

Exploring Parabolas

ID: 19084

Time required

45 minutes

Activity Overview

Students will explore the parabola by investigating links between its standard equation form and its graph. Students will also discover the axis of symmetry and the vertex of a parabola.

Concepts

- Given the parabola equation, $y = a(x - h)^2 + k$, discover the effects that changes in a , h and k have on the graph.

Teacher Preparation and Notes

- Students should be familiar with solving quadratic equations prior to beginning this activity.
- This activity requires the use of CAS technology.
- This activity is designed to either be teacher-led or to allow the students to explore on their own.
- Notes for using the TI-Nspire™ Navigator™ System are included throughout the activity. The use of the Navigator System is not necessary for completion of this activity.
- **To download the student worksheet, go to education.ti.com/exchange and enter “19084” in the keyword search box.**

Associated Materials

- *ExploringParabolas_Student.doc*
- *ExploringParabolas.tns*

Suggested Related Activities

To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

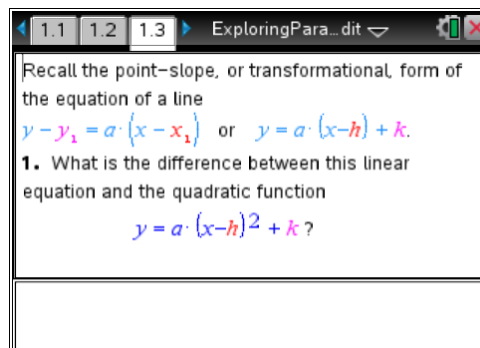
- *Equations of Parabolas (TI-Nspire Technology)* — 10220
- *An Application of Parabolas (TI-Nspire Technology)* — 13364

Problem 1 – Transformational Form of the Equation of a Parabola

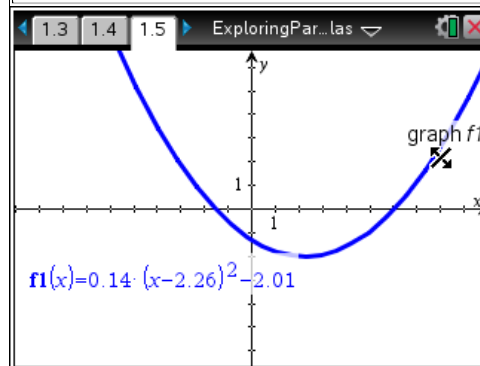
This activity begins by having the students explore the transformational form of a parabola:

$$y = a(x - h)^2 + k$$

On page 1.3, students are asked to determine any differences between the transformational forms of a line and of a parabola.



Page 1.5 allows students to investigate what happens to the values of a , h , and k in the transformational form of a parabola as the parabola is either dragged and/or its branches are resized.

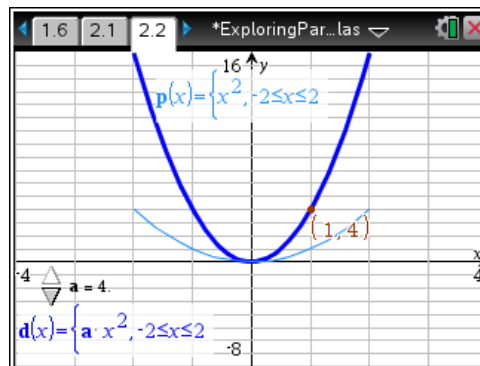


TI-Nspire Navigator Opportunity: Class Capture
See Note 1 at the end of this lesson.

Problem 2 – The Role of the “a” Value

On page 2.2, students can manipulate a slider that will specifically change the value of a in the transformational form and explore the effect it has on the graph.

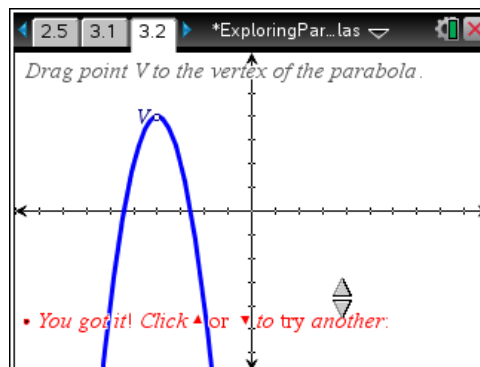
On pages 2.3 and 2.4, students may enjoy reading the story “The Parent Parabola” which supplies a few mnemonics on the effect the value “ a ” has on the graph of the parabola.



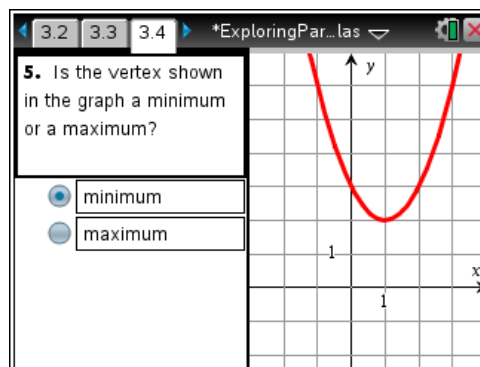
TI-Nspire Navigator Opportunity: Quick Poll
See Note 2 at the end of this lesson.

Problem 3 – The Vertex of a Parabola

On page 3.2, students will explore the definition of the vertex of a parabola by dragging a random point so that it aligns correctly with the location of a randomly graphed parabola. Students will receive a positive message indicating the location of the vertex is correct.



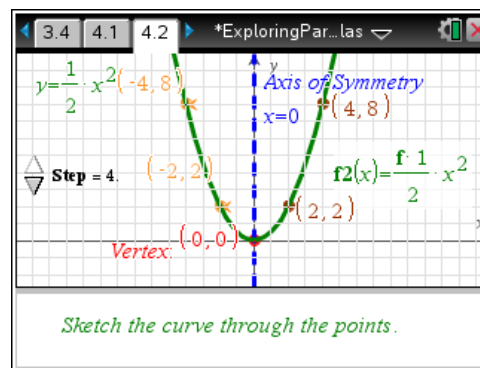
On page 3.3, students will identify the location of a pair of vertices for the graphs of two given parabolas and on page 3.4 students will be asked whether a given graph of a parabola possesses a maximum or a minimum value.



Problem 4 – The Axis of Symmetry of a Parabola

Page 4.1 will discuss the role of the axis of symmetry and page 4.2 will give the students the opportunity to investigate the four steps needed to graph a parabola using a set of points that rely on the location of the axis of symmetry.

Note: Students could use this page as a reference later when they are sketching the graphs of other parabolas by hand.

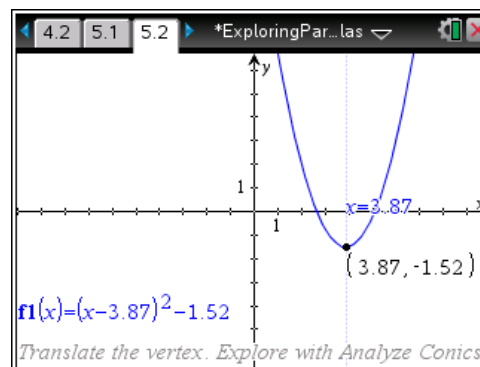


Problem 5 – Analyzing the Graph of a Parabola

Page 5.1 will give students instructions on how to analyze the graph of a parabola by using the Analyze Conics menu.

[menu] > Analyze Graph > Analyze Conics

They will put these instructions to use on page 5.2 by exploring the relationship between the values of h and k within the equation of the parabola and the equation of the axis of symmetry and the coordinates of the vertex.



Solutions – Student activity sheet

1. The quadratic will have a term that is squared. For a quadratic function, the x-term is squared.
2. opens down
3. the vertical scale factor or stretch
4. (1, 2), (-2, -3)
5. minimum

TI-Nspire Navigator Opportunities**Note 1****Problem 1, *Class Capture***

Use class capture to verify students are able to manipulate the moveable points, enter the equations of the conics correctly and perform the various graphical analyses.

Note 2**Problem 2, *Quick Poll***

Use Quick Poll to assess student understanding. Questions 1 through 5 can be used for possible questions to ask.