MATH 3220-1 FALL 2008

Third Mock Exam

INSTRUCTOR: H.-PING HUANG

LAST NAME _____

FIRST NAME _____

ID NO. _____

INSTRUCTION: SHOW ALL OF YOUR WORK. MAKE SURE YOUR ANSWERS ARE CLEAR AND LEGIBLE. USE **SPECIFIED** METHOD TO SOLVE THE QUESTION. IT IS NOT NECESSARY TO SIMPLIFY YOUR FINAL ANSWERS.

PROBLEM 1	25	_____
PROBLEM 2	25	_____
PROBLEM 3	25	_____
PROBLEM 4	25	_____
TOTAL	100	_____

PROBLEM 1

(25 pt) If $p > 0$, let f be the function

$$f(x,y) = \begin{cases} \frac{x^2}{(x^2+y^2)^p} & (x,y) \neq (0,0) \\ 0 & (x,y) = (0,0) \end{cases}$$

For which values of p is $\frac{\partial f}{\partial x}$ continuous at $(0,0)$?

PROBLEM 2

(25 pt) Find all local extrema of each of the following functions.

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

(b) $f(x, y) = \sin x + \cos y$

(c) $f(x, y, z) = e^{x+y} \cos z$

PROBLEM 3

(25 pt) Find all point $(r, \theta) \in \mathbb{R}^2$ such that the polar change of coordinates function

$$F(r, \theta) = (r \cos \theta, r \sin \theta)$$

has a smooth local inverse at a. Find the inverse and its differential at one such point.

PROBLEM 4

(25 pt) For the system of equations

$$x^2 + y^2 + u^2 - 3v = 1$$

$$2x + xy - y + 3u^2 - 9v = 0,$$

find all points on the solution set S for which there is a neighborhood in which S is a smooth 2-surface.

Bonus: how to parametrize the surface?