

**TI-Nspire Activity:** Solving Systems of Linear Equations by Graphing.  
By: Edison Teano, Jr.

**Activity Overview**

The mathematics goal of this activity is to deepen students' understanding of solving system of linear equations by graphing. First, students will compute the cost of renting a few videos using the calculator. Second, they will input the computed values in a table. Third, they will write the algebraic relationships representing the two video plans. Fourth, they will graph the set of points representing both plans. Finally, they analyze the table and the graphs to find the break-even point, which represents the point when renting a video cost the same in both plans. This activity will further explore the multiple representations of a linear function using tables, graphs, and symbols and discuss their meaning within the given situation.

At the end of a double- period class, the students should be able to:

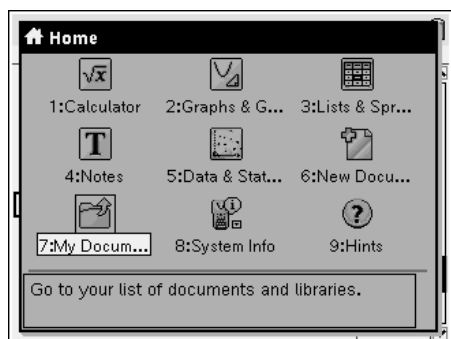
1. Graph the two given equations simultaneously using the TI-Nspire graphing calculator;
2. Give the coordinates of the point of intersection;
3. Solve real world problems by applying the concept of solving systems of linear equations by graphing;
4. Complete the group activity collaboratively; and
5. Make a reflection about the concept learned for the day.

**Concepts**

- System
- A linear equation
- A solution
- Break-even point

**Teacher Preparation**

Load *VideoRental3.tns* file onto all the students' handhelds. The activity consists of a problem designed to be teacher directed 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 solving systems of linear equations by graphing.



VideoRental3	
Name	Size
STUDENTVERSIONInequalit...	8K
TEACHERVERSIONInequalit...	5K
January 14 Rate of Change	38K
RateofChange_Contexts	20K
RateofChange2_Contexts	11K
VideoRental3	8K
Jill Gough Fast Track	118K
Julie Riggins	43K
triangle	43K
MyLib	41K
Document1	8K

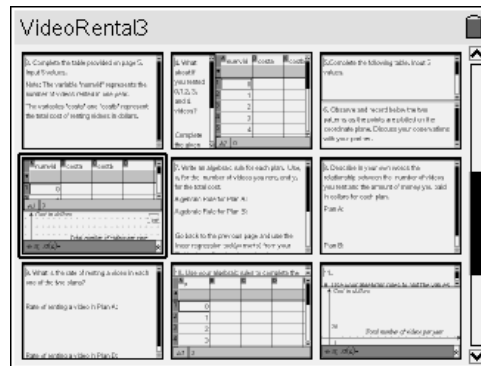
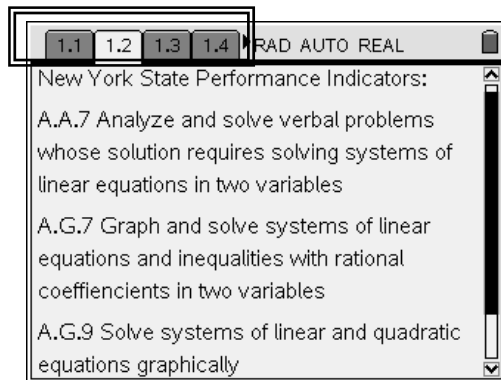
## The Classroom

Guide the students in opening the *VideoRental3.tns* document.

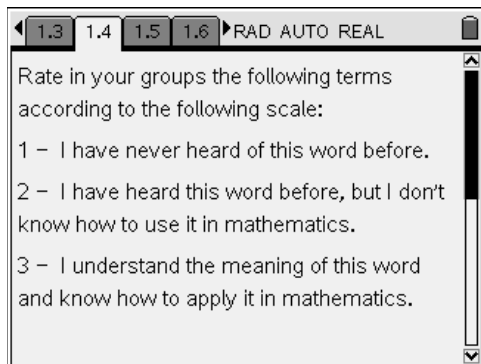
- Turn the device on w
- Press the Home Key c.
- Select 7: My Documents.
- Open the folder containing the TNS file by scrolling to the folder using the NavPad and pressing .
- Scroll to *VideoRental3.tns* document and press . to open it.
  - \*\*If asked if you want to save the other document, press 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's performance indicators with the students and have them complete the knowledge rating on page 1.4 to activate your students' background and prior knowledge of the concepts and academic vocabulary to be used in the lesson. 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.

1.4 1.5 1.6 1.7 RAD AUTO REAL

Problem:

Our Flash Video company will offer a "pay-per-view" club membership.

**Plan A:** Club members will pay \$24 a year for membership and the rental of each video costs only \$4.

**Plan B:** Non-members will pay \$5.50 per video.

On page 1.7, students read from the problem that Plan A club members pay \$4 for the rental of each video and \$24 a year for the membership and that Plan B club members pay \$5.50 for the rental of each video. On page 1.11, students use a table to compare the number of videos rented in one year (numvid) to the total cost of renting videos in dollars (costa and costb) for both Plan A and Plan B. By computing with your students several changes in the total cost of renting videos in dollars, 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 the general statements about the relationship between the total costs of renting videos to the number of videos rented in one year.

1.9 1.10 1.11 1.12 RAD AUTO REAL

4. What about if you rented 0,1,2, 3, and 4 videos?

	A numvid	B costa	C costb
1	0		
2	1		
3	2		
4	3		
5	4		

Complete the given

A 0

On page 1.13, students use a scatter plot to see the relationship between the written text, the values contained in the table, and the set of points plotted on each one of the graphs.

1.11 1.12 1.13 1.14 RAD AUTO REAL

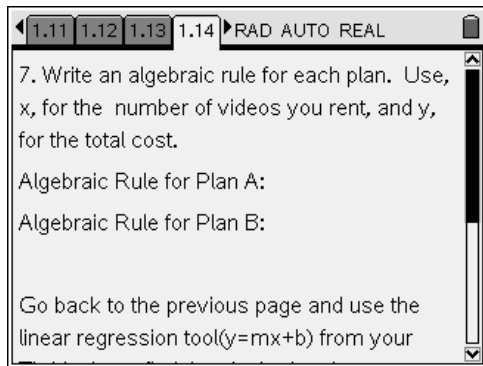
	A numvid	B costa	C costb	D
1	0			
2	1			

Cost in dollars

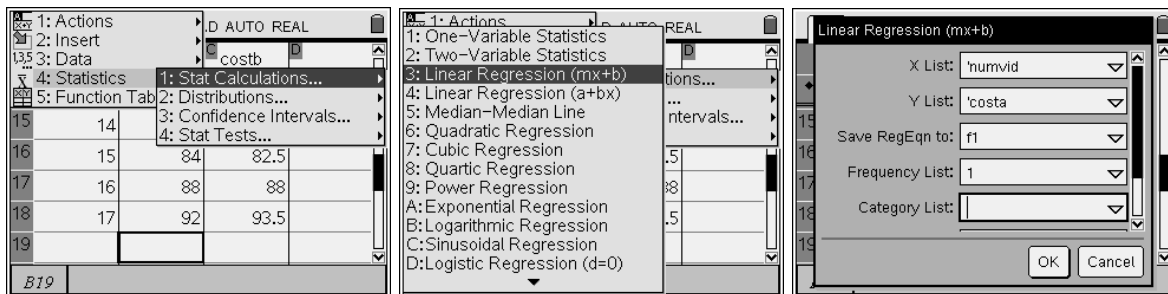
Total number of videos per year

$f(x) =$

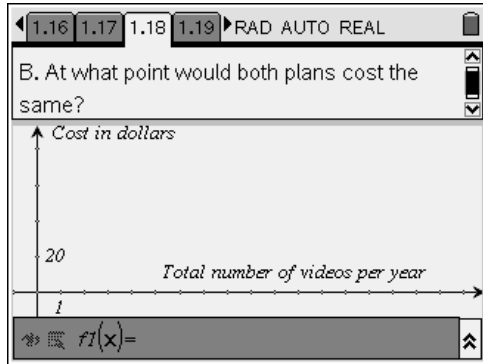
On page 1.13, students read the label on each set of axes and the set of points graphed for each plan to better understand how the membership fee and the cost of renting a video affects the total cost of renting videos in a year. The set of Plan A points starts at the coordinate (0, 24) and is plotted next at (1, 28). This means that Plan A starts with a cost of \$24 for the membership fee and it will cost \$28 for renting one video. The set of Plan B points starts at the coordinate (0, 5.50) and is plotted next at (1, 11). This means that Plan B starts with no fee and costs \$11 for renting one video. The intersection point on the graph represents the break-even point, the point at which both plans cost the same for renting videos. Indicate to the students that the points for Plan B form a steeper incline than those for Plan A. 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 cost of renting one video) between two points.



On page 1.14, students are asked to write an algebraic rule for each plan. Plan A starts with a \$24 membership fee and it costs \$4 to rent a video. Therefore, if  $x$  represents the number of videos, the total cost of renting videos in dollars ( $y$ ) is  $4x + 24$ . By applying the same reasoning, students should be able to conclude that in Plan B if  $x$  represents the number of videos, the total cost of renting videos in dollars ( $y$ ) is  $5x$ . In addition to writing the algebraic relationships for both plans, students are asked to compute the regression equations for both plans using the TI-Nspire calculators.



Finally, on page 1.18 students are asked to input the regression equation in the function entry line and state the point at which both plans cost the same. Emphasize to students that the intersection point on the graph represents the break-even point-for this number of videos, each plan costs the same amount.



After the students have recorded their observations on pages 1.19-1.20, they should each share them with the entire class. Finally, provide students with the opportunity to complete their journal writing on pages 1.21 and 1.22.

The screenshot shows a software window titled 'RAD AUTO REAL' with a navigation bar containing pages 1.18, 1.19, 1.20, and 1.21. The interface is split into two panes. The left pane contains two questions: '12. Which plan is more cost-effective? Why?' and '13. Which plan would you choose? Why?'. The right pane is titled 'Journal Writing' and contains two sections: 'A. Process Used:' and 'B. Math conclusions or discoveries about solving systems of linear equations algebraically activity:'. Both sections have empty text boxes for student input.

## The Document

<p>1.1 1.2 1.3 1.4 ▸ RAD AUTO REAL</p> <p><u>Solving Systems of Linear Equations by Graphing</u></p> <p>By: Edison Teano, Jr.</p> <p><b>Objective:</b> At the end of a double– period class, the students should be able to:</p> <ol style="list-style-type: none"> <li>1. Graph the two given equations simultaneously by using the TI–Nspire calculator;</li> <li>2. give the coordinates of the point of</li> </ol>	<p>1.1 1.2 1.3 1.4 ▸ RAD AUTO REAL</p> <p>New York State Performance Indicators:</p> <p>A.A.7 Analyze and solve verbal problems whose solution requires solving systems of linear equations in two variables</p> <p>A.G.7 Graph and solve systems of linear equations and inequalities with rational coefficients in two variables</p> <p>A.G.9 Solve systems of linear and quadratic equations graphically.</p>	<p>1.1 1.2 1.3 1.4 ▸ RAD AUTO REAL</p> <p>Is there a perfect video rental plan or a cell phone plan?</p> <p>Answer yes or no below and please discuss your response with your partner. Click TAB to answer.</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>
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<p>1.1 1.2 1.3 1.4 ▸ RAD AUTO REAL</p> <p>Rate in your groups the following terms according to the following scale:</p> <ol style="list-style-type: none"> <li>1 – I have never heard of this word before.</li> <li>2 – I have heard this word before, but I don't know how to use it in mathematics.</li> <li>3 – I understand the meaning of this word and know how to apply it in mathematics.</li> </ol>	<p>1.2 1.3 1.4 1.5 ▸ RAD AUTO REAL</p> <p>Group 1: System</p> <p>Group 2: Linear Equation</p>	<p>1.3 1.4 1.5 1.6 ▸ RAD AUTO REAL</p> <p>Group 3: Solution</p> <p>Group 4: Break–Even point</p>
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<p>1.4 1.5 1.6 1.7 ▸ RAD AUTO REAL</p> <p>Problem:</p> <p>Our Flash Video company will offer a “pay–per–view” club membership.</p> <p><b>Plan A:</b> Club members will pay \$24 a year for membership and the rental of each video costs only \$4.</p> <p><b>Plan B:</b> Non–members will pay \$5.50 per video.</p>	<p>1.5 1.6 1.7 1.8 ▸ RAD AUTO REAL</p> <p>1. How much do you pay if you rented one video?</p> <p>2.</p> <p>0/99</p>	<p>1.6 1.7 1.8 1.9 ▸ RAD AUTO REAL</p> <p>video?</p> <p>Plan B(members):</p> <p>0/99</p>
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<p>1.7 1.8 1.9 1.10 ▸ RAD AUTO REAL</p> <p>3. Complete the table provided on page 5. Input 5 values.</p> <p>Note: The variable “numvid” represents the number of videos rented in one year.</p> <p>The variables “costa” and “costb” represent the total cost of renting videos in dollars.</p>	<p>1.8 1.9 1.10 1.11 ▸ RAD AUTO REAL</p> <p>4. What about if you rented 0,1,2, 3, and 4 videos?</p> <table border="1"> <thead> <tr> <th></th> <th>A numvid</th> <th>B costa</th> <th>C costb</th> </tr> </thead> <tbody> <tr><td>1</td><td></td><td>0</td><td></td></tr> <tr><td>2</td><td></td><td>1</td><td></td></tr> <tr><td>3</td><td></td><td>2</td><td></td></tr> <tr><td>4</td><td></td><td>3</td><td></td></tr> <tr><td>5</td><td></td><td>4</td><td></td></tr> <tr><td>A1</td><td>0</td><td></td><td></td></tr> </tbody> </table> <p>Complete the given</p>		A numvid	B costa	C costb	1		0		2		1		3		2		4		3		5		4		A1	0			<p>1.9 1.10 1.11 1.12 ▸ RAD AUTO REAL</p> <p>5. Complete the following table. Input 5 values.</p> <p>6. Observe and record below the two patterns as the points are plotted on the coordinate plane. Discuss your observations with your partner.</p>
	A numvid	B costa	C costb																											
1		0																												
2		1																												
3		2																												
4		3																												
5		4																												
A1	0																													

1.10 1.11 1.12 1.13 RAD AUTO REAL

A	B	C	D
numvid	costa	costb	
1	0		
A1	0		

Cost in dollars

Total number of videos per year

$f(x) =$

1.11 1.12 1.13 1.14 RAD AUTO REAL

7. Write an algebraic rule for each plan. Use,  $x$ , for the number of videos you rent, and  $y$ , for the total cost.

Algebraic Rule for Plan A:

Algebraic Rule for Plan B:

Go back to the previous page and use the linear regression tool( $y=mx+b$ ) from your

1.12 1.13 1.14 1.15 RAD AUTO REAL

8. Describe in your own words the relationship between the number of videos you rent and the amount of money you paid in dollars for each plan.

Plan A:

Plan B:

1.13 1.14 1.15 1.16 RAD AUTO REAL

9. What is the rate of renting a video in each one of the two plans?

Rate of renting a video in Plan A:

Rate of renting a video in Plan B:

1.14 1.15 1.16 1.17 RAD AUTO REAL

10. Use your algebraic rules to complete the

A	B	C	D
x			
1	0		
2	1		
3	2		
4	3		

B1

1.15 1.16 1.17 1.18 RAD AUTO REAL

A. Use your algebraic rules to plot the values on the coordinate grid. Type your algebraic

Cost in dollars

20

1

Total number of videos per year

$f(x) =$

1.16 1.17 1.18 1.19 RAD AUTO REAL

12. Which plan is more cost-effective? Why?

13. Which plan would you choose? Why?

1.17 1.18 1.19 1.20 RAD AUTO REAL

14. Is there a perfect video rental plan or a cell phone plan?

Answer yes or no below and please discuss your response with your partner.

Click TAB to move among pages.

Yes

No

1.18 1.19 1.20 1.21 RAD AUTO REAL

Journal Writing

A. Process Used:

B. Math conclusions or discoveries about solving systems of linear equations algebraically activity:

1.19 1.20 1.21 1.22 RAD AUTO REAL

C. I need to know more about