Name _________________________________

- No calculators allowed.
- Show sufficient work to justify each answer.
- You have 15 minutes for this quiz.

1. (3 points) If \( z = \ln \sqrt{x^2 + y^2} \) where \( x = s^{100}t^{100} \) and \( y = s^{100} + t^{100} \), find \( \partial z/\partial s \) and \( \partial z/\partial t \).

2. (3 points) Using implicit differentiation, find the equation of the tangent plane at the point \((1, 1, 1)\) to the surface
\[
x^{100} + x^{100}y^{200} + x^{100}y^{200}z^{300} = 3.
\]
3. (4 points) Define the rate of change of the function $w = g(s, t)$ at $(s_0, t_0)$ in the direction of the unit vector $\vec{r} = \langle x_0, y_0 \rangle$. Use the chain rule to simplify this formula. The simplified form should involve the gradient of $g$. 
