

MA 114 MathExcel Worksheet L: Polar Coordinates and Conic Sections

POLAR COORDINATES

- Determine the equation of the tangent line to $r = 3 + 8 \sin(\theta)$ at $\theta = \pi/6$.
- Sketch the region bounded by the line $r = \sec \theta$ and the rays $\theta = 0$ and $\theta = \frac{\pi}{3}$.
 - Compute the area as an integral in polar coordinates.
 - Compute the area using geometry.
- Consider the circle $r = 4 \sin \theta$.
 - Calculate the area as an integral in polar coordinates.
 - Calculate the total length as an integral in polar coordinates.
- For each of the following find the points of horizontal and vertical tangency (if any).
 - $r = 3 + \sin(\theta)$
 - $r = \sin(\theta) \cos^2(\theta); \quad 0 \leq \theta < \pi$.
- Determine the area that lies inside $r = 3 + 2 \sin(\theta)$ and outside $r = 2$.
 - Determine the area that lies outside $r = 3 + 2 \sin(\theta)$ and inside $r = 2$.
 - Determine the area that lies inside both $r = 3 + 2 \sin(\theta)$ and $r = 2$.
- In the following problems, first graph the region on your calculator and then find the area of the region.
 - One petal of $r = \sin(5\theta)$.
 - Interior of $r = 2 - \sin(\theta)$ above the polar axis.
 - Between the loops of $r = 1 + 2 \cos(\theta)$.

CONIC SECTIONS

- Find the vertex, focus, axis, and directrix of the following parabolas:
 - $x^2 - 4y = 0$,
 - $y = x^2 + 3x + 6$,
- Answer the following questions about Ellipses.
 - Is the major axis of the following ellipse horizontal or vertical: $\frac{x^2}{6} + \frac{y^2}{4} = 1$?
 - Locate the major axis, minor axis, foci, and vertices of the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$.
 - Locate the major axis, minor axis, foci, and vertices of the ellipse $9x^2 + 3y^2 - 36x - 6y + 12 = 0$.
 - Find an equation of the ellipse with foci $(0, \pm 2)$ and vertices $(0, \pm 3)$.

9. Find the vertices, foci and asymptotes of the hyperbola and sketch its graph.

(a) $\frac{y^2}{25} - \frac{x^2}{9} = 1$.

(b) $y^2 - 16x^2 = 16$

(c) $x^2 - y^2 + 2y = 2$

(d) $9y^2 - 4x^2 - 36y - 8x = 4$.

10. Identify the type of conic section whose equation is given and find the vertices and foci.

(a) $4x^2 = y^2 + 4$

(b) $x^2 = 4y - 2y^2$

(c) $3x^2 - 6x - 2y = 1$

(d) $4x^2 = y + 4$

(e) $y^2 - 2 = x^2 - 2x$

11. (For fun!) Try to find an equation for an ellipse whose major axis is **not** parallel to the x - or y -axes.