Math 2414 **Graded Homework 3 (Sections 10.1-4)** **Spring 2015**

Instructions:

1) **Due: Friday, March 27, 2015, during the first 10 minutes of class.**
2) **Assignments must be submitted in a blue book – no exceptions. Bluebooks are available at the on campus/off campus bookstore, student union, etc.**
3) **On the front cover, write the following at the top:**
   a) **TA name**
   b) **Your name**
   c) **Assignment name**
   d) **Problem session number**
4) **Write on only the front side of each page.**
5) **Solutions must be presented neatly, completely, and with logical flow.**
6) **15% will be deducted for assignments turned in after the first 10 minutes of class.**
7) **25% will be deducted for assignments which are not neat and orderly.**
8) **15% will be deducted for assignments without your TA's name.**
9) **Assignments will not be accepted after class.**

1. Consider the parametric equations

$$x = \cos t - \sin t$$
$$y = \cos t + \sin t$$
$$0 \le t \le 2\pi$$

   a) Eliminate the parameter *t* to find a Cartesian equation for the parametric curve.

   b) Sketch this parametric curve, indicating with arrows the direction in which the curve is traced.

2. Consider the parametric equations

$$x = te^{2t}$$
$$y = t^2 e^{2t}$$

   a) Find points (*x*,*y*) on the parametric curve where the tangent lines are vertical.
   b) Find points (*x*,*y*) on the parametric curve where the tangent lines are horizontal.
   c) Find the interval(s) where the parametric curve is concave upward.
   d) Find the interval(s) where the parametric curve is concave downward.

3. Find the exact length of the parametric curve.

$$x = \cos^3\left(\frac{\theta}{2}\right)$$
$$y = \sin^3\left(\frac{\theta}{2}\right)$$
$$0 \le \theta \le \frac{\pi}{2}$$

4. Cartesian coordinates are given below for two points.
   a) $\left(-\sqrt{3},1\right)$
   b) $\left(5,-\sqrt{11}\right)$

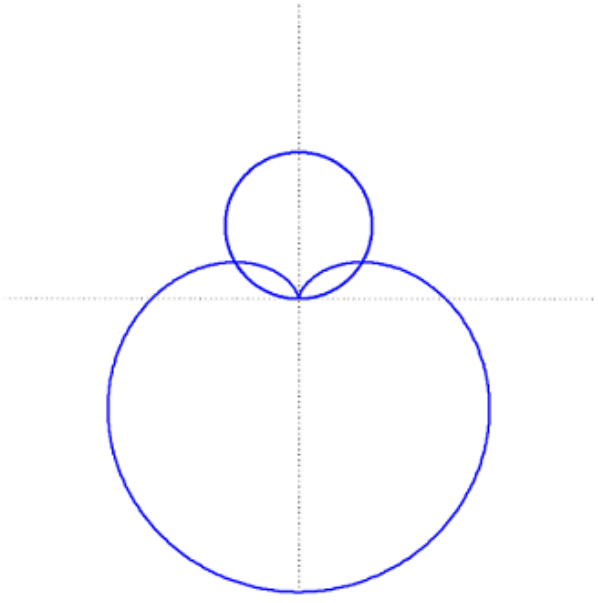
   For each point:

   Find the polar coordinates (r,θ), where $r > 0$ and $0 \le \theta < 2\pi$.

   Find the polar coordinates (r,θ), where $r < 0$ and $0 \le \theta < 2\pi$.

   Give exact answers for all points.

5. Consider the polar graphs, $r = 1 - \sin\theta$ and $r = \sin\theta$, shown in the figure below.



a) Find the polar coordinates (r,θ) for all the points of intersection on the figure.

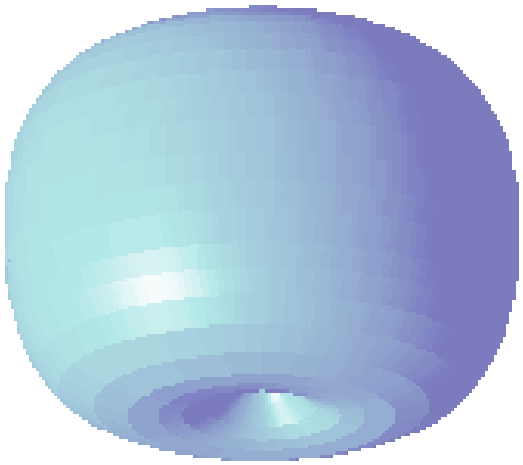
b) Find the area of the region that lies inside both the graph of $r=1-\sin\theta$ and $r=\sin\theta$.

c) Find the slope of the line tangent to the graph of $r=1-\sin\theta$ at $\theta=\pi$.

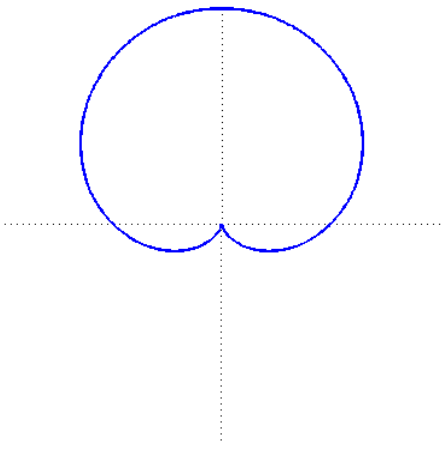
d) Find the Cartesian equation for the line tangent to the graph of $r=1-\sin\theta$ at $\theta=\pi$.

6. Find the arc length of the of the polar curve $r=1-\cos\theta$ on the interval $0\le\theta\le\pi$.

7. For some microphones, the region of sensitivity takes on the shape of a rotated cardioid (see figure).



Consider the graph of the cardioid, $r=1+\sin\theta$, below:



Set up, and evaluate the integral that represents the surface area of rotation of this cardioid about the y-axis. Hint: rotate only the right half of the cardioid.