Quiz 3 25 points Math 200 Name: _____

1. Let $f(x, y, z) = \ln(x + yz)$. You do not need to repeat work.

   (a) (3 points) Find the gradient of $f(x, y, z)$; that is, find ∇f.

   (b) (2 points) Find and simplify $f_{yy}(x, y, z)$.

   (c) (2 points) Find and simplify $\dfrac{\partial^2 f}{\partial z \partial x}$.

2. Find the limit if possible, or prove that the limit does not exist. Show organized work to defend your answer.

   (a) (3 points) $\displaystyle\lim_{(x,y)\to(0,0)} \frac{x^2 + 4y^2 + x^3}{x^2 + y^2}$

   (b) (3 points) $\displaystyle\lim_{(x,y)\to(0,0)} \frac{3xy^2}{x^2 + y^2}$

3. (6 points) Set up an integral that represents the mass of the wire that lies on $y = -\sqrt{4 - x^2}$, the lower half circle in the xy-plane, if the density of the wire is $\delta(x, y) = 8 + x^2 y$, and then **evaluate** the integral.

4. (6 points) Evaluate $I = \int_C \sqrt[3]{z}\, dx + \sqrt[3]{x}\, dy + e^y\, dz$ if C is the curve from $(-1, -1, -1)$ to $(1, 1, 1)$ on the trace of $\vec{\alpha}(t) = \langle t^3, t, t^3 \rangle$. If I is work done on a particle, what is the force field that does the work?