Math Objectives

- Students will recognize the relationship between the slope and *y*-intercept of the graph of a line and the parameters, m and b, in the equation of the line *f(x)* =m*x*+b

Vocabulary

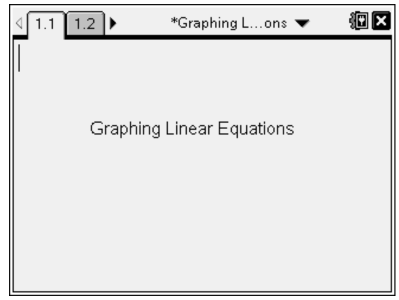
- slope
- functional notation
- transformation
- *y*-intercept

About the Lesson

- This lesson involves creating the graph of a linear equation in two variables written in the form f*(x)* = m*x* + b.
- You can choose to have the students create their own .tns file or you can create one for them. If you create your own file, send it to the class so they can manipulate it and use it to answer the questions in the lesson.
- As a result, students will:
  - Graph the line f(x)=x and obtain the coordinates of the *y*-intercept.
  - Shift the line vertically, and observe the changes in the slope and *y*-intercept.
  - Rotate the line to the left or right, and observe the changes in the slope and *y*-intercept.

TI-Nspire™ Navigator™ System

- Use Screen Capture to observe students' work as they proceed through the activity.
- Use Live Presenter to have a student illustrate how he or she used a certain tool.



TI-Nspire™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages
- Grab and drag a point

Tech Tips:

- Make sure the font size on your TI-Nspire handheld is set to Medium.
- You can hide the function entry line by pressing ctrl G.

Lesson Materials:

Create Instructions
Graphing_Linear_Equations_Create.pdf
Student Activity
Graphing_Linear_Equations_Student.pdf
Graphing_Linear_Equations_Student.doc

TI-Nspire document
Graphing_Linear_Equations.tns

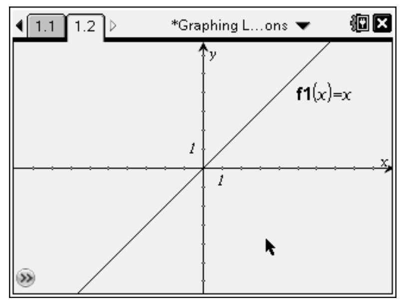
Visit www.mathnspired.com for lesson updates and tech tip videos.

Discussion Points and Possible Answers

Tech Tip: If students experience difficulty dragging a point, check to make sure that they have moved the cursor arrow until it becomes a hand (☝). Instruct students to press ctrl ☝ to grab the point and close the hand (✊).

Teacher Tip: You can choose to have students construct part of this activity as noted below.

Move to page 1.2.



1. Grab the line near the middle of the graph and move it vertically up and down. Shift the line vertically to three different locations and record the equation, slope and y-intercept for each location in the table below.

<u>**Sample Answers**</u>:

equation: **f1(*x*) = *x* – 1.3**	slope: **1**	*y*-intercept: **–1.3**
equation: **f1(*x*) = *x* – 2.08**	slope: **1**	*y*-intercept: **–2.08**
equation: **f1(*x*) = *x* + 3.2**	slope: **1**	*y*-intercept: **3.2**

Note: See the document Graphing*_Linear_Equations_Create* for more directions.

2. a. What do you notice about the slopes and about the *y*-intercepts?

Sample Answers: The slopes remain the same, but the *y*-intercepts keep changing.

b. What is the relationship between the *y*-intercept and the equation? Explain your thinking.

Sample Answers: As the line shifts vertically the *y*-intercept will change. The *y*-coordinate of each point on the line will change according to the shift up or down.

Perform the "undo" feature until the graph is **f1**(*x*) = *x*. Do this by pressing ctrl esc one or more times. If you "undo" too many times, "redo" is ctrl **Y**.

3. Move the line to y=2*x* +1. Grab the line near either "end" of the graph where you see the circular arrows, and move the graph to three different positions. Write the equation, slope, and *y*-intercept of the line for each position.

Sample Answers:

equation: **f1(*x*) = 0.39*x*+1**	slope: **3**	y-intercept: *1*
equation: **f1(*x*) = -0.5*x*+1**	slope: **-0.5**	y-intercept: **1**
equation: **f1(*x*) = 4*x*+1**	slope: **4**	y-intercept: **1**

4. a. What do you notice about the slopes and *y*-intercepts?

Sample Answers: The slopes change, and the *y*-intercept remains the same.

b. Why does only one part of the equation change?

Sample Answers: The only thing that can change is the coefficient of *x* because the *y*- intercept is fixed. The *y*-intercept stays constant.

5. Suppose you have the graph of f1*(x)*=2*x*+3. Describe how you think each graph below will compare to f1(*x*) = 2*x*+3. Explain your reasoning. Check your prediction using the .tns file.

a. f1*(x) = 2x*-4

Sample Answers: The graph will be 7 units below f1(*x*) = 2*x*+3 because each *y*-coordinate will have to be 7 units less.

b. f1(*x*) = -4*x*+3.

Sample Answers: The graph will be going down as you move from left to right, and it will be steeper than the graph of f1(*x*)=*2x*+3 because the *y*-intercept is the same, and each *x*-coordinate will be multiplied by 4, so the line will rise at a faster rate.

6. How would you explain to someone who was not in class the connection between the *y*-intercept and slope of the graph of a line and the equation of the line?

 Sample Answers: Changing the constant term will shift the line vertically up or down. Changing the coefficient of *x* will change the steepness of the line.

> **Teacher Tip:** You might want to give students other tasks relating to changing the slope and *y*-intercept of the equation and how it affects the graph or the other way around. To change the equation, you can press ctrl G and press up on the TouchPad to the line f(1)= and type in a new equation. Have students predict what they think the outcome will be before you press Enter.

Wrap Up

Upon completion of the discussion, ensure that students are able to understand:

- As the value of the *y*-intercept gets larger, the line moves up vertically.
- As the value of the *y*-intercept gets smaller, the line moves down vertically.
- Changing the direction of a line will change the slope.

Assessment

For each of the following equations, describe what the graph should look like (without actually graphing):

1. $f(x) = x + 3$

 Sample Answers: The line slants uphill, and the graph crosses the *y*-axis at $y = 3$.

2. $g(x) = –2x$

 Sample Answers: The line slants downhill, and the graph passes through the origin.

3. $h(x) = 3x – 4$

 Sample Answers: The line slants uphill, and the graph crosses the *y*-axis at $y = –4$.