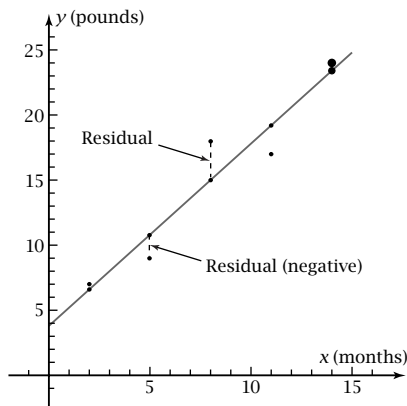


Exploration 8-1a: Introduction to Linear Regression

Objective: Find the sum of the squares of the residuals for a function found by linear regression.

Turkey Problem: Tom raises turkeys. He records the weight, y , measured in pounds, of one of his turkeys over several months, x .

x	y
2	7
5	9
8	18
11	17
14	24



- The graph is a scatter plot of the data, along with the linear regression line. Run linear regression on the data to find the particular equation of this line. Use \hat{y} (pronounced “y hat”) to distinguish the y -values for the regression equation from the y -values in the data. Store this equation as y_1 in your grapher.
 $\hat{y} =$ _____
- Calculate the value of \hat{y} for each value of x in the table. Record the results in a new, third column in the table.
- The dotted lines on the graph show by how much each data point deviates from the regression line. This is called the *residual deviation*, or simply the **residual**. Calculate the residual, $y - \hat{y}$, for each x -value, and record the results in a fourth column.
- Show that the sum of the residuals is zero.
- Square each residual and record the results in a fifth column. Then find the **sum of the squares of the residuals**. This number is abbreviated SS_{res} . It is a measure of how well the equation fits the data. The smaller the SS_{res} , the better the fit.

$SS_{\text{res}} =$ _____

- In Problem 1, you found $\hat{y} = 1.4x + 3.8$. The value of SS_{res} for this equation is the lowest possible. Demonstrate that this is correct by using the function $y_2 = 1.4x + 3.9$, which increases the y -intercept by 0.1, to calculate SS_{res} again. Show that the answer is greater than in Problem 5. What does this fact tell you about the new function?

x	y
2	7
5	9
8	18
11	17
14	24

$SS_{\text{res}} =$ _____

- Use the function $y_3 = 1.5x + 3.8$, which increases the slope of the regression equation by 0.1, to calculate SS_{res} a third time. What do the results indicate about how well \hat{y} , y_2 , and y_3 fit the given data?

x	y
2	7
5	9
8	18
11	17
14	24

$SS_{\text{res}} =$ _____

- What reason can you think of to explain why the turkey’s weight *decreased* between the 8th and the 11th month?
- What did you learn as a result of doing this Exploration that you did not know before?