Name KEY

Math 254, Quiz #6, Summer 2012

Instructions: Show all work. Use exact answers unless asked to round.

1. Find the tangent plane to the graph $\ln(xy) + x^2 - 4y^3 + 2xz = 3$ at the point (1,1,3). Then write the equation of the normal line to the graph at the same point in symmetric form.

$\ln x + \ln y$

$\nabla F = \langle \frac{1}{x} + 2x + 2z, \frac{1}{y} - 12y^2, 2x \rangle$

$1 + 2 + 6 \qquad 1 - 12 \qquad 6$

$\langle 9, -11, 6 \rangle$

Plane: $9(x-1) + (-11)(y-1) + 6(z-3) = 0$

line: $\frac{x-1}{9} = \frac{y-1}{-11} = \frac{z-3}{6}$

2. Find and characterize any critical points as maxima, minima or saddle points (if it can be determined) to the graph $f(x, y) = x^3 - 3xy - 2y + y^2 - 16$.

$f_x = 3x^2 - 3y = 0 \Rightarrow y = x^2$

$f_y = -3x - 2 + 2y = 0 \Rightarrow -3x - 2 + 2x^2 = 0$

$2x^2 - 3x - 2 = 0$

$(2x + 1)(x - 2) = 0$

$x = -\frac{1}{2} \qquad x = 2$

$\downarrow \qquad \downarrow$

$y = \frac{1}{4} \qquad y = 4$

$f_{xx} = 6x$

$f_{yy} = 2$

$f_{xy} = -3$

$D(-\frac{1}{2}, \frac{1}{4}) = (-3)(2) - (-3)^2 = -6 - 9 = -15$

$D(2,4) = (12)(2) - (-3)^2 = 24 - 9 = 15$

$(-\frac{1}{2}, \frac{1}{4})$ Saddle

$(2,4)$ min