Exploring Slope-Intercept Form of a Line

PRE-PLANNING

PRIOR KNOWLEDGE

- Know that the slope is calculated with two points on a given line and represents vertical change over horizontal change
- Know that any two points define a line
- Know that coordinate points have two components, x and y

LEARNING GOALS

- Identify the slope and y-intercept of a line given its graph or equation in slope-intercept form
- Given a graphed line, write the equation in slope-intercept form
- Graph a line given an equation in slope-intercept form

Common Core Standards	Common Core Practices
CCSS.Math.Content.8.F.A.3 Interpret the equation *y = mx + b* as defining a linear function, whose graph is a straight line. CCSS.Math.Content.HSF.IF.C.7.a Graph linear and quadratic functions and show intercepts, maxima, and minima.	1. Make sense of problems and persevere in solving them 2. Reason abstractly and quantitatively 5. Use appropriate tools strategically 7. Look for an make use of structure

MATERIALS

- PhET *Graphing Lines* simulation: https://phet.colorado.edu/sims/html/graphing-lines/latest/graphing-lines_en.html
- Computers/tablets for each student
- "Exploring Slope-Intercept Form of a Line" Activity Sheet for each student (see below)

LESSON CYCLE

WARM-UP *5 minutes*

Activate prior knowledge by leading a discussion or having students journal about the following questions:

1. What does the slope fraction describe about a line?
2. How do we know if two graphed lines are *distinct*?

INTRO *7 minutes*

Teacher will…	*Students will…*
• Solicit questions and observations from the class and write them on the board in two columns. Star any responses that are repeated by multiple students. Leave these on the board for the duration of the exploration. • Distribute activity sheets.	**Explore** the Slope-Intercept screen of the sim and think of 1–3 questions or observations.

GUIDED EXPLORATION *15 minutes*

Teacher will…	*Students will…*
• Circulate the room to be available for questions and ask probing/pushing questions, such as: 1. What is the connection between the numbers on the graph and the numbers in the equation of the line? 2. What do the colors on the line equation tickers mean? 3. Compare your actions with your neighbor. What did they do that you didn't think of? What did you do that was interesting to you?	Work on questions 1–3 on the activity sheet while interacting with the Slope-Intercept screen of the sim.

• **#3 Pair-Share**: Prompt students to stop and compare their responses to #2. • Facilitate a brief discussion about #3. Project the sim on the board and call on students to **share aloud their partner's actions/responses to #2**. Have them even demonstrate for the class. • Check in with students about their responses to **#4-5**. You may want to project the sim on the board and call on a few students to share their responses. Come to a consensus together about what *m* and *b* represent. • Circulate the room while students continue working on #6-8.	**Share** responses to #2 and record answers in #3. **Share aloud** #3. Share aloud #4-5. Continue working on activity sheet.
DISCUSSION *15 minutes*	
Teacher will… • Facilitate a class discussion to bridge an understanding across representations. Remind students to close their laptops or turn around so that the sim does not distract them from listening. Use an established teaching strategy such as popcorn discussion (one student answers, calls on the next student to talk), think-pair-share (pose question, allow time to think, turn and talk to partner), or group discussions (print out questions and have groups talk to each other and write down consensus to share aloud with class). Sample questions include: 1. What is the relationship between the first parameter (*m*) and the graphed line? 2. What do lines with the same *m* look like? 3. What is the relationship between the constant (*b*) and the graphed line? 4. What do lines with the same *b* look like? 5. What does the equation of a horizontal line look like? Why? 6. What does the equation of a vertical line look like? Why? 7. Which lines don't have a slope at all? Why is there no slope? What do their equations look like? 8. How can we graph lines (refer to #8) given an equation in the form $y=mx+b$, $y=b$, or $x=c$? • Direct attention to the original questions/observations from the intro. If possible, display the sim on the board during this whole-class discussion. 1. Did we answer all of these questions? Which still need answering? What are some answers that surprised you? 2. (*While pointing out a particular question/observation)* What is this observation referring to? OR Can anyone help us to answer this question?	*Students will…* Share responses to discussion questions. Participate in teacher-facilitated discussion. Open the sim at their desks (if possible) as they try to answer any unresolved questions.

Name: _____ **Class:** _____ **Date:** _____

Exploring Slope-Intercept Form of a Line

Learning Goals

- Identify the slope and y-intercept of a line given its graph or equation
- Write the equation of a line in slope-intercept form
- Graph a line given an equation in slope-intercept form

Activity

1. **Explore** the slope-intercept screen for 5 minutes and think of 1–3 questions or observations.
2. Manipulate parts of the **equation** *or* **graph** and describe the effects of each action below.

Action	What was changed	How the equation is affected	How the graph is affected
Increase the numerator of *m*	☑ The equation ☐ The graph		
	☐ The equation ☐ The graph		
	☐ The equation ☐ The graph		
	☐ The equation ☐ The graph		
	☐ The equation ☐ The graph		

3. **Pair-Share**: Compare your actions in #2 with your partner. Describe an action that your partner took that you didn't.

4. Describe how ***m*** in the equation $y = \boldsymbol{m}x + b$ relates to the graph.

5. Describe how ***b*** in the equation $y = mx + \boldsymbol{b}$ relates to the graph.

Amanda McGarry 9/12/14 1:44 PM
Comment [1]: If there are not enough computers for each student to work individually, students can share a device and work in pairs, alternating who is "driving" sim use. Periodically check in with the class and remind them to switch users.

Make two columns on the board, one for questions and one for observations.

Walk around and note student questions/observations that you will want to write on the board. You may even start handing students a marker to begin writing their questions/observations on the board.

Amanda McGarry 9/12/14 1:44 PM
Comment [2]: Circulate the room to be available for questions and ask probing/pushing questions, such as:
1. What is the connection between the numbers on the graph and the numbers in the equation of the line?
2. What do the colors on the line equation pickers mean?
3. Compare your actions with your neighbor. What did they do that you didn't think of? What did you do that was interesting to you?

Amanda McGarry 9/12/14 1:44 PM
Comment [3]: After partners share, facilitate a brief discussion. It is helpful to project the sim on the board and have students demonstrate an action that they or their partner took so others can observe the resulting equation and graph.

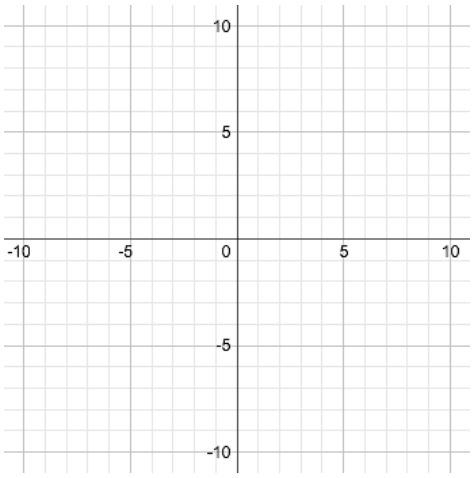
If any original questions/observations are addressed, cross them off (do not erase).

Amanda McGarry 9/12/14 1:44 PM
Comment [4]: After questions 4-5, stop the class and have some students share out their responses. Come to a consensus together about what *m* and *b* represent. If you addressed any original questions/observations that are on the board, cross them off (do not erase).

6. Complete the table below.

How can you…	Explain what you changed	What other changes did you notice?
Make a line steeper?		
Make a line less steep?		
Shift a line up?		
Shift a line down?		

7. Without using the sim, describe how you would graph a line with the equation $y = \frac{1}{5}x - 2$ and graph it on the grid provided.



8. Describe how you would graph any line with the equation $y = mx + b$.

Amanda McGarry 9/12/14 1:44 PM
Comment [5]: Note interesting strategies that students use to answer #7. Where do they start? Are their slopes accurate?

Make note of student responses so you can be sure to call on a variety of students later.

Amanda McGarry 9/12/14 1:44 PM
Comment [6]: This can be difficult to verbalize, so select some students to share their descriptions under a document camera so others can follow along by listening or reading.

Amanda McGarry 9/12/14 1:44 PM
Comment [7]: Now that students have finished their exploration, direct student attention to the original questions on the board. Ask about which still need answering and call on volunteers to answer, justifying their answers using the sim.