MATH 280 – QUIZ #3   Name: <u> Key </u>

Directions: Please show all work for maximum credit. This quiz is worth 14 points. Good luck!

1. Given $f(x, y) = \sin(xy^2)$. Determine the following.

(1 point) a. $f_x = y^2 \cos(xy^2)$

(1 point) b. $f_y = 2xy \cos(xy^2)$

(2 points) c. $f_{xx} = -y^4 \sin(xy^2)$

(2 points) d. $f_{xy} = 2y \cos(xy^2) - 2xy^3 \sin(xy^2)$

(2 points) e. $f_{yy} = 2x \cos(xy^2) - 4x^2y^2 \sin(xy^2)$

(3 points) 2. Find the equation of the tangent plane and the normal line at the point $P_0 (1,1,-1)$ on the surface $f(x,y) = x^2 - xy - y^2$.

$$f_x = 2x - y \qquad\qquad f_x(1,1) = 1$$

$$f_y = -x - 2y \qquad\qquad f_y(1,1) = -3$$

$$z - (-1) = 1(x-1) - 3(y-1)$$

$$z + 1 = x - 1 - 3y + 3$$

$$z + 1 = x - 3y + 2 \qquad\qquad x = 1 + t$$

$$\qquad\qquad\qquad\qquad y = 1 - 3t$$

$$z = x - 3y + 1 \qquad\qquad z = -1 - t$$

(3 points) 3. Given $w = x^2 y^2 + z^3$, $x = 2t^3 + 1$, $y = 4t - 3$, $z = t^3$. Find $\dfrac{dw}{dt}$.

$$\frac{dw}{dt} = \frac{\partial w}{\partial x}\frac{dx}{dt} + \frac{\partial w}{\partial y}\frac{dy}{dt} + \frac{\partial w}{\partial z}\frac{dz}{dt}$$

$$\frac{dw}{dt} = (2xy^2)(6t) + (2x^2 y)(4) + (3z^2)(3t^2)$$

$$= 12t(2t^3+1)(4t-3)^2 + 8(2t^3+1)^2(4t-3) + 9t^8$$