Math 175 - Exam 2, October 28, 2009 Name:____

Problem 1 (20 points). Consider the function $f : \mathbb{R}^2 \to \mathbb{R}$ given by $f(x, y) = \begin{cases} \frac{x^2}{2x^2+y^2} & \text{if} \quad (x, y) \neq (0, 0) \\ 0 & \text{if} \quad (x, y) = (0, 0) \end{cases}$

Draw the contour map (level curves) for f and find where the function is continuous.

Problem 2 (20 points). Find an equation for the tangent plane to the surface given by the equation $z = xe^{x(y-1)}$ at the point $(1, 1, 1)$.

Problem 3 (20 points). Consider the function $g(x, y, z) = x^2 + y^2 + z^2 - xyz$, where x, y, and z are all functions of s, and t which satisfy the equations $x = s$, $y = t$, and $s^3 + t^3 + z^3 + 6stz = 0$. Find $\partial g/\partial t$ when $s = 1$ and $t = 0$.

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Problem 4 (20 points). Let $f : \mathbb{R}^2 \to \mathbb{R}$ be the function given by $f(x, y) = x^3 + y^3 - 3xy$.

(a). Find all local minimums, maximums, and saddle points of f.

(b). Find the absolute minimum and maximum of f when restricted to the domain $D = \{(x, y) \mid 0 \leq y \leq x \leq 4\}$ i.e., D is the region above the x-axis, to the left of the line $x = 4$ and under the line $x = y$.

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Problem 5 (20 points). Find the volume of the solid which is bounded by the surface $z = xye^{x^2y}$, and the planes $x = 0$, $x = 1$, $y = 1$, $y = 2$, and $z = 0$.

Problem 6 (Extra Credit - 10 points, no partial credit). Compute $\int_0^1 \int_0^1 f(x,y)dxdy$ where $f(x,y) = \frac{1}{x+y}$. (Hint: You may want to use the fact that $f(x,y) = f(y,x)$.)