Line of Regression

Data Analysis and Probability Standard

Materials: TI-84 Plus Calculator

Inheritance factors in physical growth have been studied to compare the mother’s height to the
daughter’s and son’s heights and the father’s height to the daughter’s and son’s heights. Some
researchers have found that the midparent height, which is the number halfway between the
height of each parent, is more closely related to the heights of their children. The tables below lists
the midparent heights to the daughters’ heights and midparent heights to the sons’ heights.

<table>
<thead>
<tr>
<th>Midparent height</th>
<th>Daughters’ height</th>
</tr>
</thead>
<tbody>
<tr>
<td>161</td>
<td>156</td>
</tr>
<tr>
<td>163</td>
<td>161</td>
</tr>
<tr>
<td>165</td>
<td>165</td>
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<tr>
<td>167</td>
<td>167</td>
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<td>169</td>
<td>164</td>
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<tr>
<td>171</td>
<td>164</td>
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<tr>
<td>173</td>
<td>169</td>
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<tr>
<td>175</td>
<td>172</td>
</tr>
<tr>
<td>177</td>
<td>166</td>
</tr>
<tr>
<td>178</td>
<td>171</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Midparent height</th>
<th>Sons’ height</th>
</tr>
</thead>
<tbody>
<tr>
<td>163</td>
<td>171.5</td>
</tr>
<tr>
<td>165</td>
<td>175</td>
</tr>
<tr>
<td>167</td>
<td>178</td>
</tr>
<tr>
<td>169</td>
<td>176</td>
</tr>
<tr>
<td>171</td>
<td>180.5</td>
</tr>
<tr>
<td>173</td>
<td>180</td>
</tr>
<tr>
<td>175</td>
<td>178.5</td>
</tr>
<tr>
<td>177</td>
<td>177.5</td>
</tr>
<tr>
<td>178</td>
<td>186</td>
</tr>
</tbody>
</table>

Steps to find the Line of Regression using the TI-84 Plus

Before getting started, note that you must first press [2nd] for any commands written in blue.

1. Make sure you have DIAGNOSTIC ON. To do this press [CATALOG]. Next, press [ ] and
move the cursor until it is next to the word “Diagnostic On”. Press [ENTER]. This will
take you to the main screen. The calculator is asking if you want the Diagnostic On. Press
[ENTER] for OK. After doing this, it should say “Done”. Note: You do not have to do this
every time. Once someone has put the Diagnostic On, it will stay on until someone presses
Diagnostic Off.

2. Press [STAT].

3. We would like to create (EDIT) a list. Press [1: Edit].

4. Make sure there is no data in the column. If there is data listed, refer to the steps for
CLEARING A LIST COLUMN(page 4).

5. Under L1(List 1) input the column of numbers from the midparent heights from Table 1. Press
[ENTER] after each entry, including the last one.

6. Press [→] to move the cursor to L2(List 2).

7. Make sure there is no data in the column. If there is data listed, refer to the steps for
CLEARING A LIST COLUMN(page 4).

8. Input the column of numbers from the daughters’ heights from Table 1.
9. Go back to the main screen. To do this press [QUIT]. (Remember the idea noted above pertaining to blue commands.)

** We are now going to create a SCATTER PLOT using the data that you entered. Midparent heights represent our x values, and Daughters’ heights represent our y values. Remember x and y represent the x and y coordinates of our data.

10. Press [STATPLOT].

11. Press [1:].

12. Turn Plot1 ON. (Highlight it and press [ENTER].)

13. Move the cursor down to Type:

** Notice the other types of graphs that can be used (Scatter Plots, Line graph, pictograph, bar graph, pie graph, distribution, box-and-whisker plot, etc.) We want the first graph, which is a scatter plot.

14. Move you cursor and highlight the first graph.

15. Press [ENTER].

16. Move the cursor down and make sure that the screen displays Xlist:L1 (Midparent heights) and Ylist:L2 (Daughters’ heights).

** Mark just lets you choose what types of points you would like (squares, crosses, or dots). Choose the one you like and press [ENTER].

17. Press [QUIT] to go back to the main screen. ** Now we are going to set up the window for the points we are about to plot. A window will give us the dimensions viewable on our screen.

18. Press [WINDOW]. Locate the smallest and largest x and y values in the list. The smallest value of x is 161, and the largest is 178. The smallest value of y is 156, and the largest is 171. We will use this to construct an appropriate window for the graph.

19. For Xmin, enter 160 and press [ENTER].

20. For Xmax, enter 180 and press [ENTER].

21. Press [down] until you get to Ymin. (We’re not concerned with ΔX and Xscl)

22. For Ymin, enter 150 and press [ENTER].

23. For Ymax, enter 180 and press [ENTER]. (We’re not concerned with Yscl)

24. Go back to the main screen (Press [QUIT]).

25. Press [GRAPH]. ** You should now see a scatterplot on your screen. Now we would like to find the Line of Regression.

26. Press [QUIT] to go back to the main screen.
HERE WE GO!! Now we are going to find the Line of Regression.

27. Press **STAT**.

28. Move the cursor over to **CALC**.

29. Press 4:LinReg(ax+b). Now the calculator is asking what two lists will be used to find the Line of Regression.

30. Press **LIST**.

31. Press 1: for L1 (you should be back at the main screen).

32. Press **(This is a comma)**.

33. Press **LIST**.

34. Press 2: for L2 (you should be back at the main screen). You have just used the data from List 1 and List 2 to compute the Line of Regression.

** Now we want to save our Line of Regression and store it into the calculator.

35. Press **.

36. Press **VARS**

37. Move the cursor to **Y-VARS**.

38. Press 1: Function. Note: The line of regression is a function

39. Press 1: Y1 (You should be back at the main screen).

You have just stored the equation of the Line of Regression into the calculator, under Y1.

40. Press **ENTER**.

GREAT JOB! You should see the following:

```
LinReg
y=ax+b
a=.656759348
b=53.91658677
r^2 = .6664891162
r = .8163878466
```

Plugging in the calculated values for a and b and rounding to the nearest .01, we have the following equation for the Line of Regression: \( y = 0.66x + 53.92 \).

41. Press **GRAPH** ** This shows the Line of Regression as well as the data points that you entered.
**Problem:** Use your line of regression to predict the heights of daughters for midparent heights of 160 and 174 centimeters. Note that the midparent heights represent the $x$ values and daughters’ heights represent the $y$ values.

For 160 centimeters, plug in $x = 160$. That is, $y = 0.66(160) + 53.92 \approx 160$ centimeters.

For 174 centimeters, plug in $x = 174$. That is, $y = 0.66(174) + 53.92 \approx 169$ centimeters.

**Problem:** Use you line of regression to predict the midparent heights for daughters’ heights of 163 and 170.

For 163 centimeters, plug in $y = 163$. That is $163 = 0.66x + 53.92$ and solve for $x$. Here $x \approx 165$ centimeters.

For 170 centimeters, plug in $y = 170$. That is $170 = 0.66x + 53.92$ and solve for $x$. Here $x \approx 176$ centimeters.

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**CLEARING A LIST COLUMN**

1. Press \textit{STAT}.
2. Press \textit{1: Edit}.
3. Move the cursor so that L1 is highlighted.
4. Press \textit{ENTER}.
5. Press \textit{CLEAR}.
6. Press \textit{ENTER}. The numbers in L1 should be gone.
7. Do the same for L2.
LINE OF REGRESSION

Name _______________________

Now for the group activity. Find the Line of Regression from the data points in Table 2 (page 1). Follow the same steps as before. To clear the lists (L1 and L2) refer to CLEARING A LIST COLUMN (page 4).

IMPORTANT: Once you change your lists (L1 and L2) you may have to change your WINDOW. For L1 identify the lowest number, subtract some from the lowest number and make this your XMIN. Then locate you highest number (on L1), add some to the highest number and make this you XMAX. Do the same for (L2), but this will become your YMIN and YMAX.

We will now construct a Line of Regression for Table 2: Midparent heights vs. Sons’ heights. Answer the following questions:

1. Write your line of regression with a and b rounded to the nearest .01.

2. Is there a positive or negative association? Why?

3. Is this line of regression a good approximation? Explain.

4. Use your line of regression to predict the sons’ heights for the midparent heights of 170 and 180 centimeters.

5. Use your line of regression to predict the midparent heights for the sons’ heights of 179 and 182 centimeters.