TI-nspire™

Grade level: 10
Subject: mathematics
Time required: 45 to 90 minutes

Key Features of a Parabola

by – Patricia Kehoe

Activity overview

The purpose of this activity is to identify ordered pairs from the graphs of parabolas rising from applications, and to interpret their meaning. The graphs will be generated from their equations using the TI-Nspire technology.

Concepts

Features of a parabola: the equation of the axis of symmetry, the coordinates of the vertex, the y-intercept, the x-intercepts, the maximum or minimum value

Teacher preparation

*The teacher will run off handouts for the four different stations that students rotate through. In addition the teacher will provide each student with the handout **Demo: Key Features of a Parabola** that gives step by step instructions for the skills required for this activity.*

Classroom management tips

*It is suggested that the lesson begin with a teacher directed demonstration using TI-Nspire and the overhead palette to review, or show for the first time, how to graph a quadratic equation on a Graphs & Geometry page and from the graph use the features of TI-Nspire to adjust the window settings and generate specific ordered pairs (See **Demo: Key Features of a Parabola**). As ordered pairs are recorded, discuss with students what the values of the ordered pairs mean relative to the given context. Once the demo is complete students will be divided into groups and go to their assigned stations.*

TI-Nspire Applications

Graphs & Geometry platform: graphing an equation, adjusting window settings, tracing features

Step-by-step directions:

1) <u>Introduction to the Parabola</u>

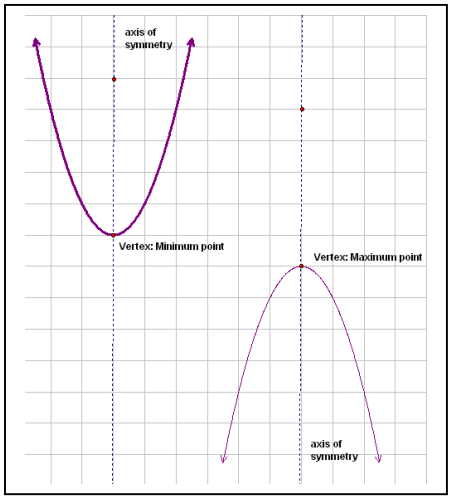
The graph of a quadratic function is a U-shaped curve called a **parabola**.

The point at which the curve changes direction is called the **vertex.**

If the parabola opens upward, then the vertex is a **minimum point** and its y-value is the **minimum value** of the function.

If the parabola opens downward, then the vertex is a **maximum point** and its y-value is the **maximum value** of the function.

The graph is symmetrical about a vertical line, called the **axis of symmetry**.



2) Work through the Demo with class on using TI-Nspire to graph and find specific ordered pairs.

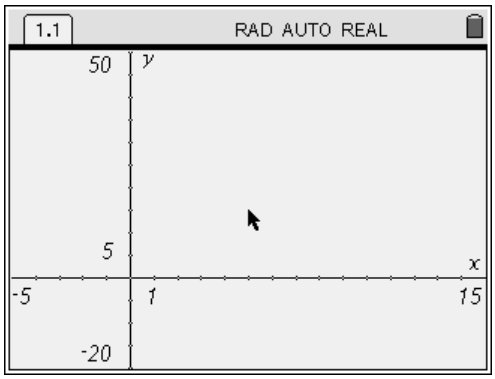
Demo: Key Features of a Parabola

The purpose of this lesson is to explore the graphs of quadratic equations generated by a given equation. You will be asked to:
a) Graph your equation on a Graphs & Geometry page of Ti-Nspire
b) Adjust the window settings from a grid provided
c) Use the trace features of TI-Nspire to find specific ordered pairs
d) Sketch your graph and ordered pairs on the grid provided

Sample Example: A water balloon is thrown into the air so that its height y, in metres, after x seconds, is given by the equation

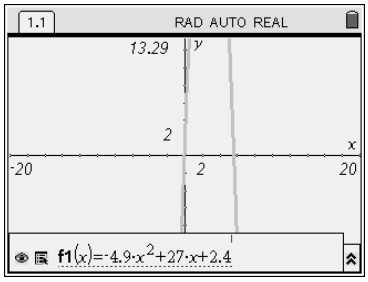
$y = -4.9x^2 + 27x + 2.4$

Grid provided

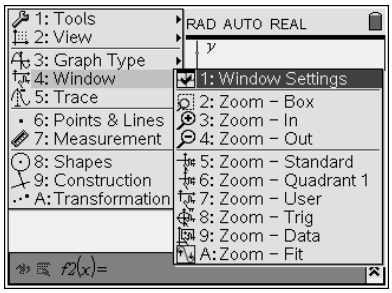


Press (home) (8) (1) and under **Display Digits** select **Float 2** by clicking on the pull down menu. Press (enter).
Use the (tab) key to tab down to **Apply to System** and press (enter). Click on **OK** when asked "Do you wish to apply current settings to system settings?".

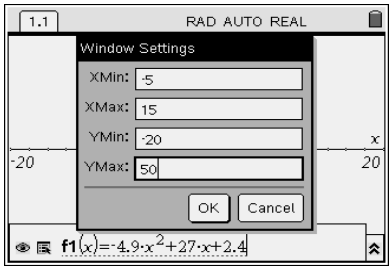
Press (home) (6) to open a new document and Select **2:Graphs and Geometry**. (If you are asked if you wish to save a previous document, click on "No").



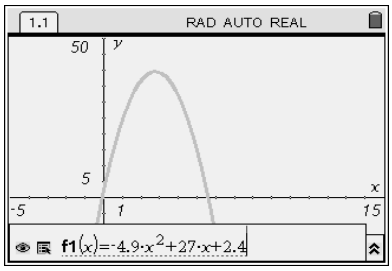
Type in the equation in the **f1** position at the bottom of your screen. Press (enter)



In order to zoom in on the important part of your graph, adjust the window settings by pressing menu 4 1.

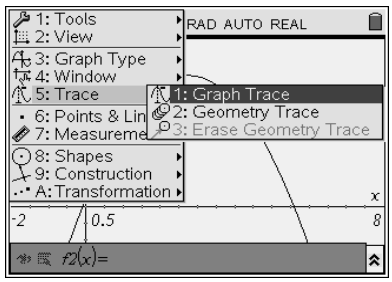


Type in the new values for your window from the grid provided with the example. Use the tab key to move from one box to the other. Click on **OK** .

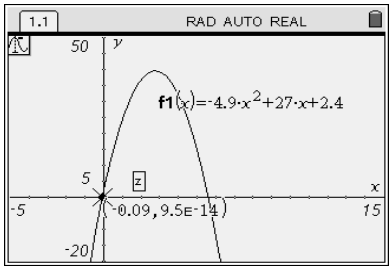


You now have a better view of your graph.
Sketch your graph on the grid provided.

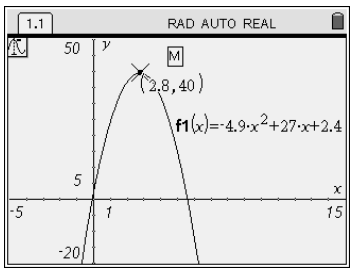
To get rid of the equation entry at the bottom of the screen press ctrl G.



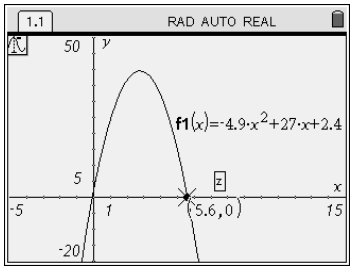
Press menu 5 1 in order to trace on your graph to locate specific points.



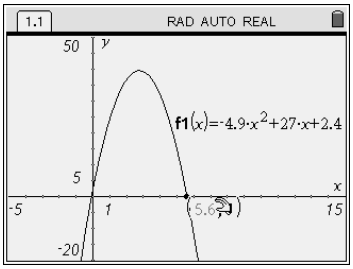
The first point you will see is **an x-intercept**.
You know it is an x-intercept because of the small **z** for zero that appears on the screen.
Record this point as (-0.09,0) on your sketch, as 9.5E-14 can be considered as 0 for this context.



Use the right arrow key on the nav pad to move your point along the graph. You will know you have reached **the vertex** of the graph when you see an **M** appear. (M stands for maximum)
Record this point on your sketch.
Interpret its meaning relative to the context of the water balloon.

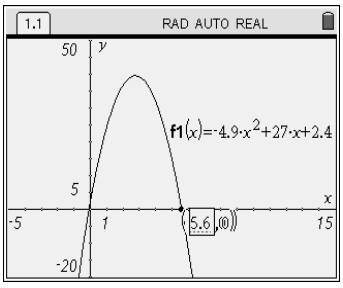


Continue tracing using the right arrow on the nav pad until you reach **the other x-intercept**. (You will know it is the intercept when a small **z** appears beside your point.)
Record this point on your sketch.
Interpret its meaning relative to the context of the water balloon.

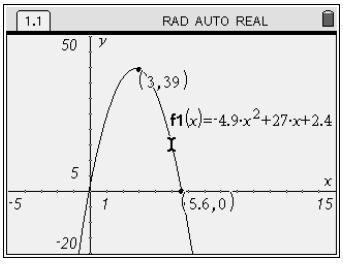


By Pressing enter esc you can keep the ordered pair on the screen.

Move the cursor over the ordered pair until a hand appears.
Press enter enter.



You now have the capability to delete the number 5.6 and type in a new x-value. For example, use the clear button to erase 5.6 and type in 3. Press enter



The cursor will jump to the closest ordered pair that has an x value of 3.

This method can be used to search for other specific points on a graph.

Assessment and evaluation

- *Following the activity, students should submit their completed activity sheets. Results from these submissions will allow the teacher to see which students need additional coaching on the concepts covered.*
- *Answers to student questions provided in the document:* ***Key Features of a Parabola Solutions***

Activity extensions

- *As the solutions are discussed with the group, the teacher can point to the role the values of the coeficients "a", "b", and "c" play in the general quadratic equation* $y = ax^2 + bx + c$
- *Teacher can introduce a fifth station for students to research other quadratic equations (taken from their text, the internet, other resources) and prepare a page similar to one of the stations provided with student generated questions and answers.*

Student TI-Nspire Document :

See documents : ***Key Features of a Parabola Student*** *and* ***Key Features of a Parabola Solutions***

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