Quiz 3 Calculus 3 9/24/2010

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

1. Find the directional derivative of $f(x, y) = 1 + 2x\sqrt{y}$ at the point (2, 4) in the direction of $\mathbf{v} = \langle -3, 4 \rangle$.

$D_{\vec{u}} = \langle f_x(x,y), f_y(x,y) \rangle \cdot \langle a, b \rangle$

$= \langle 4, 1 \rangle \cdot \langle -3/5, 4/5 \rangle$

$= -12/5 + 4/5$

$= \boxed{-8/5}$

Wonderful!

unit vector $= \dfrac{\langle -3, 4 \rangle}{|\langle -3, 4 \rangle|}$

$= \dfrac{\langle -3, 4 \rangle}{\sqrt{(-3)^2 + (4)^2}}$

$= \langle -3/5, 4/5 \rangle$

$f_x(2,4) = 2\sqrt{y} = 2\sqrt{4} = 4$

$f_y(2,4) = \cancel{2}x(1/2)y^{-1/2}$

$= \dfrac{2}{\sqrt{4}} = 1$

2. Find the gradient of $f(x, y) = y^2 / x$ at $P(1,2)$.

gradient $= \langle f_x(x,y), f_y(x,y) \rangle$

$f_x(x,y) = -\dfrac{y^2}{x^2}$

$f_x(1,2) = \dfrac{-4}{1} = -4$

$f_y(x,y) = \dfrac{2y}{x}$

$f_y(1,2) = \dfrac{4}{1} = 4$

$\langle f_x(1,2), f_y(1,2) \rangle$

$= \langle -4, 4 \rangle$

Great