

TI-Nspire Activity: LINEAR EQUATIONS AND THEIR GRAPHS: RATE OF CHANGE
By: Edison Teano, Jr.

Activity Overview

The mathematics goal of this activity is to deepen students' understanding of slope by solving two meaningful and relevant problems involving rate of change. In this activity, students utilize their understanding of patterns and algebraic rules to learn about slopes and y-intercepts. Further, they will make the connection between speed and slope and head start and y-intercept. This activity also develops the language that supports future mathematics learning.

Concepts

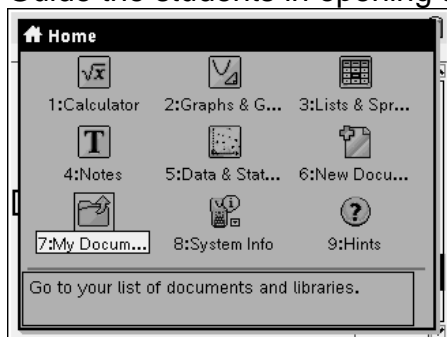
- Coefficient
- Slope
- Rate of change
- Y-intercept
- Dependent variable
- Break-even point

Teacher Preparation

Load *RateofChange2_Contexts.tns* file onto all the students' handhelds. The activity consist of two problems: the first problem is designed to be teacher directed and the second problem is designed to be student centered with time for students to investigate and record their observations. Under The Classroom section below, you will find suggestions to guide the students into deeper understanding of the concept of slopes.

The Classroom

Guide the students in opening the *RateofChange2_Contexts.tns* document.

A screenshot of the TI-Nspire file list interface. The title bar reads "*RateofChange2_Contexts". The list has two columns: "Name" and "Size". The file "RateofChange2_Contexts" is selected and highlighted with a thick border. Other files listed include "GeometrySept08", "STUDENTVERSIONInequalit...", "TEACHERVERSIONInequalit...", "January 14 Rate of Change", "Jill Gough Fast Track", "Julie Riggins", "triangle", "MyLib", and "Document1".

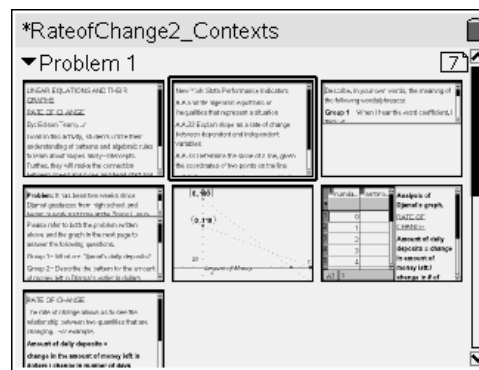
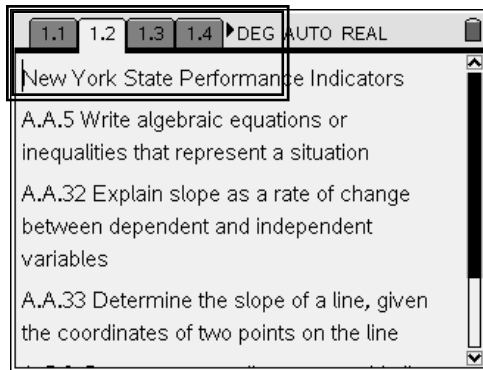
Name	Size
GeometrySept08	8K
STUDENTVERSIONInequalit...	8K
TEACHERVERSIONInequalit...	5K
January 14 Rate of Change	30K
RateofChange_Contexts	20K
* RateofChange2_Contexts	11K
Jill Gough Fast Track	118K
Julie Riggins	43K
triangle	43K
MyLib	41K
Document1	8K

- Turn the device on w
- Press the Home Key c.
- Select 7: My Documents.
- Open the folder containing the TNS file by scrolling to the folder using the NavPad and pressing .

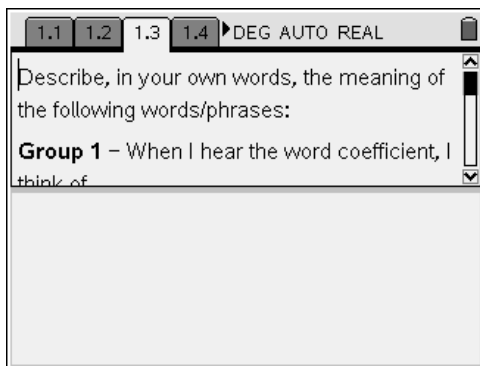
- Scroll to *RateofChange2_Contexts.tns* document and press **.** to open it.
 - ****If asked if you want to save the other document, press the Tab key **e** to highlight the No button and press Enter **.****

Remind the students how to move between pages.

- To move between pages, press **/** and **j** or **ç** on the NavPad.
- To scroll ahead or back several pages in a document, press **/** and **`** to view the Page Sorter view of the document. Use the NavPad to move to the desired page and press the center click key **x** to open the page.

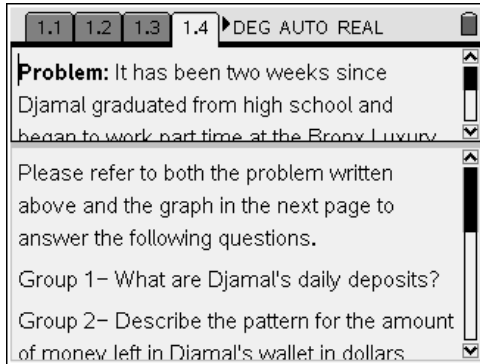


Review the activity performance indicators with the students and have them complete the note application to describe the meaning of the given words. You may use this page as a diagnostic tool to determine students' vocabulary development needs in the lesson and to guide instruction based on the students' familiarity with the concepts to be introduced.

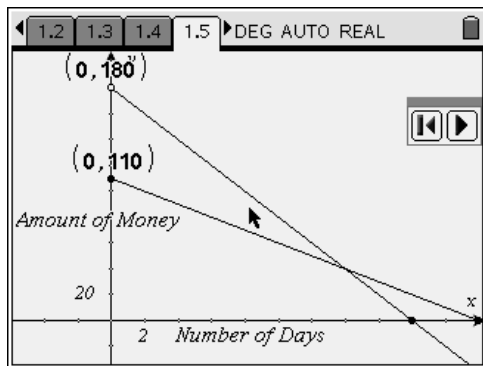


Problem 1 Comments:

Have students skim the text, and then read the problem and questions aloud for the class. Remind students to press / and e to move from the problem to the questions in the page.



On page 1.4, students can read from the problem that Djamal deposits \$10 each day in the piggy bank. On page 1.5, students read the label on each set of axes and use the floating control panel to better understand how the rate of change (\$10 deposit) affects Djamal's amount of money left in his wallet at the end of each day. The set of Djamal's points starts at the coordinate (0,180) and is plotted next at (1,170). This means that Djamal starts with \$180 in his wallet and ends with \$170 at the end of the first day. The intersection point on the graph represents the break-even point, the point at which both Djamal and his sister have the same amount of money in their wallets. Indicate to students that the points for Djamal form a steeper incline than those for his sister. Emphasize to your students that the steepness, or the slope, of the line provides us with information about the rate of change (in our problem, the changing amount of money each day) between two points.



On page 1.6, students use a table to compare the number of days (numdays) to the amount of money (amtmoney) for both Djamal and his sister. By computing with your students several changes in the amount of money, your students should be able to deduce the pattern. From the pattern, students should be able to describe specific

examples and then link the specific examples to general statements about the relationship between the amount of money and the number of days.

Djamal started with \$180 in his wallet and deposited \$10 each day in the piggy bank. Therefore, if x represents the number of days, the amount of money left in Djamal's wallet (y) is $180 - 10x$ or $-10x + 180$. By applying the same reasoning, students should be able to conclude that if x represents the number of days, the amount of money left in Djamal's sister wallet (y) is $110 - 5x$ or $-5x + 110$.

In addition to analyzing Djamal's pattern using a table, students are asked to choose two points from Djamal's table to compute the ratio of the change in amount of money to the change in number of days.

	numda...	amtmo...
1	0	
2	1	
3	2	
4	3	
5	4	

Amount of daily deposits = change in amount of money left / change in # of days. Amount of daily deposits = $() - ()$

Finally, on page 1.7 students choose two points from the table to compute the amount of daily deposits by using the slope formula. Emphasize to the students that the amount of daily deposits is the rate of change, that it determines the steepness of the line; it is the coefficient of the x variable (independent variable), and the slope of the line.

RATE OF CHANGE

The rate of change allows us to see the relationship between two quantities that are changing. For example,

Amount of daily deposits =
change in the amount of money left in dollars / change in number of days

If one quantity depends on the other, then the

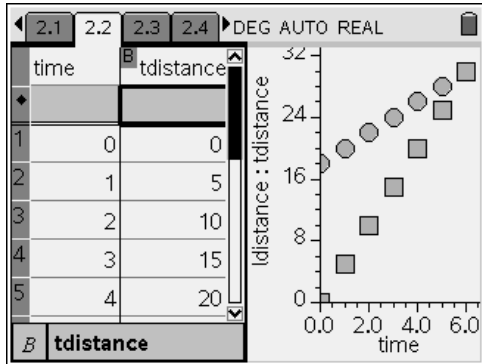
Problem 2 Comments:

On problem 2, students are asked to work in groups to apply their conceptual understanding of slope to solve a problem related to constant speed. On page 2.1, have students skim the text and then answer any questions that they might have about the problem.

QUICK CHECK

Tatiana decides to have a race with her cousin named Lauren. They agree that the finish line is 30 feet from Tatiana's house. Tatiana starts at her house, but she gives Lauren a head start. The coordinate grid given on page 2 of problem 2 shows Tatiana's graph and Lauren's graph for the race.

On page 2.2, students should organize the data in a table to make sense of the context. Then, they should make the connection between the written text, the data contained in the table, and the points on the graph. Further, they could represent the problem with an algebraic relationship: Lauren's distance, $y = 2x + 18$; Tatiana's distance, $y = 5x$, where x represents the time in seconds and y the distance in feet.



After the students have recorded their observations on pages 2.3-2.5, they should each share them with the entire class. Finally, provide students with the opportunity to complete their journal writing on pages 2.6 and 2.7.

1.10 2.1 2.2 2.3 DEG AUTO REAL

1. What is Lauren's speed?
Slope = $(y_2 - y_1) / (x_2 - x_1)$

2. What head start did Tatiana give Lauren?

2.1 2.2 2.3 2.4 DEG AUTO REAL

3. Write an algebraic rule for Lauren's distance Y from Tatiana's house related to time x .

4. Identify the slope and y -intercept of the line.

2.3 2.4 2.5 2.6 DEG AUTO REAL

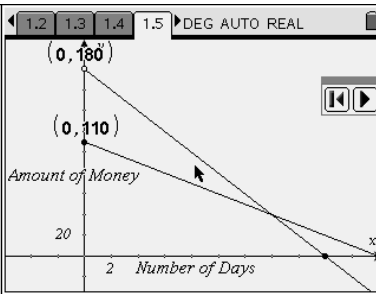
Journal Writing

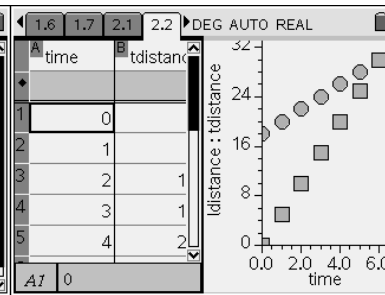
A. Process Used:

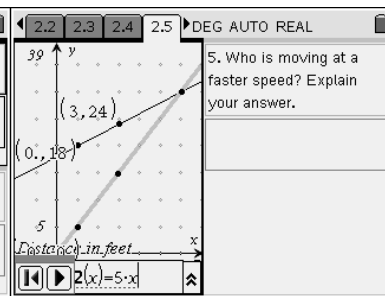
B. Math conclusions or discoveries about the rate of change activity:

The Document

<p>1.1 1.2 1.3 1.4 DEG AUTO REAL</p> <p>LINEAR EQUATIONS AND THEIR GRAPHS</p> <p>RATE OF CHANGE</p> <p>By: Edison Teano, Jr</p> <p>Goal: In this activity, students utilize their understanding of patterns and algebraic rules to learn about slopes and y-intercepts. Further, they will make the connection between speed and slope and head start and</p>	<p>1.1 1.2 1.3 1.4 DEG AUTO REAL</p> <p>New York State Performance Indicators</p> <p>A.A.5 Write algebraic equations or inequalities that represent a situation</p> <p>A.A.32 Explain slope as a rate of change between dependent and independent variables</p> <p>A.A.33 Determine the slope of a line, given the coordinates of two points on the line</p>	<p>1.1 1.2 1.3 1.4 DEG AUTO REAL</p> <p>Describe, in your own words, the meaning of the following words/phrases:</p> <p>Group 1 – When I hear the word coefficient, I think of</p>
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<p>1.1 1.2 1.3 1.4 DEG AUTO REAL</p> <p>Problem: It has been two weeks since Djamal graduated from high school and began to work part time at the Bronx Luxury</p> <p>Please refer to both the problem written above and the graph in the next page to answer the following questions.</p> <p>Group 1– What are Djamal's daily deposits?</p> <p>Group 2– Describe the pattern for the amount of money left in Djamal's wallet in dollars.</p>	<p>1.2 1.3 1.4 1.5 DEG AUTO REAL</p> 	<p>1.4 1.5 1.6 1.7 DEG AUTO REAL</p> <table border="1"> <thead> <tr> <th>A</th> <th>numda...</th> <th>B</th> <th>amtmo...</th> </tr> </thead> <tbody> <tr><td>1</td><td>0</td><td></td><td></td></tr> <tr><td>2</td><td>1</td><td></td><td></td></tr> <tr><td>3</td><td>2</td><td></td><td></td></tr> <tr><td>4</td><td>3</td><td></td><td></td></tr> <tr><td>5</td><td>4</td><td></td><td></td></tr> </tbody> </table> <p>Amount of daily deposits = change in amount of money left / change in # of days. Amount of daily deposits =</p> <p>() - ()</p> <p>() - ()</p>	A	numda...	B	amtmo...	1	0			2	1			3	2			4	3			5	4		
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