

LB 220, Sections 001 & 002, Fall 2015
Homework 6 (due 10/21)

Instructions: Please write your solutions to the problems below on a clean piece of paper (not this piece of paper). You will not need more than one page (front and back) to write your answers. Show the steps taken to arrive at each answer. Do not include scratch work, doodles, scribbles, crossed out work, etc.; instead, carefully write your solutions after you have figured out the answers and checked them over.

You may work with other students on homework problems. For this assignment, each student must submit his or her own solution to the first problem. But, for the second problem, you may partner with up to three other students and submit one solution for your group; each student in the group will receive the same score for the second problem.

1. *As with previous homework assignments, this first problem is an exam problem from a previous semester of LB 220.*

Find an equation of the plane tangent to the surface $xyz^2 = 1$ at the point $(2, 1/2, -1)$.

2. *This week's second problem is also at the level of an exam question.*

Suppose that the temperature at a point (x, y, z) is given by the function

$$T(x, y, z) = 200 \exp(-x^2 - 3y^2 - 9z^2),$$

where $\exp(x)$ is just a way of writing e^x without using a superscript. (This is handy when formulas get to be quite complicated!) Here T is measured in $^{\circ}\text{C}$ and x , y , and z in meters.

- (a) Determine the rate of change of the temperature at the point $P(2, -1, 2)$ in the direction towards the point $Q(3, -3, 3)$.
- (b) In which direction does the temperature increase at the fastest rate at P ? What is magnitude of this maximal rate of increase?
- (c) What are the units of a the directional derivative of T ? Explain or give an example which illustrates your answer.