PRACTICE MIDTERM 2

Problem 1. Determine the velocity of the path $\mathbf{r}(t) = (\cos^2(t), 3t - t^3, t)$ at time t.

Problem 2. Let $f(u, v) = (-e^v, u^2 - v^2)$ and $g(x, y) = (e^{x-y}, x - y)$. Use the chain rule to calculate $D(f \circ g)(1, 1)$.

Problem 3. Compute the directional derivative of $f(x, y) = x^y$ at $(e, 1)$ in the direction of $(5, 12)$.

Problem 4. Compute all of the 2nd partial derivatives of $x^2y + xy^2 + yz^2$.

Problem 5. Find all the critical points of $f(x, y) = e^{1+x^2-y^2}$.

Problem 6. Find the maximum and minimum values of $f(x, y, z) = xyz$ on the unit ball $x^2 + y^2 + z^2 \leq 1$.