1. Prepquiz 2 B

Problem 1: Consider the function $f(x, y, z) = xy + xz + zy$. At the point $(1, 3, 1)$ find all the direction vectors $\vec{u}$ so that a) $D_{\vec{u}}f(1, 3, 1)$ is as large as possible, b) as small as possible and c) so that $D_{\vec{u}}f(1, 3, 1) = 0$.

Problem 2: a) Find the plane tangent to the graph of $f(x, y) = x^4 - 6x^2y^2 + y^4$ at the point $(1, 1, -4)$. b) Find the line normal to the graph of f at the same point.

Problem 3: Find the absolute maximum and minimum of the function $f(x, y) = 2x^2 - 4x + y^2 - 4y$ on the closed triangle bounded by the lines $x = 0$, $y = 2$ and $y = 2x$ in the first quadrant. Find all the points in this triangle where these values are attained.