Math 2415
Homework on 14.3

1. Compute the partial derivatives $\frac{\partial f}{\partial x}$, $\frac{\partial f}{\partial y}$, $\frac{\partial^2 f}{\partial x^2}$, $\frac{\partial^2 f}{\partial y^2}$, and $\frac{\partial^2 f}{\partial x \partial y}$ of the following functions.

   (a) $f(x,y) = x \cos x \sin y$

   (b) $f(x,y) = e^{-(x^2+y^2)/(2\sigma^2)}$

2. Let $f(\rho, \theta, \phi) = \rho \sin\phi \cos\theta$. Calculate $\frac{\partial f}{\partial \phi}$ and $\frac{\partial f}{\partial \theta}$.

3. The plane $y = 2$ intersects the graph of $z = xy^3 + 5x^2$ in a curve. Find a parametrization of the tangent line to this curve at the point where $x = 3$.

4. Problem 3 from http://mathquest.carroll.edu/libraries/MVC.student.14.07.pdf

5. Problem 6 from http://mathquest.carroll.edu/libraries/MVC.student.14.07.pdf

6. Problem 10 from http://mathquest.carroll.edu/libraries/MVC.student.14.07.pdf

7. Verify that the function $u(x,y,z) = \log(x^2 + y^2)$ is a solution of the two dimensional Laplace equation $u_{xx} + u_{yy} = 0$ everywhere, except of course at the origin where f is not defined.

8. Verify that the following functions solve the wave equation, $u_{tt} = u_{xx}$

   (a) $u(x,t) = \cos(4x)\cos(4t)$

   (b) $u(x,t) = f(x-t) + f(x+t)$, where f is any differentiable function of one variable.