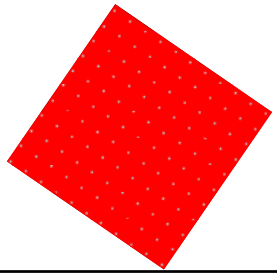
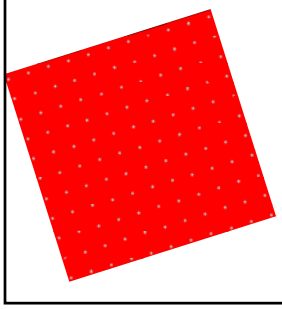
Investigating Linear Functions with Graphing Calculators

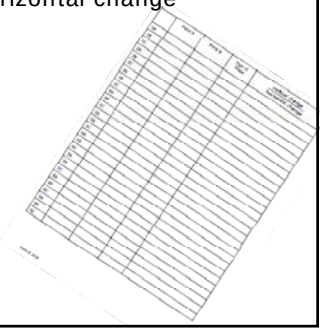
Jim Rahn
LL Teach, Inc.
www.jamesrahn.com
James.rahn@verizon.net

Investigating Slope on the Geoboard



$$slope = \frac{\text{vertical change}}{\text{horizontal change}}$$





Activity 1

- Use a rubber band to connect (1,2) and (7,8). Stretch the rubber band to make a right triangle that has these points as two its vertices. Find the length of the vertical side and the horizontal side. Write the slope of the original line using the definition above.
- Use a second rubber band to connect (1,2) and (6,8). Stretch the rubber band to make a right triangle that has these points as two its vertices. Find the length of the vertical side and the horizontal side. Is this line steeper or less steep than number 1. Explain why you think this is true. Write the slope of the original line using the definition above.

- Use a third rubber band to connect (1,2) and (5,4). Stretch the rubber band to make a right triangle that has these points as two its vertices. Find the length of the vertical side and the horizontal side. Is this line steeper or less steep than number 1. Explain why you think this is true. Write the slope of the original line using the definition above.
- Look at all three lines. Describe the direction (positive or negative) you must move from (1,2) to get to the other point. Describe the direction (positive or negative) you must move from the second point to get to the first point.
- Since both directions are either positive or negative we say that these lines have a positive slope.

Activity 2

- Use a rubber band to connect (1,9) and (7,3). Stretch the rubber band to make a right triangle that has these points as two its vertices. Find the length of the vertical side and the horizontal side. Write the slope of the original line using the definition above.
- Use a second rubber band to connect (1,9) and (5,1). Stretch the rubber band to make a right triangle that has these points as two its vertices. Find the length of the vertical side and the horizontal side. Is this line steeper or less steep than number 1. Explain why you think this is true. Write the slope of the original line using the definition above.

- Use a third rubber band to connect (1,9) and (9,5). Stretch the rubber band to make a right triangle that has these points as two its vertices. Find the length of the vertical side and the horizontal side. Is this line steeper or less steep than number 1. Explain why you think this is true. Write the slope of the original line using the definition above.
- Look at all three lines. Describe the direction (positive or negative) you must move from (1,9) to get to the other point. Describe the direction (positive or negative) you must move from the second point to get to the first point.
- Since both directions are opposite (one negative and one positive) we say that these lines have a negative slope.

Activity 3

- Use a rubber band to connect (1,3) and a second point whose coordinate is (3,____) so that the slope of the line will be 3 or 3/1. using the definition at the top of the paper. Could you have chosen a different point so that the slope is still equal to 3? Explain why or why not?
- Use a second rubber band to connect (1,3) and a second point whose coordinate is (7,____) so that the slope of the line will be 1/3 using the definition at the top of the paper. Could you have chosen a different point so that the slope is still equal to 1/3? Explain why or why not?

- Use a third rubber band to connect (1,3) and a second point whose coordinate is (8,____) so that the slope of the line will be 1 using the definition at the top of the paper. Could you have chosen a different point so that the slope is still equal to ? Explain why or why not?
- Describe why you know that all three lines have a positive slope.

Activity 4

- Use a rubber band to connect (2,1) and a second point whose coordinate is (____, 9) so that the slope of the line is equal to 1. How do you know that you are correct?
- Use a rubber band to connect (2,1) and a second point whose coordinate is (____, 10) so that the slope of the line is greater than 1. What is the slope of your line? How do you know that you are correct?
- Use a rubber band to connect (2,1) and a second point whose coordinate is (____,4) so that the slope of the line is less than 1. What is the slope of your line? How do you know that you are correct?

Activity 5

- Use a rubber band to connect (10,10) and a second point whose coordinate is (____,1) so that the slope of the line is equal to 1. How do you know that you are correct?
- Use a rubber band to connect (10,10) and a second point whose coordinate is (____, 5) so that the slope of the line is steeper than 1. What is the slope of your line? How do you know that you are correct?
- Use a rubber band to connect (10,10) and a second point whose coordinate is (____,7) so that the slope of the line is less steep than 1. What is the slope of your line? How do you know that you are correct?

Activity 6

- Use a rubber band to connect two points whose coordinates are of the form (____, 3) and (____,10) so that the line has a slope of 1. How do you know that you are correct?
- Use a rubber band to connect two points whose coordinates are of the form (1, ____) and (____,10) so that the line has a slope of 2. How do you know that you are correct?
- Use a rubber band to connect two points whose coordinates are of the form (1, ____) and (____ ,7) so that the line has a slope of 2. How do you know that you are correct?

Activity 7

- Use a rubber band to connect two points whose coordinates are of the form (____, 9) and (____,2) so that the line has a slope of -1. How do you know that you are correct?
- Use a rubber band to connect two points whose coordinates are of the form (____, 9) and (____,1) so that the line has a slope of -2. How do you know that you are correct?
- Use a rubber band to connect two points whose coordinates are of the form (____,9) and (____ ,5) so that the line has a slope of -1/2. How do you know that you are correct?

Activity 8

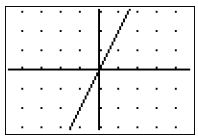
- Use a rubber band to connect two points so that the line has a slope of 1. How do you know that you are correct?
- Use a rubber band to connect two points so that the line has a slope of 2. How do you know that you are correct?
- Use a rubber band to connect two points so that the line has a slope of ½. How do you know that you are correct?

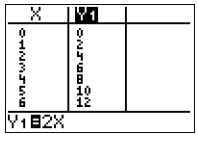
Activity 9

- Use a rubber band to connect two points so that the line has a slope of -1. How do you know that you are correct?
- Use a rubber band to connect two points so that the line has a slope of -2. How do you know that you are correct?
- Use a rubber band to connect two points so that the line has a slope of -1/2. How do you know that you are correct?

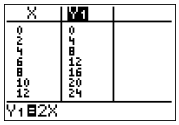
Discovering Properties of Slope

- Enter the equation y = 2x in your graphing calculator.
- Create a graph of this line in a Zoom 4.Decimal Window. Make a sketch of your window.
- Create a table that begins at x = 0 and increases by 1. Make a record of your table.
- Describe what you notice about the change in the x values?
- What do you notice about the change in the y values?
- What is the ratio of the change of y to the change in x?

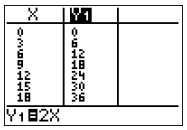




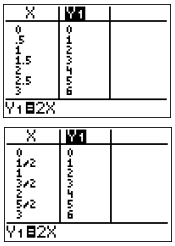
- Create a table that begins at x and increases by 2. Make a record of your table.
- Describe what you notice about the change in the x values?
- What do you notice about the change in the y values?
- What is the ratio of the change of y to the change in x?



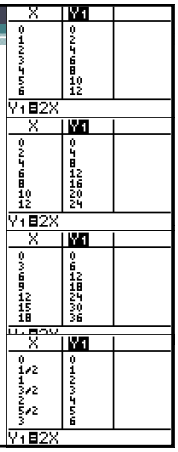
- Create a table that begins at x and increases by 3. Make a record of your table.
- Describe what you notice about the change in the x values?
- What do you notice about the change in the y values?
- What is the ratio of the change of y to the change in x?



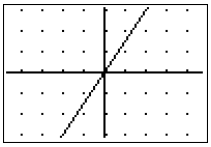
- Create a table that begins at x and increases by 0.5 or 1/2. Make a record of your table.
- Describe what you notice about the change in the x values?
- What do you notice about the change in the y values?
- What is the ratio of the change of y to the change in x?



- You worked with the same equation for each table. What did you notice about the ratio of the change in y to the change in x?
- Try creating a different table by change the ΔTBL. Calculate the change in y and the change in x for each table. What do you notice?
- How is the ratio related to the equation you entered in the calculator?



- Enter the equation $y = \left(\frac{3}{2}\right)x$ in your graphing calculator.
- Create a graph of this line in a Zoom 4.Decimal Window. Make a sketch of your graph.



- Create a table that begins at x = 0 and increases by 1. Make a record of your table.
- Describe what you notice about the change in the x values?
- What do you notice about the change in the y values?
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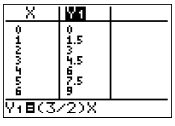

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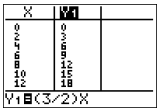

- Create a table that begins at x and increases by 0.5 or 1/2. Make a record of your table.
- Describe what you notice about the change in the x values?
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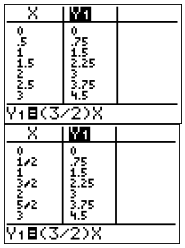

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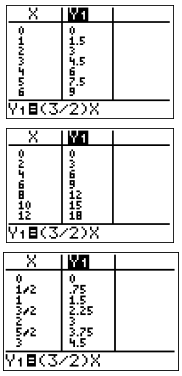
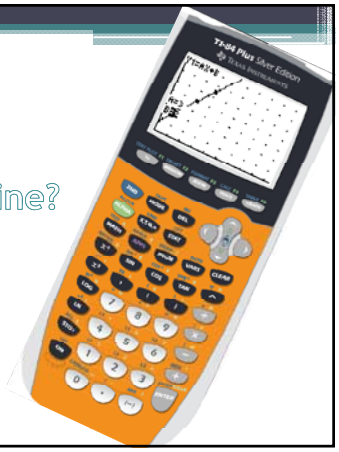
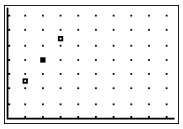


What's My Line?

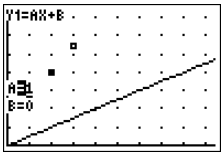


- Each table of data represents a linear function.
- Enter the data in the calculator using L1 and L2 and then create a scatterplot.
- Create a graph of the data in an appropriate window to view the current values.

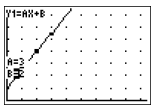


Finding a Line that Fits the Data

- Run the Transformation APPS.
- Enter the equation y1=Ax+B. Set the window so A begins at 1, B begins at 0 and the steps = 1.
- Press Graph to view the current graph and one line.



- Use the left and right cursor arrows to adjust the values of A and B. Use the up and down arrows to move between A and B.
- Adjust A and B until the line passes through the data. When you have found a line that passes through the data, the use the table or graph to find the other values for the function.



Think about the 3 Lessons

- Did the lessons engage you in thinking about the concept of
  - Slope
  - Constant Slope along a Line
  - The meaning of A and B in y=Ax+B
- Were the lesson driven by memorizing formulas for slope or y-intercept form?
- Did a manipulative (geoboard) give you hands-on experience with slope?

- Did you think differently about slope by using the geoboard?
- Did you learn new uses of the graphing calculator in exploring constant rate of change?
- Did the graphing calculator help you understand what A in y=Ax+B controls?
- Did the graphing calculator help you understand what B in y=Ax+B control?

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