

MATH 265 Section E1, Practice Test Number 2

Problem 1 (25 points)

a) Consider the function

$$f(x, y) = \log(x) + \frac{x^2 - y^2}{x + y - 1},$$

Give the domain of this function. Draw in the plane the domain of this function.

b) Show that the following limit does not exist

$$\lim_{(x,y) \rightarrow (0,0)} \frac{x^2y + x}{x^2 + y^2}$$

Problem 2 (25 points)

Consider the function

$$f(x, y, z) = x^2 + yz + z^2,$$

at the point $(0, 2, 1)$.

a) Calculate the direction of maximum growth of this function.

b) Calculate the maximum rate of growth of this function at the given point.

Problem 3 (25 points) Find the global maximum and the global minimum of the function $f = x^2y - \frac{1}{4}y - \frac{1}{2}x$ in the set

$$S := \{(x, y) | y \geq \frac{1}{2}x, y \leq 1, x \geq 0\}$$

Problem 4 (25 points) Use the method of Lagrange multipliers to minimize the function of three variables

$$f(x, y, z) = 2x^2 + y^2 + 3z^2,$$

subject to the constraint

$$g(x, y, z) = 2x - 3y - 4z - 49 = 0$$