ME 120 Homework 6

Use the direct solution format for all questions on this assignment.

Use the data (t_i, v_i) below with for questions 1 to 4. Combine your answers into a word-processing document. Print that document and the Excel sheet used to perform *all* of the computations. In other words, do not use a calculator for any part of this assignment, except, of course, to check your spreadsheet calculations. Attach your spreadsheet, word-processing document and your solution to problem 5 into a single (stapled) packet.

1. Use Excel to create a scatter plot of following data of velocity versus time.

t (s)	10	25	33	42	52	59	67	74
v (m/s)	22	52	72	90	100	102	105	94

   Add a straight line curve fit (trendline) to the plot created in step 1. Display the equation of the line fit and the value of R^2 on the plot. Include the plot in your word-processing document. Separately, write the equation and give the value of R^2 in your document.

2. Create a second plot of the data set, and add a quadratic polynomial curve fit to the data. Display the equation of the curve fit and the value of R^2 on the plot. Include the plot in your word-processing document. Separately, write the equation and give the value of R^2 in your document.

3. ~~A~~On a separate Excel sheet, create a table for the $v = f(t)$ data and compute the terms below. (Substitute t →x and v → y)

   a. $\sum x_i$

   b. $\sum y_i$

   c. $\sum x_i y_i$

   d. $\sum x_i \sum y_i$

   e. $(\sum x_i)^2$

   f. $\sum x_i^2$

   Hint 1: Substitute t for x and v for y. Hint 2: Create additional columns (or rows) for $x_i y_i$ and x_i^2.

4. Using the values from problem 3, compute the slope (m) and intercept (b) of the least squares line fit on your spreadsheet. Create columns for $\hat{y}_i$ and $\hat{y}_i - \bar{y}$ and compute the value of R^2 from the data in your table.

   Note that you should present the solution to problem 3 and problem 4 in the same page of the spreadsheet.

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5. Given the following raw data from a pump measurement

Height of exit tube above reservoir	$h = 75$ cm
Mass of water collected	$\Delta m = 350$ g
Time during mass collection	$\Delta t = 24$ s
Motor voltage	$V_m = 11.98$ V
Motor current	$I_m = 0.42$ A

   a. Using the symbols in the preceding table, write down the formulas (using symbols, not numbers!) for computing the volumetric flow rate in L/min and the efficiency of the pump. Define symbols for any additional data (e.g. physical constants) necessary to complete the calculations.
   b. Substitute the numerical values from the table into the equations from part (a) to obtain values for the flow rate and the efficiency.