

MATH 280 – QUIZ #3

Name: KEY

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

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

(1 point) a. $f_x = -2xy \sin(x^2y)$

(1 point) b. $f_y = -x^2 \sin(x^2y)$

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

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

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

(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 $f(x, y) = x^2 - xy - y^2$.

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

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

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

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

$$z + 1 = x - 3y + 2$$

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

$$x = 1 + t$$

$$y = 1 - 3t$$

$$z = -1 - t$$

(3 points) 3. Given $w = x^2y^3 + z^2$, $x = 3t^2 + 4$, $y = 6t - 5$, $z = t^4$. Find $\frac{dw}{dt}$.

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

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

$$\frac{dw}{dt} = 12t(3t^2+4)(6t-5)^3 + 18(3t^2+4)^2(6t-5)^2 + 8t^7$$