MATH 2850 Sec 003

ELEMENTARY MULTIVARIABLE CALCULUS

QUIZ 3

February 13, 2013

Name (Last, First) Key

1. Find the equation of the tangent plane to the surface at the given point.

$$x^2 + y^2 - 2xy - x + 3y - z = -4, \quad P_0(2, -3, 18)$$

$f_x(x,y,z) = 2x - 2y - 1$, $f_y(x,y,z) = 2y - 2x + 3$, $f_z(x,y,z) = -1$

$f_x(2,-3,18) = 4 + 6 - 1 = 9$, $f_y(2,-3,18) = -6 - 4 + 3 = -7$, $f_z(2,-3,18) = -1$

Equation $9(x-2) - 7(y+3) - 1(z-18) = 0$

$9x - 18 - 7y - 21 - z + 18 = 0$

$$\boxed{9x - 7y - z = 21}$$

2. Find the derivative of the function at P_0 in the direction of $\mathbf{v}$.

$$f(x,y) = 2xy - 3y^2, \quad P_0(5,5), \quad \mathbf{v} = 4\mathbf{i} + 3\mathbf{j}$$

$\nabla f = \langle 2y, 2x - 6y \rangle$

$\nabla f(5,5) = \langle 10, -20 \rangle$

$u = \frac{v}{|v|} = \frac{4i + 3j}{\sqrt{4^2 + 3^2}} = \frac{4}{5}i + \frac{3}{5}j$

$\therefore (D_u f)\Big|_{P_0} = \nabla f(5,5) \cdot \langle \frac{4}{5}, \frac{3}{5} \rangle$

$= \langle 10, -20 \rangle \cdot \langle \frac{4}{5}, \frac{3}{5} \rangle$

$= 8 - 12 = \boxed{-4}$