Name: ID #:

Exam I
Math 2443-005
September 21, 2009

Problem 1: Problem 2:

Problem 3: Problem 4:

Total:

1(a) Let $f(x, y) = e^{xy}$. Evaluate $\frac{\partial f}{\partial t}$ at $(s, t, u) = (-1, 3, 5)$ where $x = st$ and $y = u - t$. State carefully the version of the Chain Rule that you use.

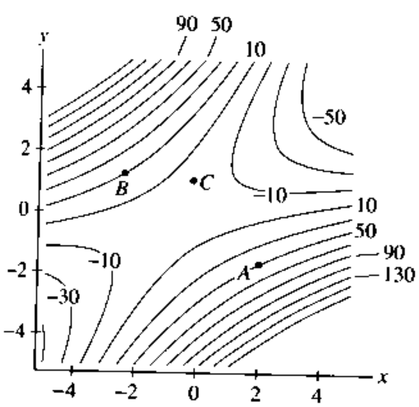
1(b) The figure shows a contour map of $f(x, y)$.

(i) Estimate f_x and f_y at point A.

(ii) At point B, in which direction does f increase most rapidly?

(iii) At which of A, B, or C is f_y smallest?

(iv) At A, is f_{yx} positive, negative, or zero? Explain briefly.



2. Let $f(x,y) = \dfrac{x^2}{y^2+1}$. Use linear approximation (or a tangent plane) at an appropriate point (a,b) to estimate $f(4.01, 0.98)$.

- What is the appropriate point (a,b)?
- What is the linear approximation or tangent plane (your choice)?
- Estimate $f(4.01, 0.98)$.

3. Find the critical points of the function $f(x, y) = (x^2 + y^2)e^{-x}$. Then analyze them using the Second Derivatives Test. What can you conclude about the behavior of f at these points?

4(a) Find the maximum rate of change of $f(x, y) = x^2y + \sqrt{y}$ at the point $(2, 1)$. In which direction does it occur?

(b) Find the directional derivative of $g(x, y) = 2\sqrt{x} - y^2$ at the point $(1, 5)$ in the direction toward the point $(4, 1)$.

(c) Find du if $u = \ln(1 + se^{2t})$.