MATH 104: WORKSHEET 10

1. Concepts

(1) Optimization
(2) Necessary condition
(3) Second derivative test for 2D

2. Discussions

Problem 2.1. (1) Find critical points of the following functions:
   (a) $f(x, y) = |x| + |y|$.
   (b) $f(x, y) = x^2 + y^2 - qxy$ where $q \in \mathbb{R}$ is a given constant.
   (c) $xy + \frac{2}{x} + \frac{4}{y}$
(2) Are the critical points you found above minima,maxima or neither.

Problem 2.2. A rectangular box without a lid is to be made from $12\,\mathrm{m}^2$ of cardboard. Find the maximum volume of such a box.

Problem 2.3. A model for the yield Y of an agricultural crop as a function of the nitrogen level N and phosphorus level P in the soil (measured in appropriate units) is

$$Y(N, P) = kNPe^{-N-P}$$

where k is a positive constant. What levels of nitrogen and phosphorus result in the best yield?

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