Educator’s Guide to Graphing $y = mx + b$

Overview: Using an iPad and Sketchpad Explorer, students will graph a linear equation using the y – intercept and slope.

Grades and Subject Areas: High School Algebra

Objective: Students will explore and deepen their understanding graphing a linear equation.

I can statements:
- I can explain how \( m \) influences \( y = mx + b \).
- I can explain how \( b \) influences \( y = mx + b \).
- I can explain how to find \( m \) using rise/run.
- I can explain how \( b \) can be used as my starting point to graph an equation.
- I can graph horizontal lines.
- I can graph vertical lines.

Curriculum Connections/Alaska Standards:

Alaska Math GLE

M5.4.5 Use coordinate geometry to graph linear equations, determine slopes of lines, identify parallel and perpendicular lines, and to find possible solutions to sets of equations.

[9] G-5 graphing or identifying (using equations or formulas to determine the slope of line segments on a coordinate plane) (M5.4.5)
ISTE Student Standards:

1. Creativity and Innovation
   Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students:
   C. Use models and simulations to explore complex systems and issues.

4. Critical Thinking, Problem-Solving & Decision-Making
   Students use critical thinking skills to plan and conduct research, manage projects, solve problems and make informed decisions using appropriate digital tools and resources. Students:
   C. Collect and analyze data to identify solutions and/or make informed decisions.
   B. Use multiple processes and diverse perspectives to explore alternative solutions.

5. Digital Citizenship
   Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:
   A. Advocate and practice safe, legal, and responsible use of information and technology.

ISTE Teacher Standards:

1. Technology Operations and Concepts
   Teachers demonstrate a sound understanding of technology operations and concepts. Teachers:
   B. Demonstrate continual growth in technology knowledge and skills to stay abreast of current and emerging technologies.

2. Planning and Designing Learning Environments and Experiences
   Teachers plan and design effective learning environments and experiences supported by technology. Teachers:
   A. Design developmentally appropriate learning opportunities that apply technology-enhanced instructional strategies to support the diverse needs of learners.
   D. Plan for the management of technology resources within the context of learning activities.
   E. Plan strategies to manage student learning in a technology-enhanced environment.

6. Social, Ethical, Legal, and Human Issues
   Teachers understand the social, ethical, legal, and human issues surrounding the use of technology in PK–12 schools and apply that understanding in practice. Teachers:
   E. Facilitate equitable access to technology resources for all students.

Hardware and Software Needs: Students and teachers will need access to the following:

1. iPads and an iPad 2 with video adaptor or documents camera
2. App “Sketchpad Explorer” an iPad only app.
3. Document Camera
Resources:

Documents needed: Attached “Graphing Linear Equations”

Video Tutorials:
  http://www.atomiclearning.com/k12/geomsketch_mac
  http://www.atomiclearning.com/k12/geomsketch_pc

Web resources:
  http://sketchexchange.keypress.com/

Handouts:
  Students will need a straight edge (ruler).
  Custom Guide to the iPad 2.
Graphing Linear Equations

Lesson Plan

Prep Time: 30 - 45 Minutes

Prior to Lesson: Reserve an iPad cart that has Geometer’s Sketchpad Explorer App. Print and copy the handouts.

Time Needed for Lesson: 90 minutes

Background Knowledge Needed: Some understanding of Algebra and Geometer’s Sketchpad.

Directions: This lesson is broken down into 5 parts. Parts 1 and 2 cover the main objectives of learning how to graph a linear equation using “m” and “b” and can be done in a 45 to 60 minute class period as a stand-alone lesson. Parts 3 – 5 have students explain their understanding of “y=mx+b” as well as look at how to graph horizontal and vertical lines. The lesson directions are designed for the iPad but if you want to use the computer version of “Geometer’s SketchPad” you could use that program instead of the iPads.

Pass out the iPads using the school norms. During this time also go over the student use norms on student expectations during this time as well. (7 minutes)

Pass out the handout titled “Graphing Linear Equations”. Have students go to the website listed on the handout. This will allow them to download the file for the iPad using the app. Go over the basics of iPad touch gestures with students on navigating using the iPad. This should include but not be limited to the Home button, two fingers to zoom in, zoom out and to center your screen as well as how to reload the file if you need to start over from scratch. (10 minutes)

This lesson is best done on a white board that you can use markers on and not a SmartBoard.

Part 1: Learning how to use the y-intercept to graph. (10 minutes)

Go over with the students what the basic equation “y=mx+b” looks like and what “b” represents, the y-intercept. Have students graph several points for the y-intercept based on equations you write on the board. Ask the students to think of what two
common errors might be when graphing the y-intercept. The answers should be similar to:

a. Using the opposite value of the y-intercept.
b. Plotting the y-intercept on the x-axis.

Part 2: Learning to graph using the y-intercept and then slope to graph a linear equation. (15 - 25 minutes)

Now discuss with students what “m” represents and what number form we like our “m” to be represented in fraction form. Cover how to change a whole number, negative, and decimals to fraction form. Remind students that we like to have the negative symbol on top of the fractions. Then explain rise over run and how that will help us graph a linear equation. Explain to students that we start counting our rise and run from our y-intercept.

Part 3: Explore “y=mx+b” using sliders to see how the y-intercept and slope affect the graph of a linear equation. (15 minutes)

I would recommend answering questions 1 – 3b with students as they will have a hard time expressing their answers correctly on these problems. Then give them about 5 to 7 minutes to work on these problems on their own and then go over the answers with the students.

Part 4: Graph a horizontal line. (5 minutes)

Discuss with students what the slope of a horizontal line is and how does that affect the equation on the line that you are graphing. Reinforce with students that you are still intercepting the y-axis and why that is important.

Part 5: Graph a vertical line. (5 minutes)

Discuss with students what the slope of a vertical line is and how does that affect the equation of the line you are graphing. Reinforce with students that you are now intercepting the x-axis and why that is important.

Collect the iPads using the school norms. (7 minutes)
Graphing Linear Equations

Go to the following url address:
bit.ly/graphgsp

Click on the “Algebra” link.
Click on the “Graphing Linear Equations” link.
Click on “Graphing Linear Equation.gsp” download link under “Attachments”.
Then open that file in “Sketch Explorer”.

By the end of the lessons students will have a deeper understanding of the following “I Can” statements.
- I can explain how “m” influences y=mx+b.
- I can explain how “b” influences y=mx+b.
- I can explain how to find “m” using rise/run.
- I can explain how “b” can be used as my starting point to graph an equation.
- I can graph horizontal lines.
- I can graph vertical lines.

Part 1: What is “b”?
Move the point up and down as needed as we give you new points to graph.

1. Based on “y=mx+b”, the “b” value tells us what?

A. Graph a y-intercept of 3

B. Graph a y-intercept of -2.5
Part 2: What is “m”?
Remember that the first thing we do is take care of graphing the y-intercept.

1. What does the “m” represent in “y=mx+b”?

2. If “m” is a whole number or decimal, what should you do to make it easier to use rise over run?

A. Graph $y = -\frac{1}{2}x + 1$

B. Graph $y = \frac{2}{3}x - 2$

C. Graph $y = 0.25x - 2$

D. Graph $y = \frac{1}{3}x + 1.5$
Part 3: Understanding a Graph

1. When you move the slider for m, how is that changing your graphed line?

2. When you move the slider for b, how is that changing your graphed line?

3. a. What variable in “y=mx+b” will be most influence when your graph moves down from left to right?

    b. What would the inequality will be expressed when your graph moves down from left to right (ex: x > 0)?

4. a. What variable in “y=mx+b” will be most influence when your graph moves up from left to right?

    b. What inequality will be expressed when your graph moves up from left to right?

5. a. Move the sliders around so that the given graph becomes a horizontal line.

    b. What variable influences when your graph becomes a horizontal line?

    c. What must that value be?

6. What values of the y-intercept will make the graph intersect the y-axis below the origin and express this as an inequality?

7. What values of b will make the graph intersect the y-axis above the origin and express this as an inequality?
Part 4: Horizontal Lines

1. When graphing a horizontal line, what axis is being intercepted?

2. What letter do we use to graph horizontal lines?

3. What is the slope of a horizontal line?

A. Graph $y = 3$

B. Graph $y = -3.5$
Part 5: Vertical Lines

1. When graphing a vertical line, what axis is being intercepted?

2. What letter do we use to graph vertical lines?

3. What is the slope of a vertical line?

A. Graph $x = 3$

B. Graph $x = -2.5$
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1. What does the “m” represent in “y=mx+b”?

2. If “m” is a whole number or decimal, what should you do to make it easier to use rise over run?

A. Graph $y = -\frac{1}{2}x + 1$

B. Graph $y = \frac{2}{3}x - 2$

C. Graph $y = .25x - 2$

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Part 4: Horizontal Lines

1. When graphing a horizontal line, what axis is being intercepted?

2. What letter do we use to graph horizontal lines?

3. What is the slope of a horizontal line?

A. Graph $y = 3$

B. Graph $y = -3.5$
Part 5: Vertical Lines

1. When graphing a vertical line, what axis is being intercepted?

2. What letter do we use to graph vertical lines?

3. What is the slope of a vertical line?

A. Graph \( x = 3 \)  

B. Graph \( x = -2.5 \)