

Math 2415
Paper Homework #8

1. Find the directional derivative of $f(x, y) = x^2y^3$ in the direction of the vector $\mathbf{u} = (3/5, 4/5)$ at the point $(2, 4)$.
2. Find the maximum rate of change of $f(x, y) = x^2 + y^3 - 4xy^2$ at the point $(2, 4)$. In what direction does it occur?
3. Let $f(x, y) = x^2 + 3xy - 4y^2$.
 - (a) Calculate ∇f at the point $(2, -2)$
 - (b) Find an equation for the tangent line to the level curve of f through the point $(2, -2)$.
 - (c) On a single set of axes, sketch the level curve, gradient and tangent line you calculated above. [You can sketch the tangent line and gradient vector exactly. For the level curve just draw approximately what it looks like near the point $(2, -2)$.]
4. Find all local maxima, local minima, and saddle points of the function $f(x, y) = 3x^2y + y^3 - 3x^2 - 3y^2$