MATH 280 – QUIZ #2 Name: KEY

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

1. Find $f_{xx}, f_{xy}, f_{yx}, f_{yy}$: Given $f(x,y) = ye^x + x - 1$. Determine the following.

(1 point) a. $f_x = ye^x + 1$

(1 point) b. $f_y = e^x$

(1 point) c. $f_{xx} = ye^x$

(1 point) d. $f_{xy} = e^x$

(1 point) e. $f_{yy} = 0$

(3 points) 2. Find the following limit: $\lim\limits_{\substack{(x,y)\to(2,2)\\ x+y\neq 4}} \dfrac{x+y-4}{\sqrt{x+y}-2}$

$$= \lim_{\substack{(x,y)\to(2,2)\\ x+y\neq 4}} \frac{x+y-4}{\sqrt{x+y}-2} \cdot \frac{\sqrt{x+y}+2}{\sqrt{x+y}+2} = \lim_{\substack{(x,y)\to(2,2)\\ x+y\neq 4}} \frac{(x+y-4)(\sqrt{x+y}+2)}{x+y-4}$$

$$= \lim_{\substack{(x,y)\to(2,2)\\ x+y\neq 4}} (\sqrt{x+y}+2) = \sqrt{2+2}+2 = \sqrt{4}+2 = 4$$

(3 points) *3.* Show that $f(x,y)=\dfrac{x^4}{x^4-y^2}$ does not have a limit as $(x,y)\to(0,0)$ by considering the different paths of approach. Use $y=kx^2$ where k represents two different integers.

$$\lim_{\substack{(x,y)\to(0,0)\\ y=kx^2}} \frac{x^4}{x^4-(kx^2)^2} = \lim_{\substack{(x,y)\to(0,0)\\ y=kx^2}} \frac{x^4}{x^4-k^2x^4} = \lim_{\substack{(x,y)\to(0,0)\\ y=kx^2}} \frac{1}{1-k^2} = \frac{1}{1-k^2}$$

Since the limit depends on k only and not on x and y $(k\neq 1)$, the limit does not exist.

(Another option is to use two paths i.e. $y=2x^2$ and $y=3x^2$ and obtain two different limits.)

(3 points) *4.* Find the equation of the tangent plane at the point $P_0(1,1,-1)$ on the surface $z=x^2-xy-y^2$. Write the equation in slope-intercept form.

$f_x = 2x-y$ $\qquad$ $f_y = -x-2y$

$f_x(1,1)=1$ $\qquad$ $f_y(1,1)=-3$

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