

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. Aon a separate Excel sheet, create a table for the  $v = f(t)$  data and compute the terms below. (Substitute  $t \rightarrow x$  and  $v \rightarrow y$ )
  - 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.

Continued on next page

5. Given the following raw data from a pump measurement

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

- 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.
- Substitute the numerical values from the table into the equations from part (a) to obtain values for the flow rate and the efficiency.