Math 164, Lecture 2, Vese
Homework #8, due on Friday, March 10, 2006

Problems:

[1] Determine if

$$f(x_1, x_2) = 2x_1^2 - 3x_1x_2 + 5x_2^2 - 2x_1 + 6x_2$$

is convex, concave, both, or neither for $x \in R^2$.

[2] Find the first 3 terms of the Taylor series for

$$f(x_1, x_2) = 3x_1^4 - 2x_1^3x_2 - 4x_1^2x_2^2 + 5x_1x_2^3 + 2x_2^4$$

at the point $x_0 = (1, -1)^T$. Evaluate the series for $p = (.1, .01)^T$ and compare with the value of $f(x_0 + p)$.

[3] Consider the following function

$$f(x) = 15 - 12x - 25x^2 + 2x^3.$$

(a) Use the first and second order derivatives to find the local maxima and local minima of f.

(b) Show that f has neither a global maximum nor a global minimum.

[4] Consider the function

$$f(x) = 8x_1^2 + 3x_1x_2 + 7x_2^2 - 25x_1 + 31x_2 - 29.$$

Find all stationary points of this function, and determine whether they are local minimizers and maximizers. Does this function have a global minimizer or a global maximizer ?

[5] Use Newton's method to solve
minimize

$$f(x_1, x_2) = 5x_1^4 + 6x_2^4 - 6x_1^2 + 2x_1x_2 + 5x_2^2 + 15x_1 - 7x_2 + 13$$

Use the initial guess $(1, 1)^T$. Make sure that you have found a minimum and not a maximum.