

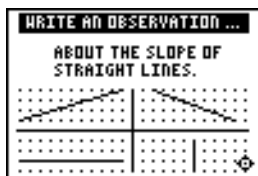
Linear Functions: Slope with Grid Student Worksheet

Overview

The **Overview** introduces the topics covered in **Observations** and **Activities**. Scroll through the **Overview** using \blacktriangleright (\blacktriangleleft to review, if necessary). Read each screen carefully. Look for new terms, definitions, and concepts.

Observations

The **Observations** illustrate the slope of a straight line. Scroll through the **Observations** using \blacktriangleright (\blacktriangleleft to review, if necessary). Read each screen carefully. When you come to a **Write an Observation** screen, stop and write the answers to the questions on your worksheet.



Observation 1

What do you notice about the slope of straight lines? Write your thoughts.

Activities

The **Activities** help you practice determining the slope of a line using a grid. You can select from two activities—**Screen Cross** or **Linked Graphing Calculators Screen Cross**. Follow these steps to play the activity and complete your worksheet.

1. Make sure you are in the **Activities** for this section.
2. Highlight an activity using \blacktriangleup or \blacktriangledown , and press ENTER .

Note: TI-84 Plus family calculators cannot use the USB unit-to-unit cable (Mini-A to Mini-B USB Cable) for the **Linked Graphing Calculators Screen Cross** game. All calculators must be linked using the I/O unit-to-unit cable in the I/O port.

Activities (continued)



Scoring: You get two attempts to solve each problem. You earn 2 points for a correct answer on the first try, 1 point for a correct answer on the second try.

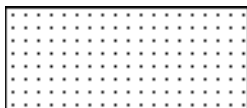
You can earn up to 10 points.

Screen Cross

1. Read the directions on the screen, and then press any key to continue.

Note: Repeat steps 2 and 3 for line segments 2 through 5.

2. Calculate the slope between the two points. Record your work below.
3. Press \uparrow or \downarrow to view the choices for the slope (**UNDEF** = undefined slope). When you think the correct slope is displayed, press **[ENTER]**.



segment 1: _____

segment 2: _____

segment 3: _____

segment 4: _____

segment 5: _____

4. What was your score? _____



Scoring: There are no points awarded in the linked version. You must answer correctly before the next line segment is shown.

The player who reaches the right side of the grid first wins.

Linked Graphing Calculators Screen Cross

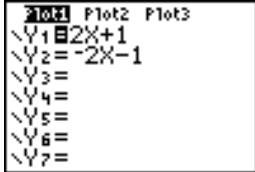

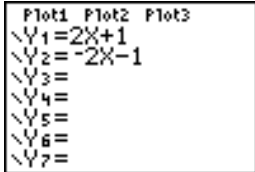




Play Screen Cross against another student. Race another student across the screen by calculating the slopes more quickly than your opponent.

1. Connect two similar graphing calculators using a unit-to-unit cable.
2. Use the grid to help determine the slope of the line segment as quickly as possible.
3. Select the slope as you did in Screen Cross.
4. Who won? _____

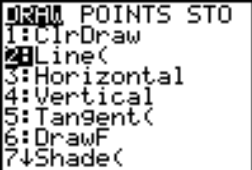

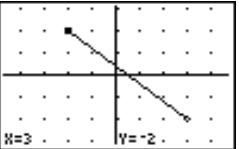
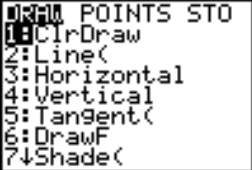
Note: TI-84 Plus family calculators cannot use the USB unit-to-unit cable (Mini-A to Mini-B USB Cable) for this game. All calculators must be linked using the I/O unit-to-unit cable in the I/O port.

 **Try-It!™ on Your TI-83 Plus or TI-73**

Draw a line segment with endpoints at (-2,2) and (3,-2). Use the **Line(** command, which draws line segments on the graph screen.

To Do This	Press	Display (TI-83 Plus shown)
1. Exit the Topics in Algebra 1 application and clear the Home screen.	$\boxed{2\text{nd}}$ [QUIT] \langle [EXIT] [CLEAR]	
2. Check to see if any functions or statistical plots are turned on.	$\boxed{Y=}$	
3. Turn off statistical plots or functions, if necessary. Note: See  Tip™ 8: <i>Creating a Statistical Plot</i> for more information.	$\boxed{\leftarrow}$, $\boxed{\rightarrow}$, $\boxed{\downarrow}$, or $\boxed{\uparrow}$ [ENTER] to deselect	
4. Display the window format screen.	$\boxed{2\text{nd}}$ [FORMAT]	
5. Select GridOn .	TI-83 Plus: $\boxed{\downarrow}$ $\boxed{\downarrow}$ $\boxed{\rightarrow}$ [ENTER] TI-73: $\boxed{\downarrow}$ $\boxed{\rightarrow}$ [ENTER]	
6. Display the ZOOM menu. These settings set the viewing window automatically. Note: For more information, see  Tip 5: <i>Adjusting the Viewing Window</i> .	$\boxed{\text{ZOOM}}$	
7. Select ZDecimal . Note: This also displays the graph screen automatically.	TI-83 Plus: 4:ZDecimal TI-73: 8:ZDecimal	

 **Try-It!™ on Your TI-83 Plus or TI-73 (continued)**

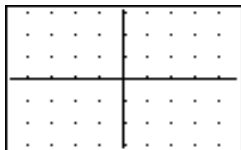
To Do This	Press	Display (TI-83 Plus shown)
8. Select the DRAW menu.	TI-83 Plus: $\boxed{2nd}$ \boxed{DRAW} TI-73: \boxed{DRAW}	
9. Select the Line(command, which draws line segments on the graph screen.	2:Line(
10. Move the cursor to (-2,2). 11. Set the endpoint (-2,2).	$\boxed{\leftarrow}$, $\boxed{\rightarrow}$, $\boxed{\downarrow}$, or $\boxed{\uparrow}$ \boxed{ENTER}	
12. Move the cursor to (3,-2). 13. Set the other endpoint (3,-2). The line segment is drawn.	$\boxed{\leftarrow}$, $\boxed{\rightarrow}$, $\boxed{\downarrow}$, or $\boxed{\uparrow}$ \boxed{ENTER}	
14. Clear your drawing with ClrDraw , if desired.	TI-83 Plus: $\boxed{2nd}$ \boxed{DRAW} 1:ClrDraw TI-73: \boxed{DRAW} 1:ClrDraw	

 **Try-It!™ on Your TI-83 Plus or TI-73 (continued)**

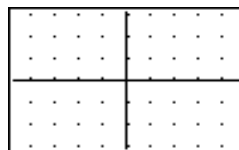
Draw the Slopes!

1. On your graphing calculator, use **Line** to draw segments that have the following slopes (m), and then copy the graph onto the screens below.

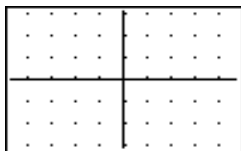
a. $m = 1/2$



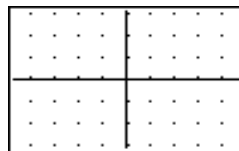
b. $m = 2/4$



c. $m = 3/2$



d. $m = -2/3$



2. Compare your graphs with others in your class. Do you all get the same graph? If not, why?

3. Compare the four segments drawn. Record your observations.

Linear Functions: Slope with Grid

Teacher Notes

Objectives

- To impose a grid on a line to quantify the steepness of a line.
- To introduce slope as the ratio of the vertical change divided by the horizontal change.
- To illustrate the slope characteristics of lines as positive, zero, negative, or undefined (no slope).
- To associate the terms with the appropriate graph of a line: increasing, horizontal, decreasing, or vertical.
- To observe that the slope of a straight line is a constant.

Math Highlights

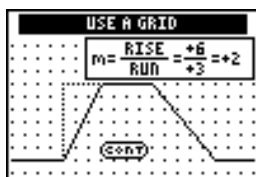
This section defines slope as the steepness of a line. It begins with a bike riding along a piecewise linear path. Students see the definition of slope as a ratio:

$$\text{Slope} = m = \frac{\text{vertical change}}{\text{horizontal change}} = \frac{\text{rise}}{\text{run}}$$

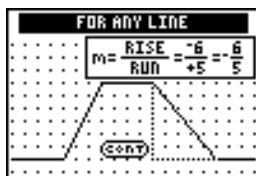
A grid is imposed on the bike path to help illustrate how students can quantify the slope of each line segment. Next, lines with positive, zero, negative, and no slope are illustrated.

Common Student Errors

- Students may have difficulties counting the *spaces* between grid points; therefore, they may count the grid points instead of the spaces. For example, students who count grid points may think that the slope shown on the screen below is $7/4$ instead of $6/3$. Using a Geoboard or grid paper, redraw the line segment to help these students count the distance between the grid points rather than the points themselves.



- In the screen below, the rise/run of the fourth segment is calculated as $-6/5$. For some students, associating “down 6 units, or -6” with the word *rise* can be confusing. The use of the terms *vertical change* or *horizontal change* helps students understand that *change* could be up or down, right or left.



Common Student Errors (continued)

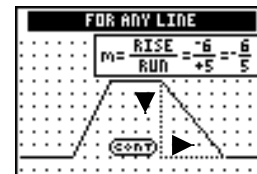
- Students can calculate the slope for the fourth segment in four ways.

With the animation to show direction, students usually will begin counting with the upper left-hand point on the segment.



5 spaces to the right (+5) and
6 spaces down (-6)
to get $-6/5$

or



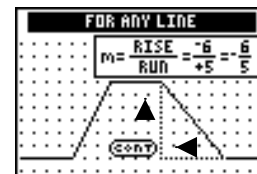
6 spaces down (-6) and
5 spaces to the right (+5)
to get $-6/5$

Without the animation to show direction, students may be as likely to begin counting from the lower right-hand point on the segment.



6 spaces up (+6) and
5 points to the left (-5)
to get $6/-5$

or



5 points to the left (-5) and
6 spaces up (+6)
to get $6/-5$

$$\text{Slope} = m = \frac{6}{-5} = \frac{-6}{5} = -\frac{6}{5}$$

All four ways of counting are correct, resulting in the same slope. The **Observations** reinforce this, stating, "The slope between any two points on a line is always the same ratio."

Student Worksheet Notes with Answers

Overview

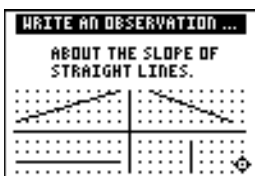
Tell students:

- How to find the **Overview**, or tell them to review the instructions on the worksheet.
- How to navigate the application, if they are not yet familiar with the application.
- To scroll through the **Overview** on the graphing calculator. Point out the new terms, definitions, and concepts, and tell students to look for them as they go through the **Overview**.

Observations

The **Observations** help students understand the slope of a straight line.

If necessary, tell students how to find the **Observations** for this section.



Observation 1

Students write what they observe about the slope of straight lines.

Answers may vary. Students observe that a line has constant slope.

Activities



Scoring: Students get two attempts to solve each problem. They earn 2 points for a correct answer on the first try, 1 point for a correct answer on the second try.

Students can earn up to 10 points.

Screen Cross

Tell students to:

1. Read the directions on the screen, and then press any key to continue.
Note: Repeat steps 2 and 3 for line segments 2 through 5.
2. Calculate the slope between the two endpoints. Record their work.
3. Press \uparrow or \downarrow to view the choices for the slope (**UNDEF** = undefined slope). When they think the correct slope is displayed, press **ENTER**.
4. Record the endpoints and slopes for each segment and their final score. The segments are different on each graphing calculator and each time the game is played.



Scoring: There are no points awarded in the linked version. Students must answer correctly before the next line segment is shown.

The player who reaches the right side of the grid first wins.

Linked Graphing Calculators Screen Cross

Tell students to:

1. Connect two similar graphing calculators using a unit-to-unit cable.
2. Use the grid to help determine as quickly as possible the slope of the line segment.
3. Select the slope as they did in Screen Cross.
4. Record which player won.

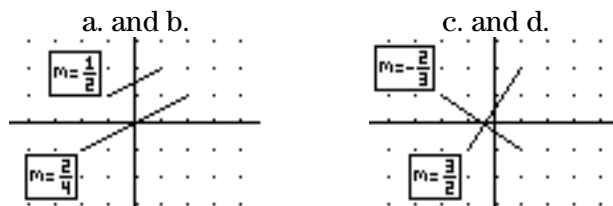
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 **Try-It!™ on Your TI-83 Plus or TI-73**

Students follow the example, which covers drawing a line on the graph screen from specified endpoints using the **Draw** menu.

Draw the Slopes!

1. These are sample answers only. Segment location varies depending on the starting point used.



2. Students should notice that their segments are not necessarily the same as others depending on the starting point used. Later, they will see that the slope **and** a point determine a line.
3. Students should notice that $1/2$ and $2/4$ have the same steepness. These segments are parallel (or on the same line). They should also observe that segments with slopes, $-2/3$ and $3/2$, are perpendicular line segments. See graphs above.