Lab Framework

Text: CORD Unit 4, 16

Unit number and title: Unit 16 Solving Problems That Involve Linear Equations

Short Description: In this investigation, students will experiment with how changes in the slope and y-intercept values within a linear equation affect the graph. The desired conclusion should lead students to the understanding that a change in the y-intercept value moves the line vertically up and down the y-axis and that a change in the slope value determines the direction (positive/negative) of the line and the steepness of the incline/decline.

Developed by: Lisa Williksen

Contact Information: East Valley High School
williksenl@evsd.org

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An Investigation on How Changes in the Slope and Y-Intercept Values Affect the Graph of a Linear Equation

LAB PLAN

TEACHER: Teacher Prep/ Lesson Plan

- **Lab Objective**

  Students will graph and re-graph the same linear equation with only one parameter change (i.e. – the only the slope changes or only the y-intercept changes… not both). Students will generate graphs both graphically on their calculators and manually without the aid of a calculator. In both scenarios, students will draw the different parameters for each given equation on the same coordinate grind in different colors to see if a trend appears.

- **Statement of pre-requisite skills needed** (i.e., vocabulary, measurement techniques, formulas, etc.)

  Unit 4: Using Graphs, Charts, and Tables
  Knowledge on entering equations and reading graphs on a graphing calculator

- **Vocabulary**

  Origin, Axis, Graph, Slope, $y=mx + b$, y-intercept, Scale, Title, Labels, Graph Units, Coordinate grind

- **Materials List**

  TI-84 graphing calculators
  Lab Worksheets
  5 to 6 different colors of colored pencils or pens
  Ruler

- **State Standards addressed**

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Math:

A1.3.B Represent a function with a symbolic expression, as a graph, in a table, and using words, and make connections among these representations.

A1.4.B Write and graph an equation for a line given the slope and the *y*-intercept, the slope and a point on the line, or two points on the line, and translate between forms of linear equations.

A1.4.E Describe how changes in the parameters of linear functions and functions containing an absolute value of a linear expression affect their graphs and the relationships they represent.

A1.6.B Make valid inferences and draw conclusions based on data.

A1.8.E Read and interpret diagrams, graphs, and text containing the symbols, language, and conventions of mathematics.

A1.8.F Summarize mathematical ideas with precision and efficiency for a given audience and purpose.

A1.8.G Synthesize information to draw conclusions, and evaluate the arguments and conclusions of others.

A1.8.H Use inductive reasoning about algebra and the properties of numbers to make conjectures, and use deductive reasoning to prove or disprove conjectures.

Communication:

C 2.2.2 – Applies skills and strategies to contribute responsibly in a group setting.

- **Leadership Skills**

  Students work in teams to hypothesis, create their graphs, analyze their graphs and make a conclusion. The students must communicate clearly in order to clearly describe their observation of the trend or lack of trend. Once grouped, each team will collect height and shoe length data and report it to the front of the class. Each group is required to verify that all data is correct and legible.

- **SCAN Skills/Workplace Skills**

  Writing

  B. Records information completely and accurately.

  Arithmetic

  A. Performs basic computations

  D. And uses tables, graphs, diagrams, and charts to obtain or convey quantities

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- **Set Up Information**
  - Have graphing calculators available
  - Have 5 to 6 different colors of pencils/pens for each group
  - Have copies of the lab worksheet for each student.
  - Assign students to work in pairs, but each student must turn in their own lab sheets

- **Lab organization**(-Grouping/leadership opportunities/cooperative learning expectations; -**Timeline required)**
  - Students are to work in pairs.
  - Creating their hypothesis and creating their graphs is collaborative, though each individual must record the data/graph on their own worksheets.
  - Students are expected to work together helping each other make accurate graphs.
  - Students are expected to use polite classroom conduct.

- **Teacher Assessment of student learning** (scoring guide, rubric)
  - ✓ Each student will turn in a completed lab sheet, with their hypothesis, all graphs completed and their conclusion.

- **Summary of learning**

  -Real World Applications

  In any industry, you create an algebraic equation to solve the problem/question at hand. You should use the knowledge of how changing parameters affects the graph of a solution to discuss possible solutions and their impacts. This allows the business to discuss a variety of solution proposals and determine the best solution for their company.

- **Optional activities**

  Students could extend the parameter changes to include true algebraic equations to solve a problem and present them with new "parameters" and they need to apply these changes to their graph and interpret how these changes affected the business.

- **Career Applications**

  All careers can utilize this skill as can all individuals in their personal lives. Should have an open classroom discussion on how students are already using this in their lives today… they just haven't thought of it as a mathematical graphing.

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LAB TITLE: Understanding Parameter Changes on Linear Equation Graphs
STUDENT INSTRUCTIONS:

- **Statement of problem addressed by lab**
  What relationship exists between the slope value in a linear equation and the graph of the equation?
  What happens to a graph when the slope value is changed when all other values are the same?
  What relationship exists between the y-intercept value in a linear equation and the graph of the equation?
  What happens to a graph when the y-intercept value is changed when all other values are the same?

- **Grouping instructions and roles**
  All students will be assigned a partner. Both partners should discuss and determine a mutually agreed upon hypothesis and conclusion. The partners should also have very similar graphs and there should be agreed and cooperation on how to complete each step/question on the lab sheet. Each individual will record their own lab sheet.

- **Procedures** – steps to follow/instructions
  1. Pass out Lab Sheet
  2. Go through Pre-Lab Expectations
  3. Group students
  4. Work Time for Students
  5. Group presentations to the class on their hypothesis and conclusions

- **Outcome instructions**
  Each student will turn in their completed lab sheet after their group presentation of their hypothesis and conclusion

- **Assessment instructions** (peer-teacher)
  Each student is to turn in a completed lab sheet with all graphs completed and all required information.

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Name: _____
Period: _____

Math Lab #1

Title: Understanding Parameter Changes on Linear Equation Graphs

Objective: How can we predict what the graph of an equation looks like without using a calculator?

Hypothesis:
I think changing the slope value of an equation will do
_____
_____
_____
_____.
I think changing the y-intercept value of an equation will do
_____
_____
_____
_____.

Procedures:

1. Graph each group at the same time on the calculator. Put each group on the same graph.
2. Label each line by drawing the graphs using different colors. Be sure to clearly communicate which equation is which color! (If needed, use **TRACE** to figure out which line is which).
3. Write neatly and make your graphs as exact as possible (use the table **2ND GRAPH** to look up the exact points). You won't be able to make observations about changes if you are not careful.
4. Use the **STANDARD** window (press **ZOOM 6**)

Data:

Complete the 3 groups of graphs below.

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Group 1

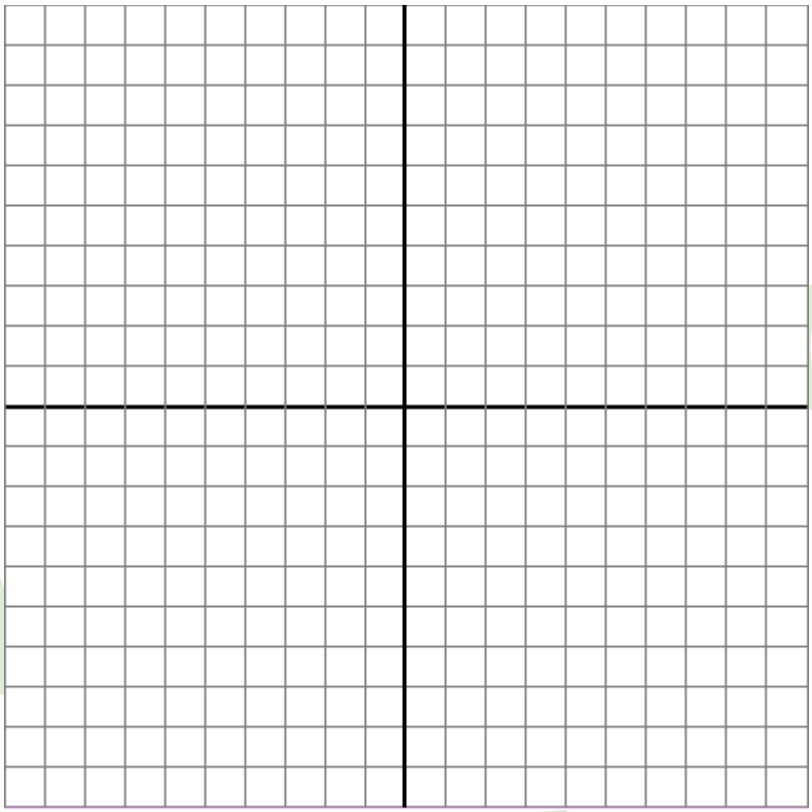
$y = x$

$y = x + 1$

$y = x - 2$

$y = x + 5$

$y = x - 4$



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Group 2

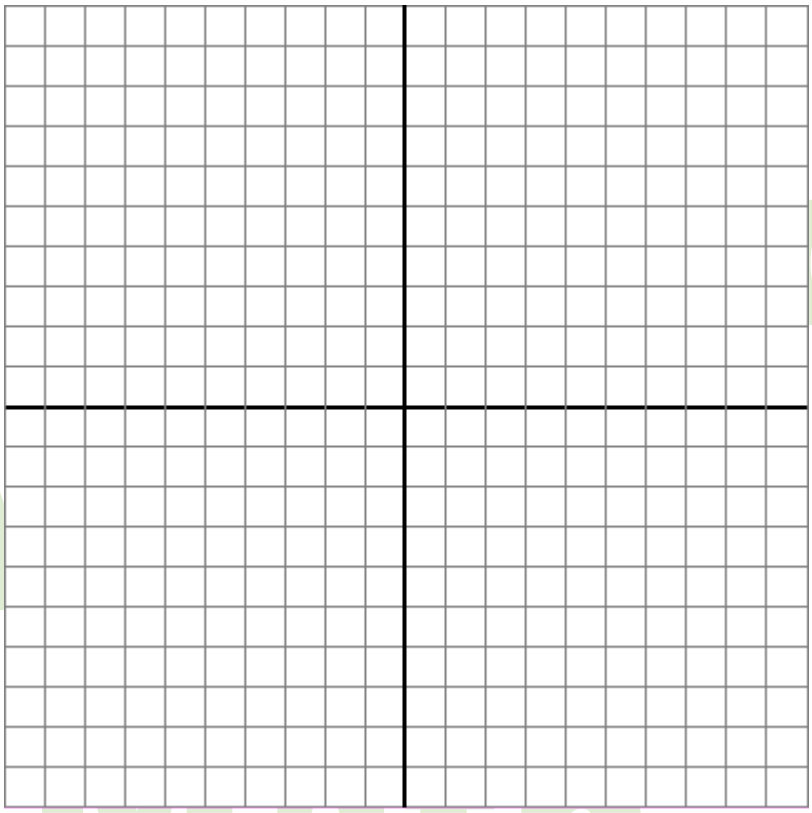
$y = x$

$y = 2x$

$y = 5x$

$y = (1/10)x$

$y = (1/2)x$



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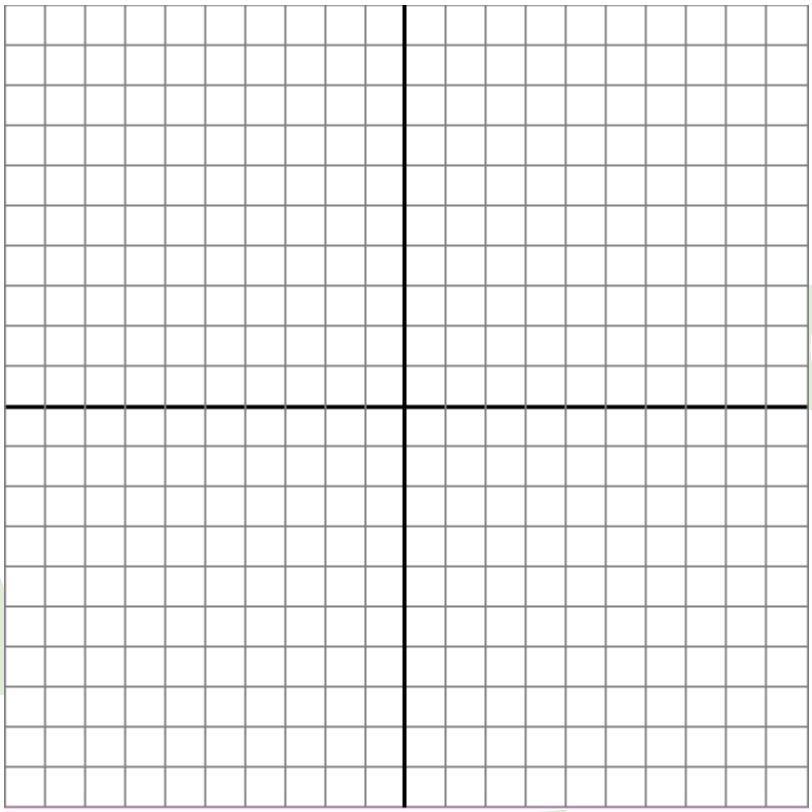
Group 3

$y = x$

$y = -x$

$y = 2x$

$y = -2x$



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Observations:

Group 1:

1. When you add a number to x, what happens to the graph?

   _____

2. When you subtract a number from x, what happens to the graph?

   _____

3. Compare each graph in Group 1 to the **parent function** (y = x). Are the changes in the graph a translation, reflection or rotation?

   _____

Group 2:

4. The bigger the number you multiply by x, what happens to the graph?

   _____

5. When you multiply a fraction times x, what happens to the graph?

   _____

6. Compare each graph in Group 2 to the **parent function** (y = x). Are the changes in the graph a translation, reflection or rotation?

   _____

Group 3:

7. When you multiply a positive number times x, what happens to the graph?

   _____

8. When you multiply a negative number times x, what happens to the graph?

   _____

9. Compare each graph in Group 3 to the **parent function** (y = x). Are the changes in the graph a translation, reflection or rotation?

   _____

Conclusion:

I can predict what the graph of a **linear equation** will look like *without a calculator* by

_____

_____

What I learned in this lab was

_____

_____

_____

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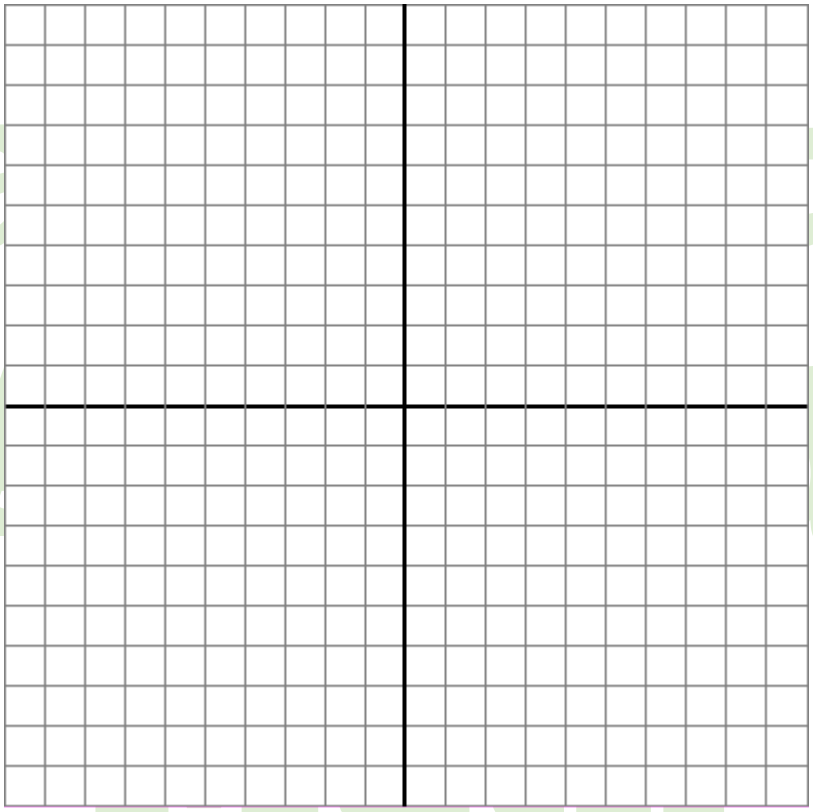
Demonstrate what you learned about graphing linear equations by graphing the equation y = -3x + 4 on the provided graph without using your calculator.



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