Name: _____

**Problem 1** (10 points) Let $f(x, y) = 3xy + x^4 + y^3 + 1$.

a) Compute the gradient vector of $f$ at the point $(1,2)$.

b) Compute the directional derivative of $f$ at the point $(1,2)$ in the direction of $\mathbf{u} = \langle 3/5, 4/5 \rangle$.

**Problem 2** (10 points) Find the critical points of $f(x, y) = 2x^2 - 4xy + y^4$.