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3/24/13

Linear Functions and Scatterplot

Modifications for Jacob (functioning at an 8th grade level) in red

Grade Level: 10th-11th

Subject Area: Algebra II

Materials Needed: Pencils, Notebooks, small group scatterplot worksheets (24 worksheets, one for each student. There are six types of worksheets, each containing a story and table of x and y values.)

Standards: HS.SID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.
c. Fit a linear function for a scatter plot that suggests a linear association.

Objectives:
- TLW be able to create an x and y table to record linear pairs.
- TLW graph each linear pair on a scatter plot
- TLW identify if the correlation is positive or negative or no correlation.
- TLW approximate the correlation coefficient based off a graph (varying from -1, -0.5, 0, 0.5, or 1). Include a chart with example graphs when the correlation coefficient is -1, -0.5, 0, 0.5, or 1. This way Jacob can visually figure out which scatterplot listed matches the one he is working on, and then write the corresponding coefficient.
- TLW approximate a line of best fit based on the graph (and find the equation for the line of best fit using point-slope form).In a note included on Jacob's worksheet, remind him that this line is an approximation, so it is okay if it is not perfect. Also mention that if he is unsure if his line is close enough, that he can come talk to me and I can help him.
- TLW use the line of best fit equation to make predictions.

Learning Activity:
- Opening hook: Have student desks arranged according to usual seating chart. Before students arrive, place one of the six worksheets on each child's desk according to a predetermined list. There are six different types of worksheets (appropriately numbered) that correspond to six different groupings (based on ability level) Place Jacob in lowest ability grouping, meaning his scatterplot has a high correlation coefficient (making it easier to determine a line of best fit). Also, spend more time checking in on this group during the free work period, examine Jacob's work and group participation. Each worksheet contains a paragraph explanation for the context

of the data table containing x and y values. The worksheet also contains the steps for finding a best-fitting line and a section of grid paper for graphing.

- When students arrive, encourage them to read the paragraph and to look at the data (3 minutes).
- Pull up this graph of a scatter plot on the smart board:
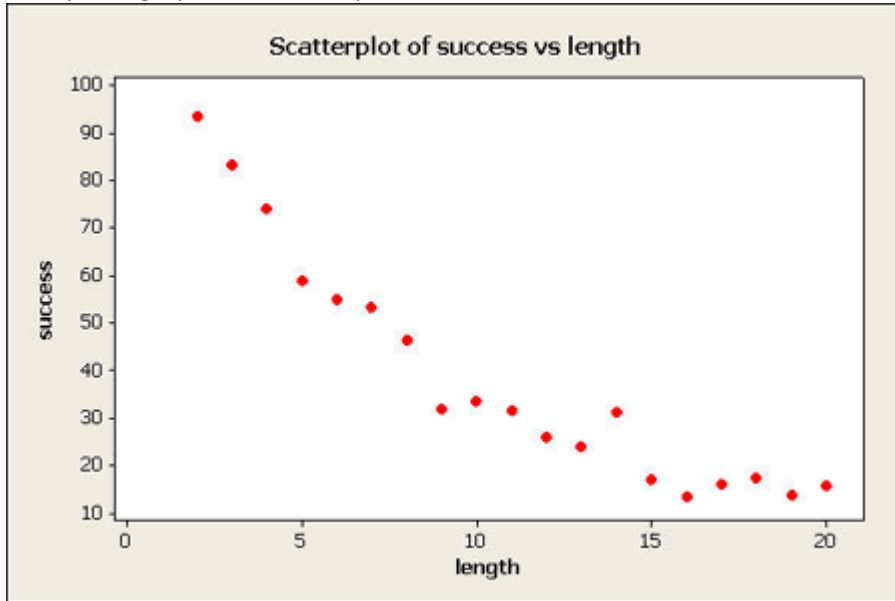
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- Ask students "Any idea of how the picture you see on the screen and what you have on your paper is similar?" (Answer: they both record a collection of points, one in the form of a table, the other is recorded graphically)

- Direct Instruction:
    - Definition: A scatter plot is a graph of a set of data pairs (x, y).
    - If y tends to increase as x increases, then the data have a *positive correlation*. If y tends to decrease as x increases, what kind of correlation do you think we would have then? (*negative correlation*) If the points show no obvious pattern, then the data has approximately *no correlation*.
    - What kind of correlation is in this first graph? Positive, negative, or no correlation? Here are some pictures of what each of those look like:

y-axis   y-axis   y-axis

O   x-axis   O   x-axis   O   x-axis
Positive Correlation   Negative Correlation   No Correlation
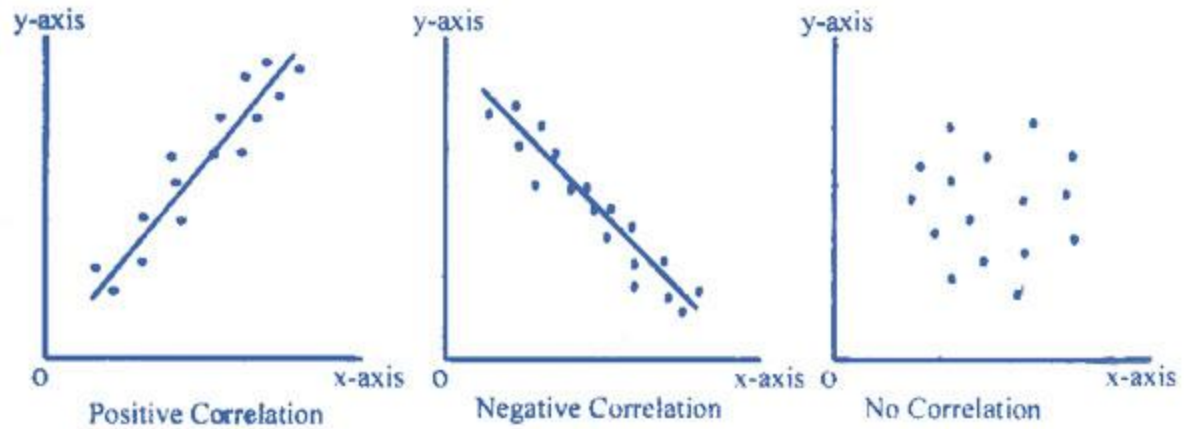
- Sometimes we want to know how closely our points form a line, or how strong of a correlation there is. A *correlation coefficient*, denoted by *r,* is a number from -1 to 1 that measures how well a line fits a set of data pairs (x,y). An *r* that is near to "1" means that the points lie close to a line with a positive slope. When the points lie close to a line with a negative slope, *r* is near "-1." If there is no correlation, then the correlation coefficient is near 0 (because the points do not lie close to any line). If it is not a strong positive correlation, sometimes we give it a 0.5, meaning that it is weak correlation, but more correlation than 0.
- Notice the line going through the middle of the first two graphs? This is what we call the *line of best fit (or best-fitting line)*. Essentially, this is the line that lies as close as possible to all the data points. The way we approximate this line is by graphing.
- Guided Discovery:

Sample problem: Pretend we want to find if there is a correlation between the number of hours I sleep in a night and the number of cups of tea I drink the next day. I think that there is a negative correlation here, that the less hours of sleep I get, the more tea I drink.

X number of hours in sleep, Y cups of tea					
X	8	9	6	8	4	10
Y	2	0	4	0	6	1

(Plot points on Smart Board coordinate plane)
- Questions about graph: Type of correlation? Guess on correlation coefficient? How should I draw my line?
- We know that lines are useful for making predictions. If I can find the equation for this line, what kind of predictions could I make? (ex: what happens if I get 0 hours of sleep? How many hours of sleep would I need so that I drink 0 cups of tea? Is there a limit to either the cups of tea or hours of sleep? How does this affect the graph?)

- Steps for finding equation of line of best fit:
  - Step 1: Draw the scatterplot
  - Step 2: Sketch a line that appears to best fit the line (one way to help approximate is to have the same number of points above and below the line)
  - Choose two points that appear on the line (preferably the points have easy to work with coordinates such as integers—not decimals or fractions)

- o Write an equation for a line. First find the slope using the points

  $$m = \left(\frac{y_2 - y_1}{x_2 - x_1} \right)$$ Verify that Jacob knows and understands these equations; If he is needing help, work with him to find two points on the best-fit line, and label exactly what is x1, y1, x2, and y2. If the algebra is the problem, offer to work with him more after school on these equations.
  - o Use point-slope form to write the equation.

    $$y - y_1 = m(x - x_1)$$ When solving for general equation, have Jacob keep the same x1, y1 as the first time.
- Small group activity:
  - o Explain that students will be put into small groups based off of the number on his or her worksheet. Once in small groups, the four students will work together to create the scatterplot, write if it has a positive, negative or no correlation, and then draw a line of best fit. Once the line has been drawn, students will find the equation for the line and write down one "prediction question" (ex: I wonder what happens when x= 3? What value of x gives me a y value of 10? Etc.)
  - o EACH STUDENT WILL RECORD HIS OR HER WORK ON SEPARATE WORKSHEETS. Credit will be determined based on each individual's worksheet.
  - o Designate where each group will work throughout the classroom.
  - o Students will work for the remainder of the class period. I will move among the groups to answer questions. If a group finishes early, they are allowed to turn in small group worksheet and begin assigned homework.
  - o If students do not finish the worksheet in class, they are allowed to take it home for homework and it will be collected the following day.

Assessment:

Small group activity will be graded on this scale:

Name:_____

Average Score:_____

Student accurately and neatly created the scatterplot
and identified the correct correlation:

0   1   2   3   4   5

Student drew an appropriate best-fitting line and
determined the equation for the line:

0   1   2   3   4   5

Student created an appropriate prediction question:

0   1   2   3   4   5

Student participated in group discussion:

0   1   2   3   4   5

Additional practice homework assignment: pg. 118, #10, #12 (creating scatter plot, approximating best-fitting line, and estimate when c=20) and #17 Error Analysis question. If Jacob shows that he is struggling during class, allow him to pick either #10 or #12 (in addition to #17) for the homework, and remind him to show all his work.

Response:

I might have planned too much in for one day. Also, I maybe should have waited on handing out the small group worksheets until after the initial instruction, that way they weren't playing with the paper while I was talking.