Name ___________________________

Class ___________________________

Conic equations in polar notation

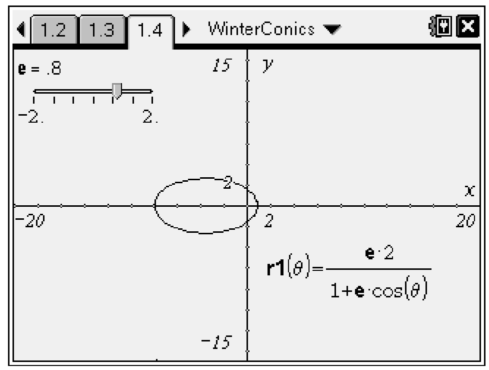
A conic is defined as the locus of points in a plane whose distance from a fixed point (focus) and a fixed line (directrix) is a constant ratio. This ratio is called the eccentricity, *e*, of the conic. The polar notation for the ellipse, hyperbola, and parabola is given by the equation:

$$r = \frac{ed}{1 \pm e\cos(\theta)}, \text{ or } r = \frac{ed}{1 \pm e\sin(\theta)}$$

where *e* is the eccentricity and *d* is the distance from the origin to the directrix.

Which conic is it?

It seems impossible that this one equation can be manipulated into three of the conic sections, but it is true. To observe this, drag the slider that controls the variable *e* for the equation and observe what happens to the graph.



What values of *e* result in a(n):

- Ellipse?

- Hyperbola?

- Parabola?

The *d* variable

What about the distance of the point from the directrix, *d*? How does this control the graph of the equation? Drag the slider that controls the variable *d* on page 2.2 for the equation and observe what happens to the graph.

Experiment with other conic sections and summarize your results below.

The other stuff

On page 3.2, experiment with the formula and observe what happens when the plus sign becomes a minus sign. Also observe what happens when cosine is changes to sine.

Experiment with other conic sections and summarize your results below.

Extension

What happens if a phase shift of *a* is added to the equation? This situation can be represented by the following equation:

$$r = \frac{ed}{1 \pm e\cos(\theta - a)}$$

What happens as the value of *a* is changed? On page 4.2, drag the slider that controls the variable *a* for the equation and observe what happens to the graph.

Experiment with other conic sections and summarize your results below.

Exercises

Determine the conic section for each equation listed below

1. $r = \frac{10}{1 + 3\cos(\theta - 5)}$

2. $r = \frac{3}{1 - \sin(\theta - 6)}$

3. $r = \frac{20}{1 - 0.5\cos(\theta - 2)}$