

## Assignment on CONICOPIA of Fun.

1. Create one of the conic sections (hyperbola or parabola) using string as we did in class. Place it on the origin and write the equation, a, b, c, e, etc all in the proper quadrants.
2. Paper-fold one of the conic sections (hyperbola or ellipse, the one you did not do on part 1) as per instructions on pages 5-7 of the Conicopia packet on Kelly's webpage. Use the graph paper and follow instructions carefully. It should not end up on the origin. Write all of the information requested in the proper quadrant.
3. Another definition of the conic sections:

In the plane, let  $\mathbf{l}$  be a fixed line (the directrix) and F be a fixed point (the focus) not on the line. The set of points P for which the ratio of the distance  $|PF|$  from the focus to the distance  $|PL|$  from the line is a positive constant  $e$  (the eccentricity), that is, the set of points P that satisfy

$|PF| = e|PL|$  is called a conic.

If  $0 < e < 1$ , it is an ellipse

If  $e = 1$ , it is a parabola

If  $e > 1$ , it is a hyperbola

Sketch how this definition works for each of the conics

for  $e = \frac{1}{2}$ ,  $e = 1$  and  $e = 2$

4. Find the area of the ellipse  $b^2x^2 + a^2y^2 = a^2b^2$ 
  - a. Find the volume of the solid if this ellipse is revolved about the y-axis.
  - b. Find the volume of the solid if this ellipse is revolved about the x-axis.
  - c. Find the dimensions of a rectangle with the greatest possible area that can be inscribed in this ellipse. Assume the sides of the rectangle are parallel to the axes of the ellipse.
  - d. The region bounded by the hyperbola  $b^2x^2 - a^2y^2 = a^2b^2$  and a vertical line through a focus is revolved about the x-axis. Find the volume of the resulting solid.
5. Do **each** of the following and sketch the results using a graphing program or graphic calculator. Your sketch must be within a window of  $[10,10]$  in both directions and should be a 'square' window. You should have nine pictures with equations, three for each of the parts.
  - a. Write an equation to rotate each of the conic sections by  $60^\circ$ .
  - b. The polar equation of a conic section is  $r = \frac{ed}{1 + e \cos \theta}$  or  $r = \frac{ed}{1 + e \cos \theta}$  where  $e$  is the eccentricity. Find values of  $e$  and  $d$  that produce each of the conic sections in the given window. These should not be too small, but must fit entirely in the window.
  - c. Write the parametric equations for each of the conic sections. These may not have a center or focus at the origin.