Calculus III (Math 233) Quiz 1

Date: October 20, 2010 Professor Ilya Kofman

Justify answers and show all work for full credit.

NAME: _____

Problem 1. For the function $F(x, y, z) = x^2 - 2y^2 + z^2 + yz$

(a) In what direction does the function increase fastest at the point $P = (2, 1, -1)$?

(b) What is the rate of fastest increase in part (a)?

(c) What is the equation of the level surface of F through the point $(2, 1, -1)$?

(d) Find the equation of the tangent plane to the level surface of part (c) through the point $(2, 1, -1)$.

Problem 2. Find all local maxima, minima, and saddle points of the following function, and determine what type they are.

$$f(x, y) = x^6 + y^6 - 6xy + 1$$

Problem 3. Find the maximum and minimum values of

$$f(x, y) = 3x^2 + 2y^2 - 4y$$

on the disc $\{(x, y) \mid x^2 + y^2 \leq 9\}$.

Problem 4. Use the method of Lagrange multipliers to find the maximum and minimum values of

$$f(x, y, z) = 2x + 6y + 10z$$

on the sphere, $x^2 + y^2 + z^2 = 35$.