Math 2263 Multivariable Calculus  
Quiz 3: 14.4-14.6  

Name: June 24, 2011

1. Consider the function \( f(x, y) = \frac{x}{y} \).  
   (a) Find \( f_x(1, -1) \) and \( f_y(1, -1) \).

   **Solution:** \( f_x(1, 1) = -1, f_y = -1 \)

   (b) Find the linearization of \( f(x, y) = \frac{x}{y} \) at the point \( (1, -1) \).

   **Solution:** \( L(x, y) = -x - y - 1 \)

2. Find the derivative matrix \( D(f \circ g)(2, 1) \), where
   
   \[
   Df(x, y) = \begin{bmatrix} 2y & 3x \end{bmatrix}, \quad Dg(2, 1) = \begin{bmatrix} 3 \\ 2 \end{bmatrix}, \quad \text{and} \quad g(2, 1) = \begin{pmatrix} 3 \\ -3 \end{pmatrix}.
   \]

   **Solution:** [0]
3. Let \( f(x, y, z) = \sqrt{xy} + z \), and let \( P \) be the point \( P(0, 3, 4) \).
   
   (a) Find the gradient of \( f \) at the point \( P \).

   Solution: \( \langle \frac{3}{4}, 0, \frac{1}{4} \rangle \)

   (b) Find the directional derivative of function \( f \) at \( P(0, 3, 4) \) in the direction toward the point \( Q(4, 6, 0) \).

   Solution: \( \frac{2\sqrt{41}}{41} \)