SPRING 2008 — MA 227— TEST 2
MARCH 5, 2008

Name: ____

1. Part I

There are 6 problems in Part 1, each worth 4 points. Place your answer on the line to the right of the question. Only your answer on the answer line will be graded.

(1) Find $\lim \sqrt{x^2 + 2xy}$ as point (x,y) goes to (2,8).

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(2) Find the first order partial derivatives of $f(x, y) = xe^y + 2y^2x^2$.

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(3) Find the linearization $L(x, y)$ of $F(x, y) = xy^2 - 2yx^3 - 7$ at the point (1,2).

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(4) Calculate the gradient of the function $f(x, y, z) = xy + z^3 + ye^x$.

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(5) The gradient of a function f is given by $\nabla f = \langle x - 2y^2, 4 - 2x\rangle$. Find all the critical points of f.

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(6) Find the directional derivative in direction $v = (1, 2)$ of the function $f(x, y) = x^3 - xy^2$ at point (1,1).

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2. Part II

There are 3 problems in Part 2, each worth 12 points. On Part 2 problems partial credit is awarded where appropriate. Your solution must include enough detail to justify any conclusions you reach in answering the question.

(1) Consider the function $f(x, y) = x^2y^4 + 2x - y^3$.
   (a) Compute $f(1, -2)$.
   (b) Find the equation of the tangent plane to the surface $f(x, y) = z$ at the point $P(1, -2)$. (Hint: An easy way to get the tangent plane is calculating the linearization at P and set $z = L(x, y)$)

(2) Use Lagrange multipliers to find the minimal and maximal values of $f(x, y) = x + 2y$ on the ellipse $\frac{1}{5}x^2 + y^2 = 1$. Where do they occur?

(3) (a) Identify which of the points $P(1, -1)$, $Q(2, -4)$, $R(-3, -9)$, $S(2, -1)$ are critical points of $f = x^2 + 14y^2 - 24y + 2xy^2 + 11$.
(b) Classify the critical points of f found in (a): local min.,local max.,saddle point.