Tutorial 7

Question 1

(11.15) Derive the following identity:

$$\text{SSE} = \sum_{i=1}^{n}(y_i - \hat{y}_i)^2 = S_{yy} - \hat{\beta}_1 S_{xy}$$

Question 2

(11.5/11.17a/11.32) The median sale prices for new single family houses are given in the table below for the years 1972 through 1979.

Year	Median Sale Price (Thousands, y)	Year Index (x)
1972	27.6	1
1973	32.5	2
1974	35.9	3
1975	39.3	4
1976	44.2	5
1977	48.8	6
1978	55.7	7
1979	62.9	8

(a) Letting Y denote the median sales price and x the year (using integers 1, 2, ..., 8), fit the model $Y = \beta_0 + \beta_1 x + \varepsilon$.

(b) Calculate SSE and S^2.

(c) Is there sufficient evidence to indicate that the median sales price for new single family houses increased over the period from 1972 through 1979? Use $\alpha = 0.01$.

(d) Estimate the expected yearly increase in median sale price by constructing a 99% confidence interval.

(e) Repeat parts (a) - (d) using **R**. After fitting the model in (a), create a plot of the residuals against the year index.

Question 3

(11.16/11.39/11.46) An experiment was conducted to observe the effect of an increase in temperature on the potency of an antibiotic. Three 1-ounce portions of the antibiotic were stored for equal lengths of time at various Fahrenheit temperatures.

Potency Reading (y)	Temperature (x)
38	30
43	30
29	30
32	50
26	50
33	50
19	70
27	70
23	70
14	90
19	90
21	90

(a) Find the least-squares line appropriate for this data.

(b) Calculate S^2.

(c) Find a 95% confidence interval for the mean potency of a 1-ounce portion of antibiotic stored at 65° F.

(d) Find a 95% prediction interval for the potency of a 1-ounce portion of antibiotic stored at 65° F. How does this interval compare to the interval found in (c)?

(e) Repeat parts (a) - (d) using **R**. After fitting the model in (a), create a plot of the data points and the fitted line to verfiy that the fit is appropriate.