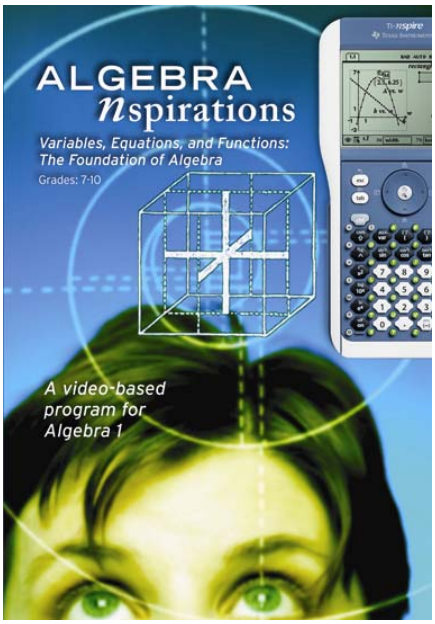
MEDIA 4MATH

ALGEBRA NSPIRATIONS

Variables and Equations: The Foundation of Algebra



Teacher's Guide

Series Overview

For Algebra 1 teachers looking for a video resource that uses graphing calculators, *Algebra Nspirations* provides an ideal solution. Each program in this series focuses on a key topic in algebra and uses real-world examples to explore these topics. In addition, all the relevant calculator keystrokes for the TI-*N*spire calculator are provided. In addition, Math Labs allow for hands-on exploration of these topics.

Program Overview

In this program the TI-Nspire is used to explore the nature of variables, equations, and functions. Part history of math and part exploration into the fundamentals of algebra, this program answers some fundamental questions about the nature of algebra. In addition, problems that involve linear and quadratic equations are solved using the TI-Nspire graphing calculator. Algebra teachers looking to integrate hand-held technology into their instruction will benefit greatly from this series.

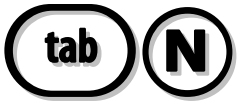
Concepts explored: Variables, equations, functions, formulas, linear functions and equations, quadratic functions and equations, solving equations graphically

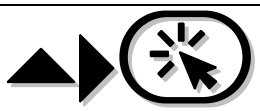
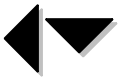
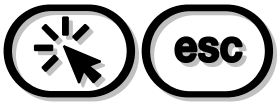
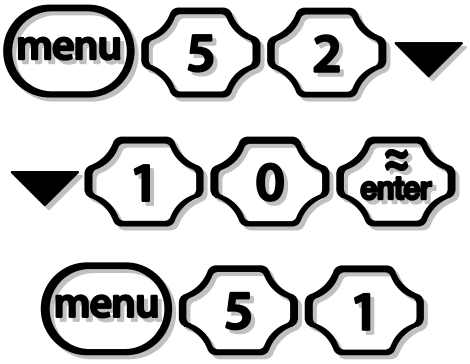
Grades: 7-10

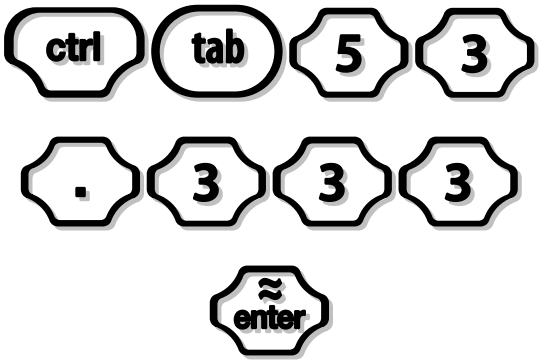
Investigation 1

In this part of the program, students investigate the following scenario using the TI-Nspire:

> You are participating in a bikeathon. You have found a sponsor who pledges 75¢ for each km you bike plus a $10 dollar donation. How many km must you personally ride to raise $50?

TI-*n*spire Keystrokes	
Turn on the *n*spire.	
Press the home key followed by 6, or ctrl N to open a new document.	 OR 
A previous document may be open: if so, a prompt will ask if you wish to save the document. Click to choose "yes" or press tab then click to choose "no."	 OR 
Select 2 to create a Graphs and Geometry Page.	
Input $0.75x + 10$. Press Enter to graph.	 

	
Press esc to move the cursor from the entry line to the work area. To hide the entry line, press Ctrl G.	
Use the Navigation Pad or Nav Pad to move the arrow to a clear area of quadrant one. Press and hold the Click button down until the pointer changes to a grasping hand. Use the Nav Pad again to drag the origin to the bottom left corner of the monitor. Press esc to exit the grab-and-drag feature.	 (changes to)  
Next press menu. Under Window, select Zoom Out. Move the center box to the center of the screen then click twice. Press esc.	 (Use  to move the pointer to the middle of the screen) 
Press menu again and under trace select trace settings. Press the down arrow ▼and select Enter Value. Type 10 then tab to OK and press Enter. Go back to trace again and this time select graph trace. Your cursor is on the point (0, 10) meaning that if you walk zero km, you'll raise $10, your sponsor's up-front donation.	

Press the right arrow several times. As x increases so does y. This yields a rising graph. These points show the money you'll raise (in the y value) for consecutive 10-km increments of the x value.	
Next, press menu and under View select Add Function Table. The graph and table are now side by side. Scrolling down the function column with the down arrow ▼, you can see all the points on this line that have an integer coordinate x. While 50 is not listed in the y-column, it corresponds to an x value between 53 and 54.	 
Press Ctrl and Tab to switch back to the graph. Type 53.333 then press Enter. Your cursor is now on the solution point.	
Solution: Biking $53\frac{1}{3}$ km will yield \$49.999, which concretely is \$50	

Assessment

Use the scenario from the investigation to determine the number of km needed to earn the following amounts.

1. **$100**
2. **$150**
3. **$500**

The following year, your sponsors agreed to pay you 25 cents per km and you had an initial amount of $12. Determine the number of km needed to earn the following amounts.

4. **$100**
5. **$150**
6. **$500**

Investigation 2

In this investigation, students solve the following problem using the TI-Nspire:

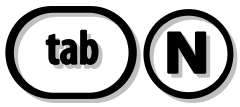
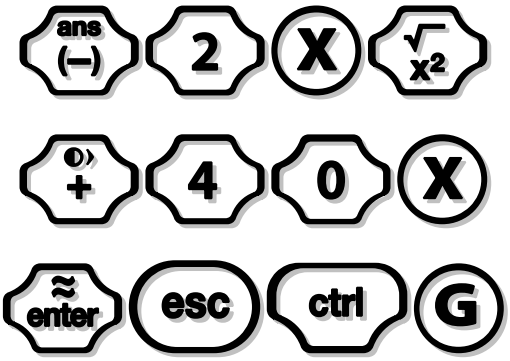
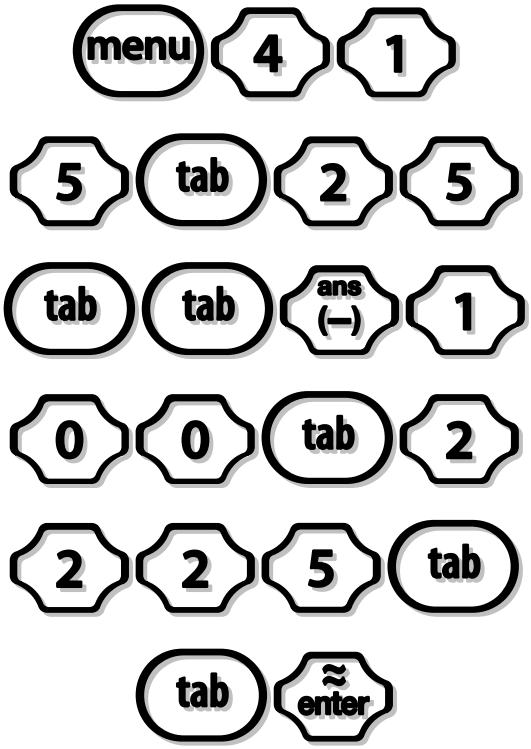
> Suppose you recently acquired a pet and wanted to design a rectangular pen in your backyard. You have 40 feet of fence and you're using the building wall for one of the sides.

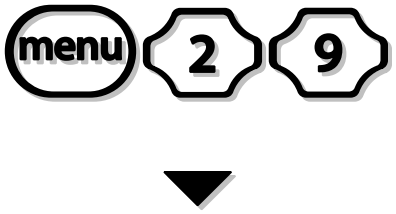
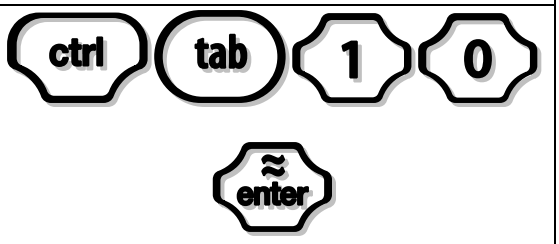
What dimensions would maximize the area of the rectangular pen?

Mathematical Background

PERIMETER	**AREA**
$2w+l=40$ $2w+l=40 \Leftrightarrow l=40-2w$	$A=w\bullet l$ $A=w(40-2w)$ $A=40w-2w^2$ $A=-2w^2+40w$

TI-*n*spire Keystrokes	
Turn on the *n*spire.	
Press the home key followed by 6, or **ctrl N** to open a new document.	 OR 
A previous document may be open: if so, a prompt will ask if you wish to save the document. Click to choose	

"yes" or press tab then click to choose "no."	OR 
Select 2 to create a Graphs and Geometry Page.	
Enter $-2x^2+40x$ for f1(x). Press Enter to graph, Esc to move to the work area, and Ctrl G to hide the entry line.	
Press Menu and under Window select window settings. Enter the following: –5, 25, –100, and 225; press tab from one to the next. Select OK.	
This graph of a quadratic function is called a parabola. Press Menu and under Trace select Graph Trace. The cursor is on the origin and the z indicates the function's first zero. A	

zero width obviously gives a zero area.	
Factoring f(x) gives 20 as our second zero so type 20 next, then press Enter. That's our second zero: a width of 20 gives a length of zero, which also yields a zero area. Notice that the function's zeros occur on the x axis—where y is zero.	
Press menu and under view, select Function Table. Scroll down and you'll see all the points we've encountered: (0, 0), (5, 150), (15, 150), and (20, 0). Scroll back up and you'll find the maximum area of 200 when the width is 10. In this case, the length would be 20 and 10 times 20 is 200 sq. ft.	
Lastly, press Ctrl and Tab to switch back to the graph. Type 10 then press Enter. The maximum area corresponds to the highest point of the graph.	

Assessment

Find the maximum for the following parabolas.

1. $y = -x^2 + 4$
2. $y = 7x - x^2 - 10$
3. $y = 5x - x^2 + 14$
4. **Some parabolas have a minimum, instead of a maximum value. Graph each of the parabolas from questions 1-3. Determine if each has a minimum that shares an x-coordinate with the corresponding maximum.**