Quiz 6

Multivariable Calculus

Name: ______________________________

Assigned: **Wednesday March 4**

Due: **Monday March 16**

Time Begun: ____________________

Time Ended: ____________________

Prof. Ron Buckmire

Topic : The Multivariable Chain Rule

The idea behind this quiz is to provide you with an opportunity to demonstrate your understanding of the multivariable chain rule.

Reality Check:

EXPECTED SCORE : __________ **/10**

ACTUAL SCORE : __________ **/10**

Instructions:

1. Once you open the quiz, you have **30 minutes** to complete, please record your start time and end time at the top of this sheet.
2. You may use the book or any of your class notes. You must work alone.
3. If you use your own paper, please staple it to the quiz before coming to class. If you don't have a stapler, buy one. QUIZZES WITH UNSTAPLED SHEETS WILL NOT BE GRADED.
4. After completing the quiz, sign the pledge below stating on your honor that you have adhered to these rules.
5. Your solutions must have enough details such that an impartial observer can read your work and determine HOW you came up with your solution.
6. Relax and enjoy...
7. **This quiz is due at the beginning of class on Monday March 16.**
NO LATE OR UNSTAPLED QUIZZES WILL BE ACCEPTED FOR GRADING.

Pledge: I, ____________________, pledge my honor as a human being and Occidental student, that I have followed all the rules above to the letter and in spirit.

(Adapted from **Math 212 Spring 2006 Midterm #2**.)

1. Consider the function $u(x, y, z) = f(x - y, y - z, z - x)$. Our goal is to show that a function u with this form satisfies the following famous partial differential equation

$$\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0.$$

(a) (*3 points.*) Consider a function $u = f(r, s, t)$ where $r = r(x, y, z)$, $s = s(x, y, z)$ and $t = t(x, y, z)$ are given. In other words, although u is a function of r, s and t, since each of these functions is a function of x, y and z one can consider u as a function of x, y and z. Draw a "tree diagram" reflecting the relationships between the variables.

(b) (*3 points*) Use the Multivariable Chain Rule to write down expressions for $\frac{\partial u}{\partial x}$, $\frac{\partial u}{\partial y}$, and $\frac{\partial u}{\partial z}$ where u is assumed to be related to x, y and z as described in part **(a)**.

(c) (*4 points*) Let $r = x - y$, $s = y - z$ and $t = z - x$. Use this information and your answer to **(b)** to show that $u(x, y, z) = f(x - y, y - z, z - x)$ satisfies the equation $u_x + u_y + u_z = 0$.