Math 2551 Worksheet Section 14.5

1. Let
$$f(x,y) = x^2y + e^{-x} + e^{xy}\sin y, \qquad P = (1,0).$$
   (a) Find the directions in which the function f increases and decreases most rapidly at P.
   (b) Find all the unit vectors $\vec{u}$ such that the directional derivative $D_{\mathbf{u}}f(P) = 0$.
2. Let $f(x,y) = xy$. Sketch the curve $f(x,y) = -4$ together with ∇f and the tangent line at $(2,-2)$. Then, find write an equation for the tangent line.
3. The directional derivative of some differentiable function $f(x,y)$ at $(2,1)$ in the direction going from $(2,1)$ toward the point $(1,3)$ is $-\frac{2}{\sqrt{5}}$, and the directional derivative of f at $(2,1)$ in the direction going from $(2,1)$ toward the point $(5,5)$ is 1. Compute $f_x(2,1)$ and $f_y(2,1)$.