Scatterplot Pulse Rates

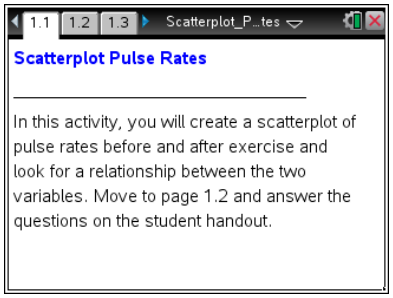
Student Activity

Name _____

Class _____

Open the TI-Nspire™ document *Scatterplot_Pulse_Rates.tns.*

In this activity, you will create a scatterplot of pulse rates before and after exercise and look for a relationship between the two variables



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The data in the tables below represent the pulse rates for 30 students. The data in the "before" columns represent the mean pulse rate over a period of five days at the beginning of class for a student, and the data in the corresponding "after" columns represent the mean pulse rate of each student after one minute of jumping jacks.

Create a scatterplot of the data below using the directions in the Scatterplot_Pulse_Rates_Create.doc document. Once you have created your scatterplot, follow the directions to add a movable line. Then, drag it to model the relationship between the "before" and "after" pulse rates.

	Pulse Beats/Min **before** exercise	Pulse Beats/Min after exercise			Pulse Beats/Min **before** exercise	Pulse Beats/Min after exercise
1	86	164		16	73	144
2	88	164		17	73	136
3	75	140		18	79	145
4	88	160		19	79	141
5	64	137		20	86	150
6	84	136		21	98	156
7	85	154		22	74	136
8	93	140		23	76	122
9	93	164		24	96	160
10	86	156		25	92	145
11	87	153		26	58	140
12	96	154		27	84	148
13	72	145		28	92	150
14	67	134		29	88	141
15	62	129		30	80	130

Answer the questions on the following worksheet pages once you have completed your scatterplot and movable line.

1. a. Write down your equation. Describe what the slope represents in terms of the pulse rates.

   b. Is the *y*-intercept of your line meaningful? Why or why not?

   c. Identify a point for which your line would not be a good predictor and a point for which your line would be a good predictor. Explain your reasoning.

2. Follow the directions in the Create document (Step 9) to show the residuals for your line.

   a. Move the cursor to the point you identified in 1c as the one for which the line would not be a good predictor. Move the cursor over the point to see the coordinates. What do these represent?

   b. Select this point, and observe the associated point in the residual plot. Move the cursor over the point in the residual plot to see the coordinates. What do these represent?

   c. The *y*-coordinates of the points in a residual plot are called residuals. By moving the cursor over the points in the residual plot, identify the points that seem to have the largest residuals.

   d. Describe any pattern you can see in the residuals. What does this indicate about your line?

3. Move your line, and observe how the residuals change. (Note: you may have to select **Menu > Window/Zoom > Zoom – Data** in order to see all of the residuals.)

   a. Find a line where the residuals have a clear pattern. Describe the pattern and the relationship between the line and the scatterplot that led to the pattern.

   b. Find a line where the residuals seem to have no pattern. Compare your line to the lines several other students have created. Whose line seems to be the "best fit" for the trend in the data? Explain your thinking.

4. Return to the .tns document (Step 10), and add a new page with a scatterplot of the data. Fit the least-squares linear regression line to the data. Look back at your answer to question 1a.

   a. Compare the slope of your line in question 1a to the slope of the least-squares linear regression line.

   b. Describe the residual plot for the regression line.

According to certain experts, the average resting heart rate for an adult is between 60 and 100 beats per minute, while athletes might have between 40 and 60 beats per minute. The maximum pulse rate should be 220 minus your age, and a healthy pulse rate during, or just after, exercise, should be about 60-80% of the maximum value.

5. Assume the students were between 16 and 17 years old. Which of the students had a healthy pulse rate after the exercise?

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Patterns in the residuals suggest that that line might not be an appropriate model for the relationship between two variables.

6. Return to Page 1.3 and follow the directions in the Create document to display the sum of the squared residuals for your movable line.

   a. Write down the sum of the squared residuals for your line.

   b. The area of a square is the square of the residual for a given average pulse rate. Select a square, and describe its dimensions and area.

   c. Drag your line to minimize the sum of the squared residuals. What is the smallest sum you can find?

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7. One special attribute of the least-squares linear regression line is that the line minimizes the sum of the squared residuals. Go to Page 1.4, and display the sum of squared residuals for the regression line. Given your work with the movable lines on Page 1.3, does this statement seem to be true?