**Activity 1.2.4a Are Conics Functions?**

In this activity we will use Geogebra to explore graphs of conic sections. Conics sections are circles, parabolas, ellipses, and hyperbolas. Using Geogebra applets, we will determine whether each conic is *always* a function, *sometimes* a function, or *never* a function.

**Circles**: The standard form of the equation of a circle with center at the origin is $x^{2}+y^{2}=r^{2}$, where *r* is the radius of the circle.

Directions:

* Go to <http://tube.geogebra.org/student/m56447>
* Move point A to the origin and point B to (1,0). This creates the graph of the unit circle (circle with center (0,0) and radius of 1). The resulting equation of the graph is shown on the left side of the screen.
1. Is the unit circle a function? Explain.
2. Experiment by moving point B around. What happens?
3. Experiment by moving point A around. What happens?
4. Is a circle *always* a function, *sometimes* a function, or *never* a function? Explain your answer.

**Ellipses**: The standard forms of the equation of an ellipse, centered at the origin, with foci *c* units from the origin are  (major axis is horizontal), or  (major axis is vertical), where $c^{2}=a^{2}-b^{2}$.

Directions:

* Go to <http://tube.geogebra.org/student/m70896>
* The applet contains sliders for the parameters of the standard form of an ellipse. The resulting equation of the graph is shown on the left side of the screen.
1. Move the slider representing the parameter *a*. What happens?
2. Move the slider representing the parameter *b*. What happens?
3. Move the sliders representing the parameters *h* and *k*? What happens?
4. Is an ellipse *always* a function, *sometimes* a function, or *never* a function? Explain your answer

**Parabolas**: The standard forms of the equation of a parabola are:

* $(x-h)^{2}=4p(y-k)$, where the vertex is (*h*, *k*), the axis of symmetry is parallel to the *y*-axis, the focus is (*h*, *k* + *p*), and the directrix is $y=k-p$, or
* $(y-k)^{2}=4p(x-h)$, where the vertex is (*h*, *k*), the axis of symmetry is parallel to the *x*-axis, the focus is (*h* + *p, k*), and the directrix is $x=h-p$.

Directions:

* Go to <http://tube.geogebra.org/student/m35054>
* Select “Vertical Parabola” on the lower left side of the screen. The applet contains sliders for the parameters of the standard form of a parabola. The resulting equation of the graph is shown on the left side of the screen.
1. Move the sliders representing the parameters *h* and *k*. What happens?
2. Move the slider representing the parameter *p*. What happens?
3. Select “Horizontal Parabola” on the lower left side of the screen. Move the slider representing the parameter *h*. What happens?
4. Move the sliders representing the parameters *h* and *k*. What happens?
5. Move the slider representing the parameter *p*. What happens?
6. Is a parabola *always* a function, *sometimes* a function, or *never* a function? Explain your answer.

**Hyperbolas**: The standard forms of the equation of a hyperbola centered at (*h*, *k*) with foci *c* units from the center are (opens to the left and right), OR (opens up and down), where $c^{2}=a^{2}+b^{2}$.

Directions:

* Go to <http://tube.geogebra.org/student/m35056>
* Click “Horizontal Axis” on the lower left side of the screen. The applet contains sliders for the parameters of the standard form of a parabola. The resulting equation of the graph is shown on the left side of the screen.
1. Move the sliders representing the parameters *h* and *k*. What happens?
2. Move the sliders representing the parameters *a* and *b*. What happens?
3. Select “Vertical Axis” on the lower left side of the screen. Move the slider representing the parameter *h*. What happens?
4. Move the sliders representing the parameters *h* and *k*. What happens?
5. Move the sliders representing the parameters *a* and *b*. What happens?
6. Is a hyperbola *always* a function, *sometimes* a function, or *never* a function? Explain your answer.