Quiz 4a **Calculus 3** **9/29/2006**

Each problem is worth 5 points. Clear and complete justification is required for full credit.

1. Find the gradient of the function $f(x, y) = \ln(x^2 + y^4)$ at the point (2,1).

$f(x,y) = \ln(x^2+y^4)$

$f_x(x,y) = \frac{2x}{(x^2+y^4)}$ $\quad f_x(2,1) = \frac{2(2)}{(2^2+1^4)} = \frac{4}{5}$

$f_y(x,y) = \frac{4y^3}{(x^2+y^4)}$ $\quad f_y(2,1) = \frac{4(1^3)}{(2^2+1^4)} = \frac{4}{5}$

$\text{grad } f(2,1) = \langle \frac{4}{5}, \frac{4}{5} \rangle$

Excellent

2. Find the directional derivative of the function $g(x, y) = x^2y - y^3$ in the direction of the vector $\langle 3, -4\rangle$ at the point (1,2).

$\vec{u} = \frac{\langle 3,-4\rangle}{\sqrt{3^2+(-4)^2}} = \frac{\langle 3,-4\rangle}{\sqrt{25}} = \langle \frac{3}{5}, -\frac{4}{5} \rangle$

$g_x(x,y) = 2xy \quad g_x(1,2) = 4$

$g_y(x,y) = x^2 - 3y^2 \quad g_y(1,2) = -11$

Great

$D = \frac{3}{5} \cdot 4 + (-\frac{4}{5})(-11)$

$= \frac{12}{5} + \frac{44}{5}$

$\boxed{= \frac{56}{5}}$