Calculus III: Project 5

Due: Monday, 8 July 2013

Instructions: Complete all problems in a neat and organized fashion on your own paper. If you use Wolfram|Alpha, a calculator, or any other resources, please state what you used it for. You will not lose any points for doing so, as long as you're honest about how and why you used it.

1. Use the implicit differentiation formulas from class to find $\partial z/\partial x$ and $\partial z/\partial y$ for

$$e^z = xyz.$$

2. One more chain rule problem (last one, I swear). If $z = f(x, y)$, $x = s + t$ and $y = s - t$, show that

$$\left(\frac{\partial z}{\partial x}\right)^2 - \left(\frac{\partial z}{\partial y}\right)^2 = \frac{\partial z}{\partial s}\,\frac{\partial z}{\partial t}.$$

3. Find an equation of the tangent plane to the surface $x^4 + y^4 + z^4 = 3x^2y^2z^2$ at the point $(1, 1, 1)$.

4. If $f = xy$, find the gradient vector $\nabla f(3, 2)$ and use it to find the tangent line to the level curve $f(x, y) = 6$ at the point $(3, 2)$. Sketch the level curve and the tangent line (with the gradient vector) in a plane.