MATH 2010E ADVANCED CALCULUS I HOMEWORK 9

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Due at 5:00pm on Friday, 12th June, 2015

When you work on homework problems, please do not simply write down the numerical answers, but also the **step-by-step deduction** for each problem. In your homework, mid-term and final exam, your step-by-step deductions will take up an important proportion of your final scores.

Problems that need to be submitted 14.4 10, 22, 24 (you may skip the branch diagrams), 28, 32, 36, 40, 42, 44, 47, 52.

Problem 1. Find the tangent plane of (a) $z = e^x \cos y$ at the point $(x, y) = \left(0, \frac{\pi}{2}\right)$. (b) $w = \sqrt{x^2 + y^2 + z^2}$ at the point (x, y, z) = (1, 1, 0).

Problem 2. Let $f(x,y) = \begin{cases} 0 & \text{if } x^2 < y < 2x^2 \\ 1 & \text{otherwise.} \end{cases}$ Show that $f_x(0,0)$ and $f_y(0,0)$ exist but f is not differentiable at (0,0). (*Hint*: Show that f is not continuous at (0,0).)

Problem 3. Let $f(x,y) = \begin{cases} y^2 + x^2 \sin \frac{1}{x} & \text{if } x \neq 0 \\ y^2 & \text{otherwise.} \end{cases}$ Show that f is differentiable at (0,0) but not C^1 at (0,0).

(*Hint*: Show that f_x is not continuous at (0, 0).)

Other problems 14.4 5, 45, 48, 49.

Date: Tuesday, 9th June, 2015.