Student Name: **ID#:**

Answer the following

Problem 1

Consider the following the linear regression model

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i, \quad i = 1,2,...,n,$$
$$E(\varepsilon_i) = 0, \quad Var(\varepsilon_i) = \sigma^2 and \quad Cov(\varepsilon_i, \varepsilon_j) = 0, i \neq j \Big\},$$

(a) Write the given regression model with the associated conditions in the matrix form.

(b) Use the least square method to derive the estimate of the vector of parameters $\beta' = (\beta_0, \beta_1)$.

Problem 2

A marketing researcher studied annual sales of a product that had been introduced 10 years ago. The data are as follows, where X is the year (coded) and Y is the sales in thousands of units:

i:	1	2	3	4	5	6	7	8	9	10
X_i:	0	1	2	3	4	5	6	7	8	9
Y_i:	98	135	162	178	221	232	283	300	374	395

(a) Estimate the simple linear regression models before and after the transform
$Y' = \sqrt{Y}$

(b) Compare between the two models based on the meaning of the coefficient of determination.

(c) Calculate 90% CI for E(Y) in when X=11 before and after the transform. Then, compare the results.

Problem 3

To investigate the simple linear model $Y = \beta_0 + \beta_1 X + \varepsilon$, we have the following data:

$$X\,'X = \begin{bmatrix} 60 & 3599 \\ 3599 & 224091 \end{bmatrix}, \quad X\,'Y = \begin{bmatrix} 5098 \\ 296024 \end{bmatrix} \quad and \quad Y\,'Y = 448662$$

(a) Estimate the coefficients of the model.
(b) Find the standard deviation of the coefficients.
(c) Calculate R^2 and the correlation coefficient and interpret the results.
(d) Find 90% prediction interval of Y_{New} when $X = 50$