

MATH 104: WORKSHEET 11

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 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

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

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