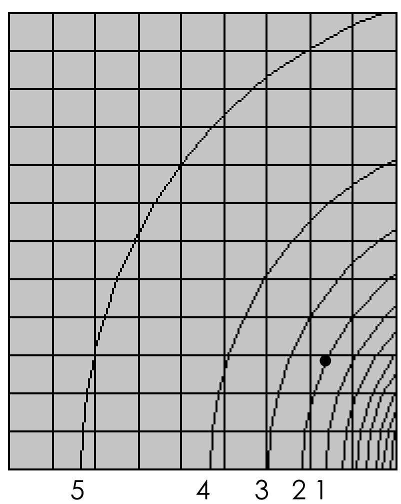
SM221S-6021 EXAM TWO
Monday, February 26, 2007 Name_______________________________________

Please answer the following questions on the paper provided. Additional paper is available should you need it. Show the details of your work and indicate your answers clearly. I am more interested in the process you use to discover a solution than I am in the solution itself. When you rely on your calculator for a computation, please make it clear what you asked your calculator to do.

1. (10 points) The graph below shows level curves f(x,y) for a differentiable function f. At the point Pm determine the sign of each of the indicated partial derivatives. (Just mark the correct answer; no penalty for guessing, and no partial credit.)

(a) f_x	positive	negative	zero, or too close to tell
(b) f_y	positive	negative	zero, or too close to tell
(c) f_{xx}	positive	negative	zero, or too close to tell
(d) f_{xy}	positive	negative	zero, or too close to tell
(e) f_{yy}	positive	negative	zero, or too close to tell



2. (65) Suppose that f is a differentiable function of 3 variables, and that w = f(x,y,z). Assume that f(1,2,3) = 4 and that $\nabla f(1,2,3) = \langle -2,3,-1 \rangle$.

(a) Find the directional derivative $D_{\mathbf{u}}f(1,2,3)$, where **u** is the unit vector $\left\langle \frac{3}{13}, \frac{12}{13}, \frac{-4}{13} \right\rangle$.

(b) Find the unit vector **v** such that $D_{\mathbf{v}}f(1,2,3)$ is as large as possible.

(c) Find an equation for the plane tangent to the surface w = 4 at the point (1,2,3).

(d) Give a reasonable estimate of f(.97, 2.01, 3.02).

(e) Suppose that $x = s^2$, $y = s^2 + s$, and $z = 4-s^3$. This makes w into a function of s. Find $\frac{dw}{ds}$ when s = 1.

3. (25) Find positive numbers x, y, and z (not necessarily integers) such that $x + 3y + z = 9$ and x^2yz is as large as possible.