Assignment #10

Due on Wednesday, March 4, 2015

Read Section 14.1, on *The Partial Derivative,* in Calculus: Multivariable, by McCallum, Hughes–Hallett, Gleason, et al.

Read Section 14.2, on *Computing Partial Derivatives Algebraically,* in Calculus: Multivariable, by McCallum, Hughes–Hallett, Gleason, et al.

Do the following problems

1. Compute the first partial derivatives of the function f given by

$$f(x, y) = \frac{x}{x^2 + y^2}, \quad \text{for } (x, y) \neq (0, 0).$$

2. Compute the first partial derivatives of the function f given by

$$f(x, y) = e^{-x} \sin y, \quad \text{for all } (x, y) \in \mathbb{R}^2.$$

3. Find a function f of the variables x and y satisfying

$$\begin{aligned} \frac{\partial f}{\partial x} &= y + 2x; \\ \frac{\partial f}{\partial y} &= x. \end{aligned}$$

4. Let f be as in Problem 2.

   Compute the second partial derivatives of f:

$$\frac{\partial^2 f}{\partial x^2}, \quad \frac{\partial^2 f}{\partial x \partial y}, \quad \frac{\partial^2 f}{\partial y \partial x} \quad \text{and} \quad \frac{\partial^2 f}{\partial y^2}.$$

5. Let $f(x, y) = e^{-x} \cos y$ for all $(x, y) \in \mathbb{R}^2$.

   Verify that

$$\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} = 0.$$