Name:_____

Math 235 - Calculus III - Spring 2012

Exam 1

INSTRUCTIONS: Show all your work to receive full credit. Books and notes are not allowed.

1. (10 points) Find all the t-values where the parametric curve has a horizontal tangent and all the t-values where the parametric curve has a vertical tangent.

$$x(t) = 2\sin t \quad y(t) = 4\cos(t)$$

2. (5 points) Which of the following is the equation of $r = \frac{6}{3\cos\theta + 2\sin\theta}$ expressed in rectangular coordinates

   (a) $y = \frac{6}{3x+2y}$

   (b) $\sqrt{x^2+y^2} = \frac{6}{3x+2y}$

   (c) $y = 3 - 1.5x$

   (d) $y^2 = \frac{36}{3x+2y} - x^2$

3. (10 points) Find the area inside the cardioid $r = 1 + \cos\theta$ and outside the circle $r = \cos\theta$

4. (7 points) Write down *but do not integrate* an expression for the arc length of the polar curve $r = \sqrt{\theta}$ over the interval from 0 to $\pi/2$.

5. (10 points) Find the equation of the ellipse that has foci at $(-1, 1)$ and $(-1, 3)$ and minor axis of length 4.

6. (8 points each) Given the vector $\mathbf{v}$=$\langle 2, 6, 2 \rangle$and the vector $\mathbf{u} =< 1, 1, 2 >$, compute the following

   (a) $\mathbf{u} \cdot \mathbf{v}$. What does this tell you about the angle between $\mathbf{u}$and $\mathbf{v}$?

   (b) $\mathbf{u} \times \mathbf{v}$

   (c) $\text{proj}_{\mathbf{u}}\mathbf{v}$

7. (10 points) Find the point of intersection of the line and plane.

$$x = 1 + t \qquad y = -1 + 3t \qquad z = 2 + 4t$$
$$x - y + 4z = 7$$

8. (10 points) Find the equation of the plane that contains the point$((2, 0, 3)$ and the line $\quad x = -1 + t \quad y = t \quad z = -4 + 2t$

9. (10 points) Draw a picture that illustrates where the conversions from spherical coordinates to cylindrical coordinates come from.