Name:

Math 208, Section 3

Exam 3

1. (20 pts.) Find the volume of the region lying under the graph of the function

$$f(x, y) = \cos(x^2 + y^2)+1$$

which lies over the circle of radius 3 in the x-y plane centered at the origin.

2. (20 pts.) A particle moves along a curve C in 3-space, starting at time $t = 0$ at the point (1,0,1), and at every time t, it's **velocity vector** is given by

$$\vec{r}\,'(t) = (2t, 1, 4t^3)$$

What is the particle's position at time $t = 2$?

(Hint: how do you determine $f(t)$, knowing $f'(t)$ and $f(0)$?)

3. (20 pts.) Show that the vector field

$$\vec{F}(x, y) = (2xy, x^2 - y^2)$$

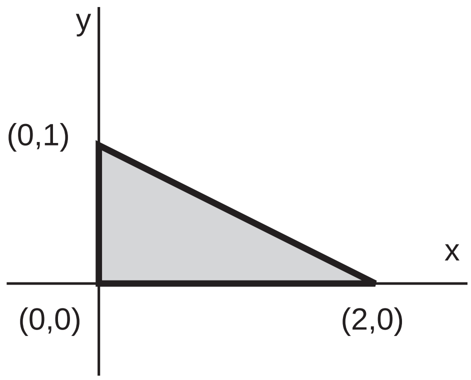
is a conservative vector field, find a potential function for $\vec{F}$, and use this function to compute the line integral of $\vec{F}$ over the parametrized curve

$$\vec{r}(t) = (t^2 \cos t, t \sin^2 t) \quad , \quad 0 \le t \le \pi$$

4. (20 pts.) Use Green's theorem to compute the line integral of the vector field

$$\vec{F}(x, y) = (2xy, y^2 - x^2)$$

over the curve which follows the line segments from (0,0) to (2,0) to (0,1) to (0,0); see figure.



5. (20 pts.) Find the flux integral of the vector field

$$\vec{F}(x, y, z) = (1, x, yz)$$

over that part of the graph of the function

$$z = f(x, y) = xy$$

which lies over the triangle in the plane with vertices (0,0),(1,0), and (1,2) (and using the upward pointing normal for the surface); see figure.