# HOMEWORK 5, MATH 175 - FALL 2009

## DUE FRIDAY OCTOBER 16TH (AT THE BEGINNING OF CLASS)

This homework assignment covers Sections 15.4 - 15.6 in the book.

1. Find an equation of the tangent plane to the surface given by $z = x^2 e^{x^2 - y^2}$ at the point $(-1, 1, 1)$.

2. Find the linear approximation of the function $f(x, y, z) = \sqrt{x^2 + y^2 + z^2}$ at the point $(2, 3, -1)$.

3. Suppose $z = x^2 e^{yx}$, where $x = \sin t$, and $y = \ln t$. Find $dz/dt$.

4. Suppose $z = e^{x-y}$, where $x = st$, and $y = s/t$. Find $\partial z/\partial s$ and $\partial z/\partial t$.

5. Suppose $z = \sqrt{r^2 + s^2}$, where $r = y + x \cos t$, and $s = x + y \sin t$. Find $\partial z/\partial x$, $\partial z/\partial y$, and $\partial z/\partial t$.

6. Suppose $y^5 - x^2 y^2 = 1 - e^{xy}$. Find $dy/dx$.

7. Suppose $xyz = \cos(x + y + z)$. Find $\partial z/\partial x$, and $\partial z/\partial y$.

8. Consider the function $f(x, y) = y^3/x^2$.
   (a). Find the gradient of $f$.
   (b). Find the directional derivative of $f$ in the direction of $(4, -1)$ at the point $(1, 1)$.

9. Find the directions in which the directional derivative of the function $f(x, y) = x \cos y$ at the point $(-1, \pi/4)$ has the value $-1$.

10. Find the maximal value of the directional derivative $D_u f$ at the point $(1, 2, -1)$ to the function $f(x, y, z) = \frac{1}{1 + 2x^2 + 3y^2 + 4z^2}$. In which direction is this maximum attained?