Homework

Consider the following set of data:

x	y
-4	-0.1892
-1	0.8415
0.2	0.9933
0.5	0.9589
3	0.0470

1. Write the normal equations out for this data if you are attempting to fit the data to a cubic polynomial $p_3(x) = ax^3+bx^2+cx+d$ in a least squares sense. Find the polynomial p_3 using the backslash command. then give a plot of the data (represented by `'o'` in the `plot` command) and p_3 on the same graph over the interval $[-5, 5]$ (use 50 equally spaced points for p_3 with the `polyval` command).
2. Find p_3 from Problem 1 using the `polyfit` command.
3. Write the normal equations for this data if you are attempting to fit the data to an expression of the form

$$f(x) = c_1b_1(x) + c_2b_2(x) + c_3b_3(x)$$

if $b_1(x) = x$, $b_2(x) = 1 - x$ and $b_3(x) = \frac{1}{1+x^2}$. Use the backslash command to find your coeffients c_i. Plot the data with the least squares function $f(x)$ over the interval $[-5, 5]$ as in Problem 1.

Write a function m-file called exercise_11_prob1 that will plot the data and the curve fit on the same plot.

- The m-file should be able to be called with the following command:
  exercise_11_prob1(x,y,a,b)
- x and y should be column vectors of data.
- a and b are the left and right endpoints (respectively) of the x interval from the original data.
- Your file should find a least squares regression (curve fit) of the form $y = c_1x^{c_2}$. (Hint: take the natural log of both sides).
- It should plot the original data (represented by diamonds) as well as the regression on the same plot.
- The interval for plotting should be [a,b] with 50 equally spaced points.
- Label the plot "y = …" using the values that you find for the constants.
- Do not use the commands polyfit or polyval.
- Use the normal equations to solve for the constants.
- Test your function m-file using the following data:

x	1.00	1.57	2.01	2.49	3.00
y	1.30	5.70	13.04	20.40	50.30