Name: _____

Math 210 **Hour Exam Two** **April, 2010**

For every question, write your solution with computations in the exam booklet. Each part of each problem is worth a certain number of points, indicated in the right margin. There are a total of 100 points on this exam. Turn in this exam sheet with your booklet.

1. Find and classify the critical points of the function [17 pts]

$$f(x, y) = x^3 + 3xy - y^3.$$

2. Sketch the region of integration and compute $\int_0^1 \int_0^y e^{-y^2}\, dx\, dy$. [17 pts]

3. Compute

$$\iiint_A z\, dV$$

where A is the region inside the sphere $x^2+y^2+z^2 = 2$, inside the cylinder $x^2+y^2 = 1$, and above the xy-plane. [17 pts]

4. Compute the integral of the field $\vec{F}(x, y) = (x + y)\vec{i} + 0\vec{j}$ along the curve $\vec{c}(t) = \cos\theta\vec{i} + \sin\theta\vec{j}$. [17pts]

5. Find the maximum and minimum of the function $f(x, y) = x + y^2$ subject to the condition $2x^2 + y^2 = 1$. [16 pts]

6. For the vector field $\vec{F}(x, y) = (x+y)\vec{i}+(x-y)\vec{j}$, find a function $\varphi(x, y)$ with grad $\varphi = \vec{F}$ or use the partial derivative test to show that such a function does not exist. [16 pts]