Test #2 100 points Math 200 Name:____________________________________

Circle or box, and simplify your final answers. Show work or some other defense of your answers.

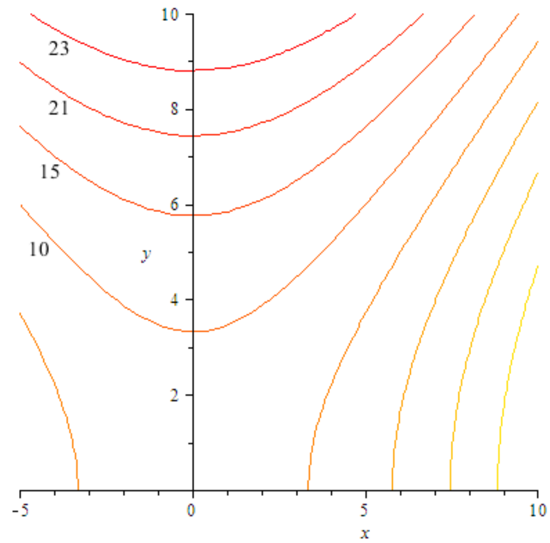
1) a) Find the value of a that makes $\vec{G} = \langle 2axy, 3x^2 + 2y \rangle$ into a conservative vector field and then find a potential for $\vec{G}$ using a method discussed in class. . (9 points)

b) Use the FTCLI to evaluate $\int_C \vec{G} \cdot \overrightarrow{dr}$ if C is parameterized by $\vec{r}(t) = \langle t, \cos(t) \rangle$ for $0 \le t \le \pi$.
(6 points)

2) Sketch the region of integration for I = $\int_0^4 \int_{-2y}^{y^2} f(x, y)\, dxdy$ and then write I as an integral expression with the order of integration switched. (10 points)

3) Find $f_y(1,0)$ if $f(x,y)=g(u,v)=u^2v(1+\ln(v))$ where $u=u(x,y)$, $v=e^y$, $u(1,0)=2$ and $u_y(1,0)=5$. (10 points)

4) The contour plot for $f(x,y)$ is shown. Sketch the gradient vector $\nabla f(2,6)$. How did you decide on the length and direction? (7 points)



5) Find an equation for the tangent plane to the surface $xyz=xy-z^2$ at the point $P=(-4,1,2)$. (8 points)

6) Let $h(3,-2)=4$, $\nabla h(3,-2)=\langle -1,3\rangle$, and unit vector $\hat{a}$ is in the same direction as $\langle 1,1\rangle$. (20 points)

a) Find $D_{\hat{a}}h(3,-2)$.	b) Find the maximum $D_{\hat{u}}h(3,-2)$.
c) Use differentials to estimate $h(3.1,-2.3)$.	d) Find the equation of the tangent plane to z = h(x, y) at $(3,-2,4)$.

7) **Use polar coordinates** to evaluate $I=\int_0^5\int_{-\sqrt{25-y^2}}^0 x^2y\,dxdy$. (10 points)

8) Use double integrals to find I_0, the moment of inertia about (0, 0), of the lamina with density $\delta(x, y) = 1 + \sin x$ that occupies the rectangular region $[-1,1] \times [0,2]$. (10 points)

9) **Use polar coordinates** to find the volume of the solid that is **inside** $x^2 + y^2 + z^2 = 16$ but **outside** $x^2 + y^2 = 4$. (10 points)