# Calculus: Homework 7

April 24th, 2008

1. Express $\partial v / \partial x$ in terms of $u$ and $v$ if the equations $x = v \ln u$ and $y = u \ln v$ define $u$ and $v$ as functions of $x$ and $y$.

2. Explain why the function $f(x, y) = e^{2y-x}$ is differentiable at $(x, y) = (1, 2)$ and find its linearization $L(x, y)$ at the point.

3. Consider the function
$$f(x, y) = \begin{cases} \frac{xy}{x^2 + y^2}, & \text{if } (x, y) \neq (0, 0); \\ 0, & \text{if } (x, y) = (0, 0). \end{cases}$$

   Use Definition 7 on page 926 of our textbook to explain why the function fails to be differentiable at $(0, 0)$.

4. (a) Around the point $(1, 0)$, is $f(x, y) = x^2(y + 1)$ more sensitive to changes in $x$ or to changes in $y$? Give reasons for your answer!

   (b) What ratio of $dx$ to $dy$ will make $df$ equal to zero at $(1, 0)$?

5. If
$$w = \frac{x}{z} + \frac{y}{z}, \quad x = \cos^2 t, \quad y = \sin^2 t, \quad z = 1/t,$$

   compute $\partial w / \partial t|_{t=3}$.