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MAC 2313.8443
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Quiz 5
You must show all work to receive full credit!!

Problem 1. (6 pts) Let $f(x,y) = \dfrac{x}{x+4y}$. Evaluate $f_y(3, \frac{1}{4})$ and $f_{yy}(1, \frac{1}{4})$.

$$f_y = \frac{(x+4y)\cdot 0 - x\cdot 4}{(x+4y)^2} = \frac{-4x}{(x+4y)^2} \Rightarrow f_y(3,\tfrac{1}{4}) = \frac{-4(3)}{(3+4\cdot\frac{1}{4})^2} = \frac{-12}{4^2}$$

$$= \frac{-12}{16} = \boxed{\frac{-3}{4}}$$

$$f_{yy} = \frac{\partial}{\partial y}(f_y) = \frac{(x+4y)^2\cdot 0 - (-4x)\cdot 2(x+4y)\cdot 4}{(x+4y)^4} = \frac{32x}{(x+4y)^3}$$

$$\Rightarrow f_{yy}(1,\tfrac{1}{4}) = \frac{32\cdot 1}{(1+4\cdot\frac{1}{4})^3} = \frac{32}{8} = \boxed{4}$$

Problem 2. (4 pts) Let $g(x,y) = \dfrac{x^2}{x^2+y^2}$.

(a) Evaluate $\lim\limits_{(x,y)\to(0,0)} g(x,y)$ along the x-axis.

Along the x-axis, $y=0$, so

$$\lim_{x\to 0} \frac{x^2}{x^2+0^2} = \lim_{x\to 0} \frac{x^2}{x^2} = \lim_{x\to 0} 1 = \boxed{1}$$

(b) Evaluate $\lim\limits_{(x,y)\to(0,0)} g(x,y)$ along the line $y = x$.

$$\lim_{x\to 0} \frac{x^2}{x^2+x^2} = \lim_{x\to 0} \frac{x^2}{2x^2} = \lim_{x\to 0} \frac{1}{2} = \boxed{\frac{1}{2}}$$

(c) What can you conclude about $\lim\limits_{(x,y)\to(0,0)} g(x,y)$? Explain your answer.

The limit does not exist since we found two paths which approach different limits.