PIERIAN DATA

EXERCISE #6 - Regression – ANSWER KEY

1. A plant manager wants to study the relationship between daily temperatures and plant output. What are the dependent and independent variables?

   Plant output is the dependent variable, and daily temperature is the independent variable. Daily temperature may have an effect on plant output, but plant output should not affect daily temperature.

2. The general formula for linear regression is $\hat{y} = b_0 + b_1 x$
   Describe each of the variables $\hat{y}$, b_0, b_1, and x

   $\hat{y}$ predicted value of our dependent variable y
   b_0 y-intercept when x=0
   b_1 slope of the regression line*
   x an independent variable

   * in a multiple regression, b_1 would represent the contribution of x_1 to the slope of the regression line. In other words, the change in $\hat{y}$ for a given change in x_1, all else remaining constant

3. What determines that a line is the "best fit" for the given data?

   We want to minimize the sum of distances between each data point and the line.

4. An engineer wants to study the relationship of several independent variables against soil acidity in a particular region. Why might you avoid putting both annual rainfall and depth of the water table in the same linear regression formula?

   There will likely be strong multicollinearity between the amount of rain and the depth of the water table.

5. A company wants to determine the linear relationship between the selling price of their product in US dollars and the number of units sold in thousands. Perform a linear regression on the following data to determine the linear predictor function

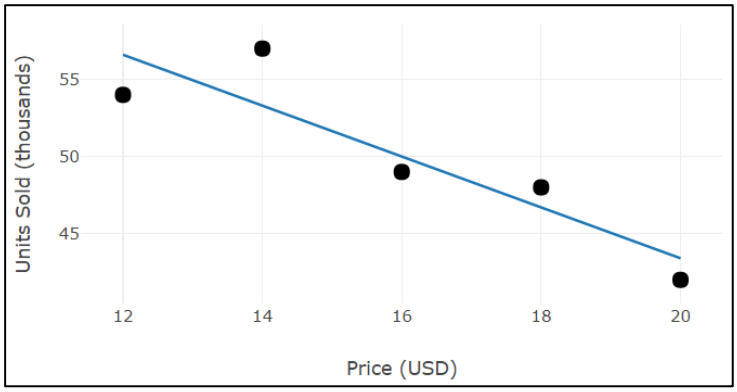
$$\hat{y} = b_0 + b_1 x$$

	Price (USD)	Units Sold (thousands)	$(x-\bar{x})$	$(y-\bar{y})$	$(x-\bar{x})(y-\bar{y})$	$(x-\bar{x})^2$
	12	54	-4	4	-16	16
	14	57	-2	7	-14	4
	16	49	0	-1	0	0
	18	48	2	-2	-4	4
	20	42	4	-8	-32	16
Sum:	80	250		Sum:	-66	40
	$\bar{x} = 16$	$\bar{y} = 50$				

$$b_1 = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sum(x-\bar{x})^2} = \frac{-66}{40} = -1.65$$

$$b_0 = \bar{y} - b_1\bar{x} = (\ 50\ ) - (\ -1.65\ )(\ 16\ ) = 76.4$$

$$\hat{y} = 76.4 - 1.65x$$



Line added for illustration only – not part of the assignment!