18.02A Problem Set 2B – Fall 2006

due (along with Part 2A) Thursday Nov. 16/06, 12:45 in 2-106

Part I (5 points)

Recitation. Mon. Nov. 13 Functions of several variables; graphs, level curves.
Read: 19.1 Work: 2A - 1abe

Read: 19.2, 19.3, Notes TA Work: 2A-2ae; 2B- 1b, 4, 6

Lecture 29. Thurs. Nov. 16 Gradient, directional derivative Read: 19.5

Part II (15 points)

Directions. Try each problem alone for 15 minutes. If you collaborate subsequently, your solutions
must be written up independently. It is illegal to consult problem sets from previous semesters.

Problem 1. (3 pts) Show that \( z = \tan^{-1}(y/x) \) satisfies \( z_{xx} + z_{yy} = 0 \).

Problem 2. (6pts) Find the tangent vector at the point \((1,1,2)\) to the curve of intersection of the
surfaces \( z = x^2 + y^2 \) and \( 2x^2 + 2y^2 - z^2 = 0 \).

Problem 3. (6pts) Consider a surface with an equation of the form \( z = xf(x/y) \). Show that all
of its tangent planes have a common point. What is this point?

Hint: try it first for the function \( f(u) = u \), so that the equation becomes \( z = x^2/y \). Consideration
of this special case alone is worth 3 points.