

What's My Line?

ID: 4648

Time required

45 minutes

Activity Overview

In this activity, students focus on strengthening understanding of connections among graphical, tabular, and algebraic representations of simple linear functions. They enter a simple calculator program that allows them to determine the equations for lines, in the form $Y = AX + B$, based on tabular and graphical information.

Topic: Algebra

- *Linear Equations*

Teacher Preparation and Notes

- *The coding for the calculator program LINE is given on page 4 of the student worksheet.*
- *The program can be downloaded by linking one calculator to another. Once the program has been downloaded into a second calculator, programs can be downloaded to two other calculators, then to four more, then to eight more, etc. until all classroom calculators contain the LINE program.*
- *If you cannot link calculators, you could enter the program into your calculator and either use the overhead calculator to lead a whole class investigation or spend some time helping the students enter the program into their calculators. Entering the program should take 20-25 minutes.*
- *There are only four grids given on the student worksheet for student to record four different trials of the calculator program. More trials of the program can be completed if desired.*
- ***To download the student worksheet, go to education.ti.com/exchange and enter "4648" in the quick search box.***

Associated Materials

- *WhatsMyLine_Student.doc*

Suggested Related Activities

To download the activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *Introduction to Slope and Intercepts (TI-84 Plus family with TI-Navigator) — 5663*
- *Sack Race (TI-73 Explorer or TI-84 Plus family) — 7989*
- *Matching the Sports Equipment (TI-84 Plus family) — 8063*

The focus of this activity is on strengthening student understanding of connections between graphical, tabular, and algebraic representations of simple linear functions. Encourage students to share their reasoning as they determine the algebraic form of the function from their tables and graphs.

The Problem

The **LINE** program randomly generates values of A and B. Students may choose to see either a graph or a table of ordered pairs that fit the equation $Y = AX + B$ but they will not be told the specific values of A and B used by the calculator. Students will be able to use a table and/or a graph provided by the calculator to deduce the values of A and B that have been selected.

Questions 1 through 7 guide students on how to use the information generated from the program. After discussion of this sample, they will be given instructions on the actual use of the **LINE** program.

Questions 1 and 2

The sample table at the right was generated by the calculator after the **LINE** program was run. This screenshot is also given on the student worksheet.

X	Y1	
-3	5	
-2	6	
-1	7	
0	8	
1	9	
2	10	
3	11	

X = -3

Since the **LINE** program works with random numbers, a different table is generated each time it is run. The program defines $Y1 = AX + B$ so the table gives us the values of the expression $AX + B$ for each of the integers from -3 to 3 .

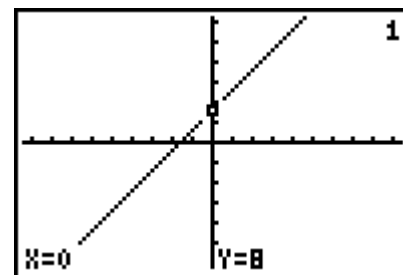
Question 3, 4, and 5

You can study the table and try to guess the values of A and B. For example, $X = 2$ gives $Y = 10$; so by substituting, we get that $(2 \times A) + B = 10$.

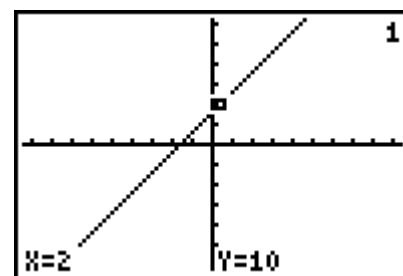
Questions 6 and 7

In addition to generating a table of ordered pairs, students can study a graph of the ordered pairs satisfying $Y = AX + B$.

Students can use **TRACE** to see the coordinates of the points on a graph. The display at the right shows the graphing window after **TRACE** is pressed for the set of sample ordered pairs shown in the table on the previous page. Note that a specific set of values for **X** and **Y** are shown at the bottom of the screen.



Other ordered pairs on the graph can be displayed by pressing **◀** and **▶**. In the example, pressing **▶** twice moves to $X = 2$ and results in the display shown at the right.



Even at this point you may want to have students focus on what information can be gained by examining the graph.

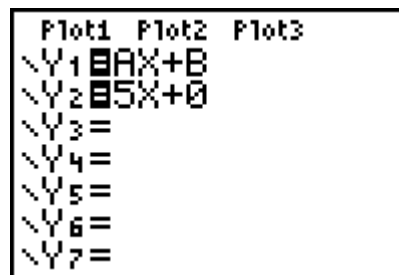
- (1) What information relative to the expression $AX + B$ does the point $(0, 8)$ provide? (It indicates the B value is 8.)
- (2) What is the name for this point? (The y -intercept.)
- (3) How steep does the line appear to be? How does steepness provide information relative to the expression $AX + B$? (Steepness provides a sense of the value of A , the slope.)
- (4) Since the line appears to “rise” as we view it from left to right, what does that indicate about the value of A ? (The slope must be positive.)

The point highlighted on the graph is the same ordered pair used earlier to make conjectures (educated guesses) about the values of A and B .

Assume that, after examining patterns in the ordered pairs shown in the table and/or the graph, you guess that the calculator is using $A = 5$ and $B = 0$. You already know this isn't correct, but we will use it to illustrate how you check a guess. If $A = 5$ and $B = 0$, then the calculator should be using the relationship $Y = 5X + 0$ to produce both the table and the graph.

Explain to students that to check a guess, enter it into the second line of the $\boxed{Y=}$ screen. Instructions for doing this will be provided after the discussion of the example. Students may also just enter $5X$; $5X + 0$ emphasizes the $AX + B$ relationship.

The illustration at the right shows the entry for a guess of $Y = 5X + 0$.

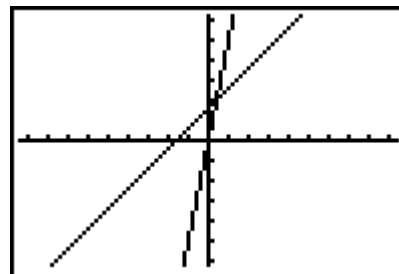


Explain to students that to test the guess, just look at the table of ordered pairs or the graph again. At the right is the new table of ordered pairs generated after the guess for $A = 5$ and $B = 0$ has been entered. Note that the original column of numbers for $Y1$ is still generated but a new column, $Y2$, showing the values associated with the guess, is generated.

X	Y1	Y2
-3	5	-15
-2	6	-10
-1	7	-5
0	8	0
1	9	5
2	10	10
3	11	15

X = -3

A guess can also be tested by looking at a graph of the ordered pairs from the table. A graph for the example is shown at the right.



Using the Calculator

Once students have either entered the program themselves or it has been downloaded to all the calculators, students can begin using the LINE program.

Initially, you may want to pair up the students. They can share with each other their decisions on their choices for A and B. Once students are comfortable with the game, they will enjoy playing it by themselves.



Student Worksheet – Answers

1. When $X = 2$, $Y = 10$.
2. 2 was multiplied by some number, A, and then another number, B, was added to that product to get 10.
3. Try other values for X.
4. For example, $A = 3$ and $B = 4$.
5. No.
6. If the guess were correct, the tabled values under **Y1** and **Y2** would have exactly the same entries; that is obviously not the case for the guess made here.
7. If correct, the two graphs would coincide and it would appear that only one line had been graphed. In this case, two distinct lines are apparent.
8. The table provides a listing of individual points that exist on the graph. The graph includes those points from the table and many more.

Explanation of LINE program code

The first few lines **ClrHome** through **FnOff** set certain features of the calculator to the desirable settings for this activity.

The next two lines **-47→Xmin:47→Xmax:5→Xscl** and **-31→Ymin:31→Ymax:5→Yscl** set up a “friendly” window that (1) forces pixel points to have whole number coordinates and (2) accurately reflects the slope of a line; for example, a line with slope of 1 makes a 45° angle with the x-axis.

The next line **"AX+B"→Y1** places the expression “AX+B” into **Y1**. The “current” values of A and B are used in defining the actual function.

The line **int(13rand)-6→A** generates a random integer value from $\{-6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6\}$ and uses that value to define A (the slope of the line). If you wish to focus only upon non-negative slopes, changing this line to **int 7rand→A** will produce slopes from the set $\{0, 1, 2, 3, 4, 5, 6\}$.

The line **int(33rand)-16→B** produces a random integer value between -16 and $+16$ inclusive and assigns this value to B (the y-intercept of the line).

The last three lines set up the parameters defining the generation of the table of ordered pairs.