Fourth Examination
Tuesday, April 8, 2008

Instructions: This exam should be done on your own paper. Your name should be on each sheet and on the back of the last sheet; the answers should appear written carefully and in order. If in doubt, show intermediate steps: Full credit may not be given, even for correct answers, unless work is arranged clearly and explained. This exam is closed book. You may leave after handing in your exam paper, but be sure to check your answers carefully. You may keep this copy of the exam questions. Each entire problem is worth 33 points, and one point is free.

1. Find all critical points of the function

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

2. Find the global maximum and global minimum of the $f(x, y)$ in Problem 1 over the square $-3 \leq x \leq 3$, $-3 \leq y \leq 3$.

3. Refer to the following figure (from page 772 of our text, *Multivariable Calculus*, fourth edition, of McCallum et al). Does f have a maximum value subject to the constraint $g(x, y) = c$ for $x \geq 0$ and $y \geq 0$? If so, approximately where is it and what is its value? Does f have a minimum value subject to the constraint? If so, approximately where and what?