Test #1 100 points Math 200 Name:______________________________________

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

1) Find and evaluate an integral representing the work done by $\vec{F} = \langle \sin(y), x \rangle$ on a particle that moves from (1, 0) to $(-1, \pi)$ on the path $x = \cos(y)$. (10 points)

2) Evaluate I = $\int_C (1-2y)\,dx + z\,dy - x\,dz$ if C is a line segment from (0, 0, 0) to (3, 0, 0) followed by a line from (3, 0 ,0) to (1, 2, 3). (15 points)

Sketch the following surfaces with positively oriented and labeled axes. (10 points)

3A) $x = y^2 + z^2$

3B) $y = x^2 - z^2$

4) For all parts of #4, $\vec{a} = \langle 1,1,1 \rangle$, $\vec{b} = 2\hat{\mathbf{i}} + \hat{\mathbf{j}} - 2\hat{\mathbf{k}}$, and $\vec{c} = \langle 0,3,4 \rangle$. (10 points)

4A) Find the area of the parallelogram spanned by $\vec{b}$ and $\vec{c}$.

4B) Find the flux of $\vec{a}$ through the parallelogram spanned by $\vec{b}$ and $\vec{c}$ and oriented positively from $\vec{b}$ to $\vec{c}$.

4C) Find the component of $\vec{a}$ onto $\vec{b}$.

4D) Simplify $2\vec{a} \cdot \vec{b} + \vec{c} \cdot (\vec{a} + \vec{b})$.

5A) Find all the second partial derivatives of $f(x,y) = \ln(x^2 y) + x^2 e^y$. (6 points)

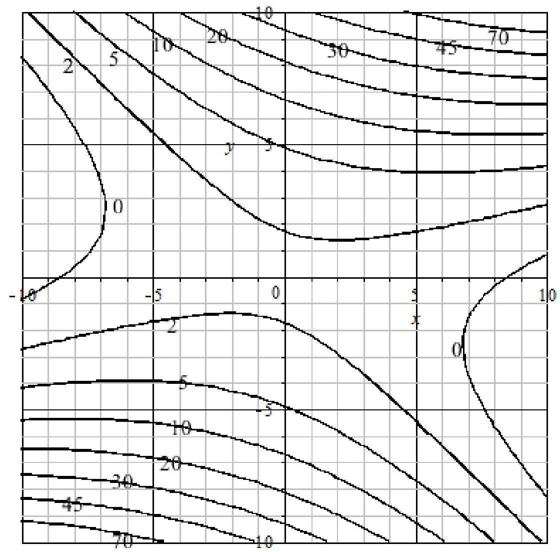
5B) What is $\nabla f(1,1)$ if $f(x,y) = \ln(x^2 y) + x^2 e^y$? (4 points)

6) Find the equation of the plane in ax + by + cz = d form that contains the point P = $(2,0,1)$ and the line $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$. (10 points)

7) Find the length of the curve $\vec{r}(t)=\left\langle \frac{t^3}{3}, t^2, 2t \right\rangle$ from (0, 0, 0) to (9, 9, 6). (10 points)

8) Find $\hat{\mathbf{T}}(0)$ if $\vec{r}(t)=f(t)\vec{p}(t)$ where $f(t)=2\cos(t)$, $\vec{p}(0)=\langle 2,1,2\rangle$, $\vec{p}'(0)=\langle 4,4,2\rangle$, and $\vec{p}''(0)=\langle 1,1,0\rangle$. (10 points)

9) Use the contour plot of f(x, y) to estimate $f_x(-2,5)$. Draw an appropriate segment. Show work. (5 points)



10) Which curve has the largest curvature at the point (1, 1, 1), C_1 or C_2? C_1 is parameterized by $\vec{r}(t)$ so that $\vec{r}(1)=\langle 1,1,1\rangle$, $|\vec{r}'(t)|=2t$, and $\hat{\mathbf{T}}(t)=\dfrac{\langle 2t,t^2,2\rangle}{t^2+2}$. C_2 is parameterized by $\vec{p}(t)$ so that $\vec{p}(0)=\langle 1,1,1\rangle$, $\vec{p}'(0)=\langle 1,-2,2\rangle$, and $\vec{p}''(0)=\langle 2,1,0\rangle$. Defend your answer. Hint: find the curvature for each curve. (10 points)