

**Math 739/839****Homework: Transformation****Total Points: 20 /30**

Problem 1: The vapor pressure data set explores the relationship between temperature and the vapor pressure of water.

- a) (5 pts.) Fit the straight-line model. Compute the scatterplot, summary statistics and the residual plots. What are your conclusions regarding model adequacy?
- b) (5 pts.) From physical chemistry, the Clausius-Clapeyron equation states that

$$\ln(p_v) \propto -\frac{1}{T}$$

Repeat part a using the appropriate transformation based on this information.

Problem 2: A glass bottle manufacturing company has recorded data on the average number of defects per 10,000 bottles due to stones (small pieces of rock embedded in the bottle wall) and the number of weeks since the last furnace overhaul. The data are in an Excel file in the assignment.

- a) (5 pts.) Fit a straight-line regression model to the data and perform the standard tests for model adequacy.
- b) (5 pts.) Suggest an appropriate transformation to eliminate the problems encountered in part a. Fit the transformed model and check for adequacy.

Problem 3: (Required for 839 students & Honor students. )

Vining and Myers (“Combining Taguchi and Response Surface Philosophies: A Dual Response Approach,” Journal of Quality Technology, 22, 15–22, 1990) analyze an experiment, which originally appeared in Box and Draper [1987]. This experiment studied the effect of speed (x1), pressure (x2), and distance (x3) on a printing machine's ability to apply coloring inks on package labels. The following table summarizes the experimental results.

- a) (5 pts.) Fit an appropriate multivariate model and conduct the residual analysis.
- b) (5 pts.) Use the sample variances as the basis for weighted least-squares estimation of the original data (not the sample means). Conduct the residual analysis