

# Analytic Conics

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**Description:** Students explore conic sections analytically. They change parameters in the equation of a conic in standard position and observe changes in the graph, and then explore the general equation of a conic section.

**Technology Strength:** By editing the parameters for two equation forms and immediately seeing the changes in the resulting curve, students build their understanding of analytic representations of conics and visually reinforce concepts they have learned.

**Objectives:** Explore and interpret conic sections both geometrically and analytically; explore the properties of the general second-degree Cartesian equation that defines a conic

**Prerequisites:** Preferably, familiarity with conic sections expressed by equations in standard form and general form

**Suggested Grade Level:** 11 to 12

**Sketchpad Level:** Beginning

**Suggested Duration:** 30 minutes. The sketch manipulations will not take long, but the questions will take a while to answer. Either part of the activity can stand alone.

**Suggested Classroom Setting:** Whole Class, Student Pairs. This activity, designed for use by student pairs, can be easily modified for whole-class use.

**Preparation:** Review the Activity Notes. Preview the student sketch. Work through the steps on the worksheet and make a copy of the worksheet for each student.

**Materials:** None

**Student Worksheet(s):** Analytic Conics

**Student Sketch:** Conics.gsp

**Presentation Sketch:** None

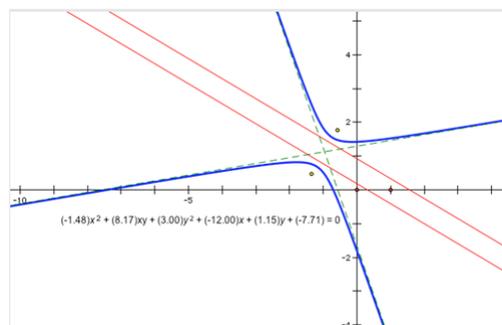
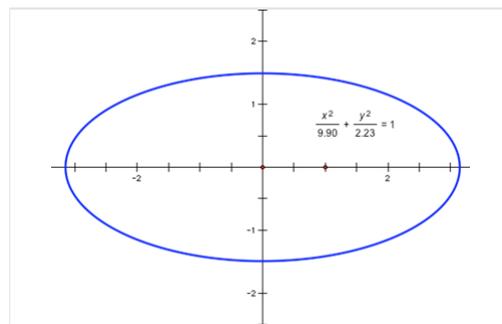
**Vocabulary:** Conics, ellipses, hyperbolas, transverse axis, major axis, minor axis, major radius, minor radius, transverse radius, conjugate radius

**Sketchpad Version:** GSP5

## Using the Sketch:

On page 1 of the sketch, students work with the equations for circles, ellipses, and hyperbolas in standard position and experiment by either editing or animating the two parameters that define these conics. They observe and record the patterns they discover.

On page 2, students work with the general second-degree Cartesian equation that defines a conic and repeat their investigation. They first examine the cases when the coefficient of the  $xy$  term is zero and experiment with either editing or animating the other five parameters that set the values for the coefficients of this equation. They summarize their observations in a table, predicting the general form for each possible conic section. They then edit or animate the parameter that defines the coefficient of the  $xy$  term and see if their predictions hold.



## Sketch Tips:

Sketch Tips show skills needed in this activity, and the step at which the skill is first used.

Sketch Tip	Tip Sheet or Tip Video
Step 1: Change the value of a number (parameter)	Changing Parameters