

MAC 2313, Section 04 with Dr. Hurdal
Spring 2008 – Assignment 3

Due: Wednesday February 27, 2008 at the beginning of class.

With your group (2-3 people per group), please hand in complete written solutions (1 solution set per group in one hand writing) for the following questions. Points will be allocated for clear and well written mathematical solutions.

Individually, hand in a typed log which you sign, of when your group met and who was there, include when you worked on the problems by yourself, and also rank each member of your group (including yourself) with a percentage contribution to the assignment. Individuals who do not submit a typed log will have points deducted. It is not guaranteed that every group member will get the same grade.

Homework must be stapled to be accepted.

1. Suppose that the concentration in mg/cm^3 of a chemical at position (x, y, z) is given by $C(x, y, z) = 50 + z \cos(2\pi x) \sin(2\pi y)$.

- In what direction is the concentration increasing most rapidly at the point $(1/6, 1/8, 3)$?
- What is the maximum rate of change in concentration at this point?
- What is the rate of change of concentration at the point $(1, 2, 3)$ in the direction to $(2, 0, 6)$.
- Find an equation of the tangent plane to C at $(1/6, 1/8, 3)$.

2. Find and classify the local extrema of $f(x, y) = x^3 + x^2y - y^2 - 4y$.

3. A closed rectangular box is to contain 1000 cm^3 . If the material for the top and bottom costs 2 cents per square centimeter and the material for each side costs 4 cents per square centimeter, find the dimensions of the box that minimize its cost.

4. Find the maximum value of $f(x, y) = y - x^2$ subject to the constraint $x - y^2 = 0$.

5. An electronics manufacturing company incurs costs of $C(x, y) = 5x^2 + 2xy + 3y^2 + 800$ (in thousands of dollars) when it produces x thousand units of cell phones and y thousand units of cell phone chargers. It's weekly production capacity is such that $x + y = 39$ (ie. the number of cell phones and number of chargers produced is 39,000 per week). At what production levels will the company's costs be minimized? What will be the corresponding total cost?