TI Calculator Worksheet

Statistics : Grade 9

Subject: Residuals, residual plots and correlation coefficients.

Necessary Equipments: TI-84 Plus Calculator, Computer, Excel Programming

Time Required: 60 minutes

Objectives:

- İD. 9.6.1.1.Merkezi eğilim ve yayılım ölçülerini verileri yorumlamada kullanır.
    - Merkezi eğilim yayılım ölçüleri kullanılarak gerçek/gerçekçi hayat durumları yorumlanır.

Task

The correlation coefficient is not the only tool that statisticians use to analyze whether or not a line is a good model for the data. However, you can also consider the residuals, which is to look at the difference between the observed value(the data) and the predicted value (the y-value on the regression line). That is, you can think the residual as how far away the actual data is from the regression line.

Problem

Safety authorities advise drivers to travel three seconds behind the car in front of them. This gives the driver a greater chance of avoiding a collision if the car in front has to brake quickly or itself involved in an accident.

A test was carried out to find out how long it would take a driver to bring a car to rest from the time a red light was flashed. The following results are for one driver in the same car under the same test conditions.

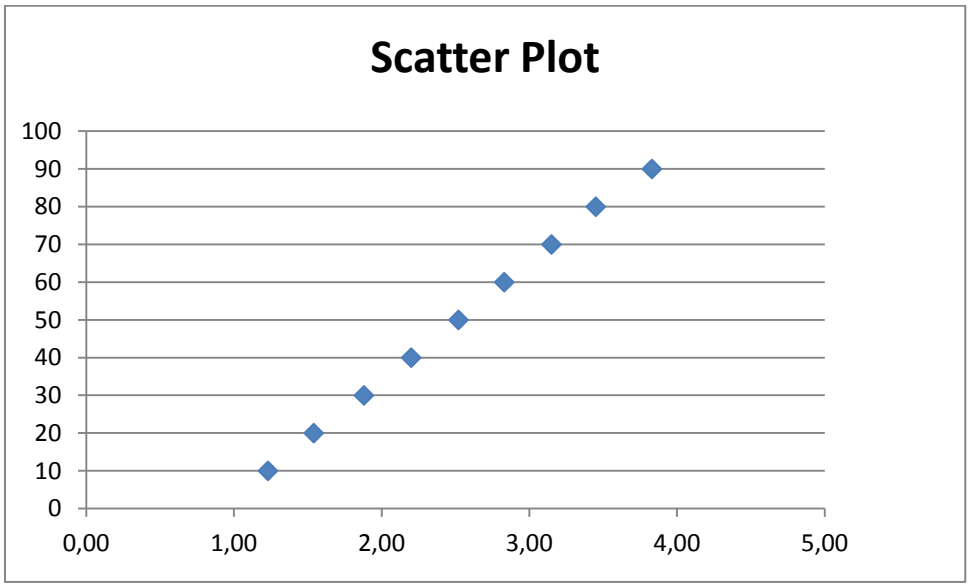
Speed v (kmh^{-1})	10	20	30	40	50	60	70	80	90
Stopping time t (s)	1.23	1.54	1.88	2.20	2.52	2.83	3.15	3.45	3.83

Part 1 : Create a scatter plot and graph the regression line.

1. Open the Excel Programming to make the table.

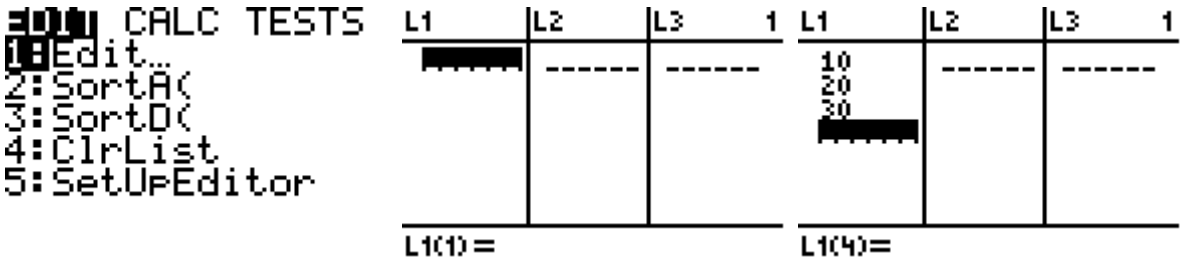
	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3	X	1,23	1,54	1,88	2,2	2,52	2,83	3,15	3,45	3,83	
4	Y	10	20	30	40	50	60	70	80	90	
5											
6											

2. To draw the graph choose the all cells on which x and y variables are. Then select the **Add** from the main menu. Come to the **Graphs**. And choose Scatter Plot Graph. Hence, obtain the graph.

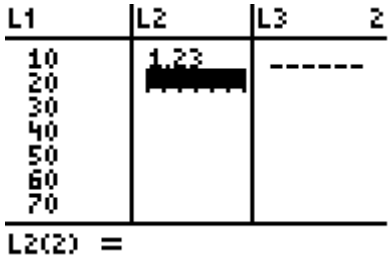


Part 2 : Create a scatter plot and graph the regression line. To do on TI calculator;

1. Press **STAT 1** to select **1:Edit** from the **STAT EDIT** menu. The stat list editor is displayed. Press **10** and **ENTER in L1**. The rectangular cursor moves to the next row. Repeat this step to enter each values in the table.

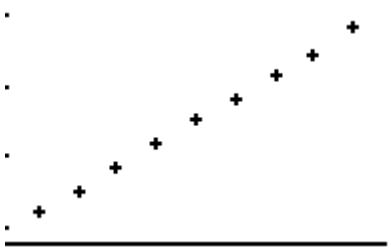


2. Press ▹ to move the rectangular cursor to the first row **L2.** Press **1.23** to store the first time measurement. Repeat this step to enter each values in the table.



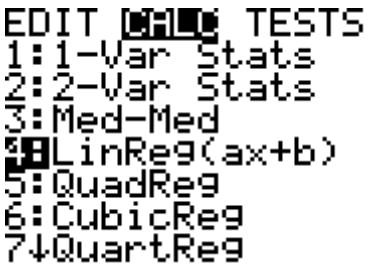
3. Press **Y=** to display the Y= editor. Press **2nd [STAT PLOT] 1** to select **1: Plot1** from the **STATS PLOTS** menu. Press **ENTER** to select **On**, which turns on **Plot1**. Press **∇ ENTER** to select Scatter plot.

4. Press **ZOOM 9** to select **9:ZoomStat** from the **ZOOM** menu. The window variables are adjusted automatically, and **Plot1** is displayed. This is a scatter plot of time-versus-speed data.

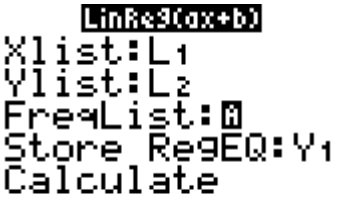


Part 3 : Find the linear regression model best fits the data.

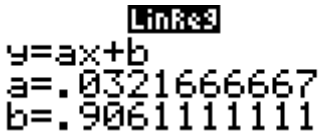
1. Press **STAT** ▷ **4** to selet **4:LinReg(ax+b)** (linear regression model) from the **STAT CALC** menu.



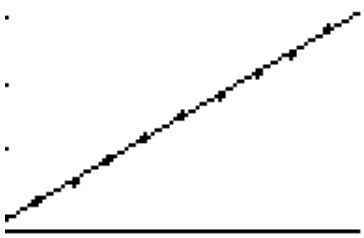
2. Press **2nd [L1]**(for Xlist), and **∇ 2nd [L2]** (for Ylist), Press **∇ ∇** (to store ReqEQ:) and then press **ALPHA [F4] ENTER** to paste **Y1**. Press **∇** to select **Calculate**.



3. Press **ENTER** to execute **LinReg(ax+b)**.



4. Press **GRAPH**. The regression line and scatter plot are displayed.



Question:

a) Estimate the stopping time for a speed of

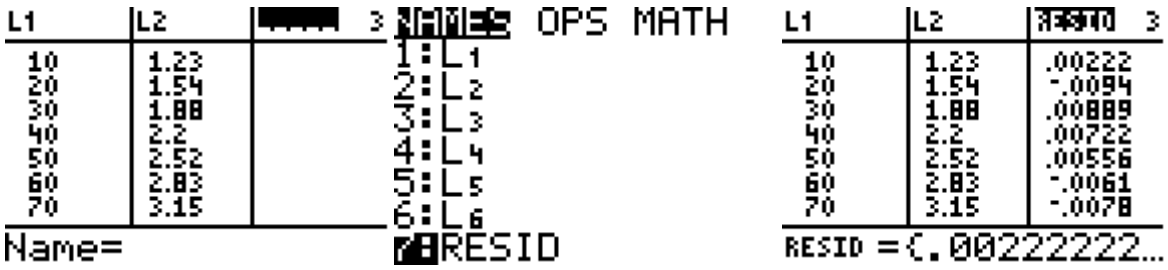
i: 55 kmh^{-1} **ii:** 110 kmh^{-1}

b) Interpret the vertical intercept of the model.

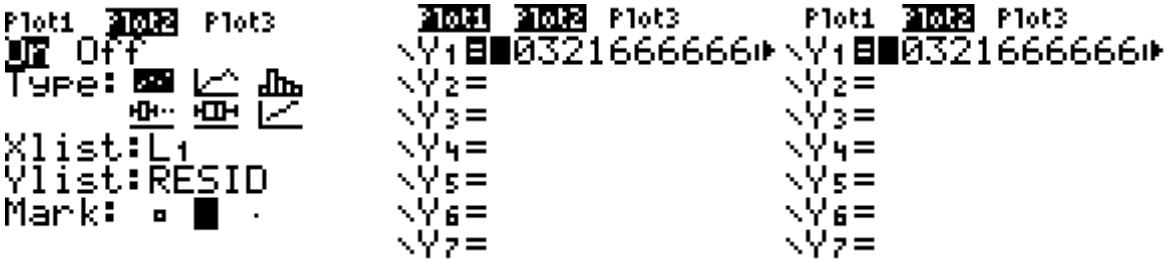
Note: *The regression line appears to fit the central portion of the scatter plot well. However, a residual plot may provide more information about this fit.*

Part 4 : The residuals are the lengths of the segments drawn each data point to the regression line. Generally if the data point is above the regression line, the residuals positive. If the data point is below the line, the residual is negative.

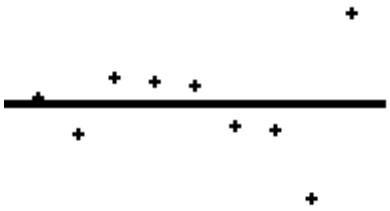
1. Press **STAT 1** to select **1:Edit** from the **STAT EDIT** menu. The stat list editor is displayed. Press ▷ and Δ to move the cursor onto **L3.** Press **2nd [INS].** The **Name=** prompt is displayed in the entry line. Press **2nd[LIST]**. And press **7:RESID** and then **ENTER** and **ENTER**.



2. Press **2nd [STAT PLOT] 2** to select **2: Plot2** from the **STATS PLOTS** menu. Press **ENTER** to select **On**, which turns on Plot2. Press **2nd [L1]**(for Xlist). Press **∇ ENTER** to select **Scatter plot.** Press **2nd [A-LOCK]** to lock the alpha key. Press **∇ [R][E][S][I][D]** to specify **Ylist: RESID** for Plot2. Press **Y=** to display the Y= editor. Press ◅ and press **ENTER** to deselect **Y1.**



3. Press **ZOOM 9** . The window variables are adjusted automatically and Plot2 is displayed. This is a scatter plot of the residuals.



Note: *Statisticians look at graphs of the residuals to judge their regression lines. So you get your chance to do it.*

Activity : Create a problem and collect two different types of data; but pay attention to the relatedness of each data. Then, as in the above example find the residual plot considering each step on TI calculator. Finally, answer the following questions.

1. If a residual is large and negative, what does it mean?

2. If someone told you that they estimated a line of best fit for a set of data points and all of the residuals were positive, what would you say?

3. What does it mean if a residual is equal to 0?

4. If the correlation coefficient for a data set is equal to 1, What will the residual plot look like?

Reflection

While deciding the topic, I considered that analyzing situations has a significant role on human life. Since the statistics is as one of the best branch of science and mathematics, it serves this purpose. Before preparing this worksheet, I searched too many word problems related to statistics by considering the MoNE objectives. Furthermore, I paid attention to this problem should be a real life example since statistics itself was already related with the real life. Therefore, I also looked at Hease and Harris SL book and finally found a word problem written in the beginning of the worksheet and then I developed the idea. My purpose to prepare this task was to develop an understanding of the residuals and how to use residual plots to analyze the strength of a linear model for data by using technology, TI calculator. Hence, students will be able to represent data on two quantitative variables on a scatter plot, and describe how the variables are related. And, they can compare the residual plot with the scatter plot of the data with the regression line drawn. In this manner, I also learned much about statistics and its applications on TI calculator.