Exploring Ellipses and Hyperbolas

ID: 19146

Time required
45 minutes

Activity Overview

Students will explore two conic sections, ellipses and hyperbolas, both graphically and analytically.

Topic: Ellipses and Hyperbolas

- *Find the foci and vertices of an ellipse and explore its graph.*
- *Find the foci, vertices and asymptotes of a hyperbola and explore its 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 TI-Nspire document (.tns file) and student worksheet, go to education.ti.com/exchange and enter "19146" in the keyword search box.***

Associated Materials

- *ExploringEllipsesAndHyperbolas_Student.doc*
- *ExploringEllipsesAndHyperbolas.tns*

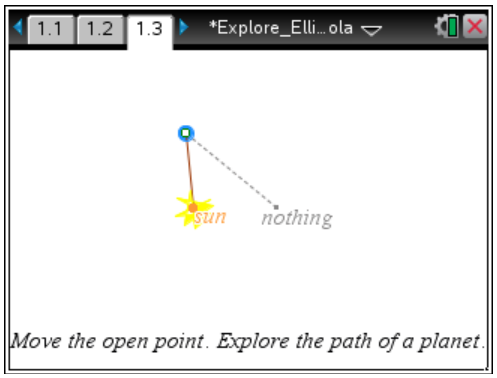
Suggested Related Activities

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

- *Focus/Directrix Definition of Conics (TI-Nspire technology) — 17274*
- *Reflective Property of Conics (TI-Nspire technology) — 17275*
- *Constructing an Ellipse (TI-Nspire technology) — 9980*

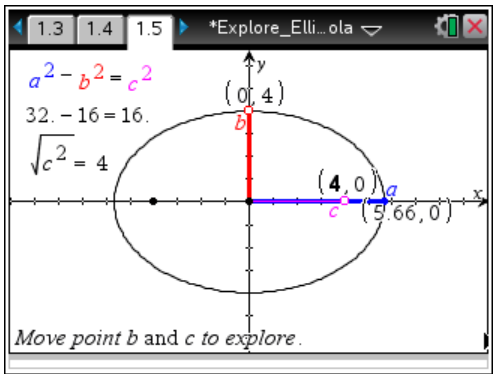
Problem 1 – Ellipses

This activity begins by having the students explore the path of an orbiting planet on page 1.3.



On page 1.4, students are provided with the standard form of the equation of an ellipse with the horizontal axis as the major axis, along with the formula to determine the distance, *c*, of the foci from the center of the ellipse.

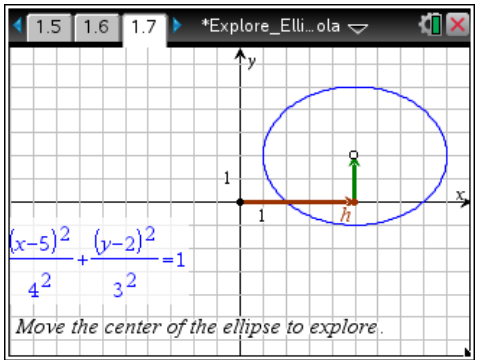
Page 1.5 asks students to further investigate what happens to the graph of an ellipse by manipulating the moveable points to reflect changes in the values of *b* and *c*.



TI-Nspire Navigator Opportunity: *Class Capture*

See Note 1 at the end of this lesson.

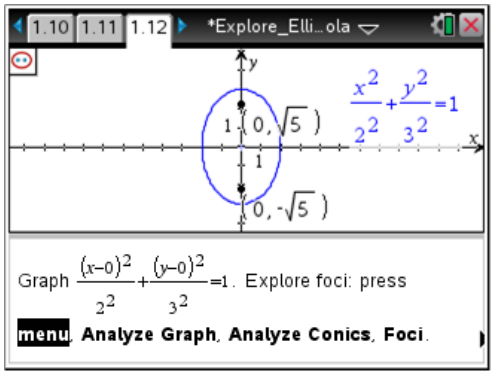
On page 1.7, students will see what happens to the equation of an ellipse when center is moved about the coordinate plane.



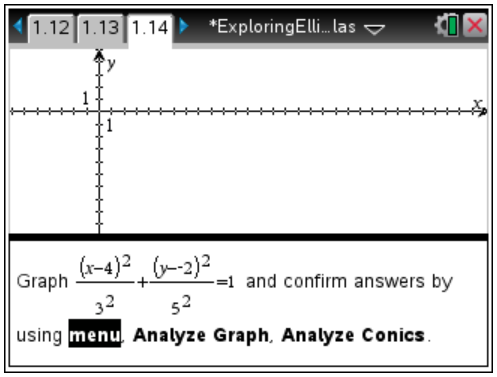
Students will be able to sketch the graph of an ellipse written in standard form on page 1.10 providing further reinforcement of the meaning of the values *h*, *k*, *a*, and *b*.

On page 1.12, students will graph another ellipse and use the **Analyze Conics** feature to plot the foci of the ellipse.

Note: Be sure to remind the students that after they choose menu **> Analyze Graph > Analyze Conics > Foci**, they must click on the graph of the ellipse.



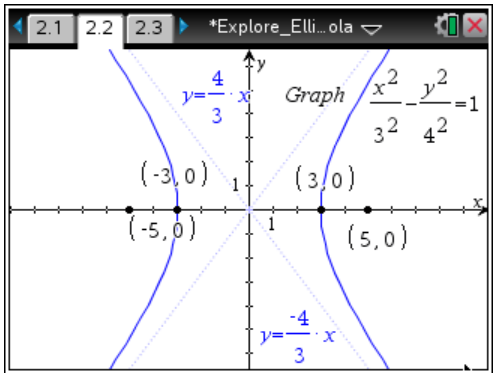
After graphing another ellipse and determining its center and vertices visually on page 1.13, students will have the opportunity to use the Analyze Conics feature on page 1.14 to confirm their findings.



Problem 2 – Hyperbolas

Page 2.1 will present students with the standard form of a hyperbola as well as the formula to determine the distance, c, of the foci from the center of the hyperbola.

On page 2.2, instruct student to graph the hyperbola $\frac{x^2}{9}-\frac{y^2}{16}=1$ and to find the vertices and foci using the graph and the given formulas.



Lastly, on page 2.3, students will be able to use **Analyze Conics** to confirm their results as well as find the equations of the asymptotes.

TI-Nspire Navigator Opportunity: *Quick Poll*

See Note 2 at the end of this lesson.

TI-Nspire™ Navigator™ Opportunities

Note 1
Problem 1, *Class Capture*
Use Class Capture to verify that 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 7 can be used for possible questions to ask.

Solutions – Student activity sheet

1. $\sqrt{5}$

2. *h* gets smaller

3. *k* gets bigger

4. vertically with a length of 6 units

5. (4, –2), (4, 3), (4, –7)

6. (4, 2), (4, –6)

7. $\pm\frac{b}{a}$

8. In standard form, the equation for an ellipse is the sum of the two squared variables and in a hyperbola it is the difference. Hyperbolas have asymptotes; ellipses are closed. The center and vertices for both are found the same way.