Test #3 100 points Math 200 Name:______________________________

Simplify your final answers. Show organized work. Defend all answers.

1) Find the center of mass for the lamina that is the part of $1 \le x^2 + y^2 \le 4$ **in the first quadrant** of the xy – plane if its density equals $\frac{1}{\sqrt{x^2 + y^2}}$ grams per square meter. (10 points)

2) Find the moment of inertia about the origin, I_0, for the lamina and density in #1. (5 points)

3) Use Green's Theorem to find the work done by $\vec{F} = \langle y, x^2 \rangle$ on a particle that moves once counterclockwise around the boundary of the lamina from #1. (10 points)

4) Find the volume of the solid that is inside the sphere $\rho = 2$, but **outside** the cone z = r. (10 points)

5) Find the mass of the solid bounded by the cylinder r = 2, the plane $z = -1$, and the plane x + y + z = 5 if the density is $\delta(x, y, z) = \sqrt{x^2 + y^2}$ grams per square cm. (10 points)

6) **Use Green's Theorem** to find the area of the region inside the closed curve C parameterized by $\vec{r}(t) = \langle \cos t + \sin t \, , \sin t \rangle$, $0 \le t \le 2\pi$. (5 points)

7) Find the area of the surface parameterized by $\vec{\alpha}(u,p)=\langle \cos u, \sin u, \sin p\rangle$ for $0 \le u \le \frac{\pi}{2}$, and $0 \le p \le \frac{\pi}{2}$.
(13 points)

8) Find the flux of $\vec{F}(x,y,z)=y\hat{\mathbf{j}}-z\hat{\mathbf{k}}$ through the part of $z=xe^{y}$ with $0 \le x \le 1$ and $0 \le y \le 1$, oriented up.
(12 points)

9) Find the flux of $\vec{F}(x, y, z) = x\hat{\mathbf{i}} - z\hat{\mathbf{j}} + y\hat{\mathbf{k}}$ through the part of $x^2 + y^2 + z^2 = 4$ that lies in the first octant oriented **towards the origin**. (13 points)

9) Find the mass of the part of $y^2 + z^2 = 4$ that lies between x = 0 and x = 3 **in the first octant** if the density is $\delta(x, y, z) = z + x^2 y$ grams/cm^2. (12 points)