

## Engineering 6 Spring 2016

### Lab 3 – Section A07

Please create a script (.m file) named XX\_labN.m where XX are your initials and N is the lab number.

At the top, put the following comments:

% <First Name, Last Name>

% <ID Number>

% <Section Number>

When submitting your script, make sure to click the honor pledge, or else your quiz will not be submitted. Also make sure to submit before the end of the time, or the lab will be considered late! If your section ends at 1:00 PM, submit by 12:59 AM.

#### Problem 1

A biologist is interested in the average height of the trees in a certain area. After several years of measuring, he obtains the following data set:

Time (Years)	Average Height (m)
1	2.2
2	2.7
3	3.1
4	3.8
5	4.9
6	6.2

**Table 1: Data set for the tree height**

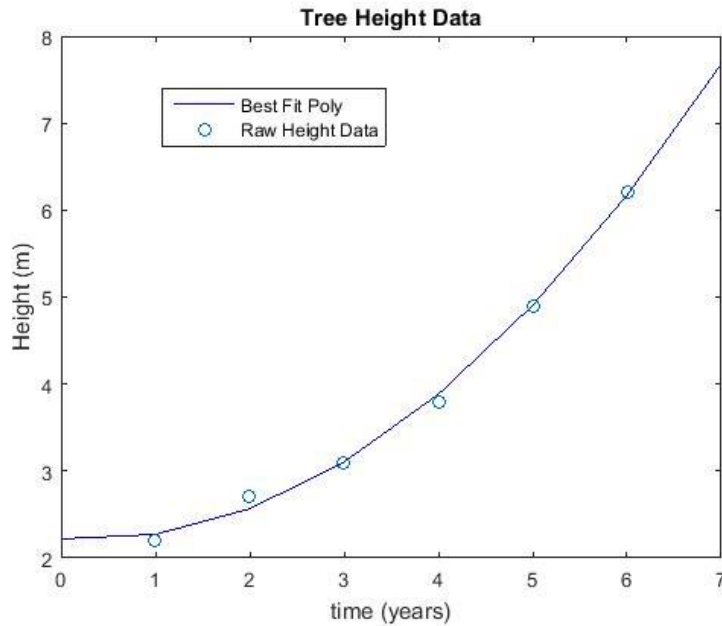
Our biologist hasn't got the any idea of the mechanism behind these numbers, but still wants to have a line through the data points. He decides to resort to the use of polynomial functions. He wants to fit the data using a second order polynomial, which takes the form:

$$y = ax^2 + bx + c$$

- 1) First create an array x containing the data of time and an array y containing the data of height.
- 2) Use polyfit() to find the values for a, b and c for given values of y and x, where year number as x, and average height as y. This function applies the method of least squares.
- 3) Now you have found the coefficients, compute the height at year 0 and year 7 using the function polyval(). Use fprintf() function to show your answer!

*"The height at year 0 is \_\_\_ m, and at year 7 is \_\_\_ m."*

- 4) Plot the data points (scattered points) and the best fit polynomial curve in one figure (including 0 and 7 seconds). Add title, x/y labels, and legend to your plot.



*Example figure output*

## Problem 2

In this problem, we will compare differentiation using MATLAB with a mathematical closed form differentiation expression.

- Create a vector  $x$  starts at  $0$  and stop at  $2\pi$  with a step of  $0.001$ .
- Plot the vector  $y$  where  $y = \sin(x)$
- Differentiate the vector  $y$  numerically using the Matlab function `diff` and assign the output to  $z$ .
- On a new figure, plot  $(z/step)$  the vector created by dividing  $z$  by the `step`. On the same figure, plot the mathematical closed form expression of the differentiation  $\frac{dy}{dx}$  of  $\sin(x)$ . Add legend, titles and labels.