frac{5\pi}{12} - 0.425$. Submit *projectileGraphs1.pdf* and *projectileGraphs2.pdf* each having the respective launch angles held using the hold on function. Limit the altitude distances from 0 to 150 meters, without these limits the altitudes for θ_1 and θ_2 are negative, depicting a non-physical solution (i.e. projectile penetrates the Earth). In a comment in *projectile2.m* note which launch angle produces the furthest horizontal displacement.

Question 2 (20 Points)

Write a well-documented MATLAB program *leibnitz.m*, that uses vectorization techniques only to determine the accuracy of the series calculation (compared to MATLAB's pi) using 10, 100, 1000 … 10^8 terms.

The Leibnitz Series is: $\frac{\pi}{4} = \frac{1}{1} - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots = \sum_{n=0}^{\infty} \frac{(-1)^n}{2n+1}$.

Your program should produce the labelled figure *leibnitzAcc.fig*, which should be included as a pdf in your solution.