Math 110 Fall 2007

BONUS Quiz **3** — Basic Calculus I

Name: _____

Date: _____
Time Begun: _____
Time Ended: _____

Math 110
Friday, October 26, 2007
Ron Buckmire

Topic: The Chain Rule

The idea behind this quiz is to assess your understanding of the mopst powerful derivative rule, the Chain Rule.

Reality Check:

EXPECTED SCORE : _____**/10** ACTUAL SCORE : _____**/10**

Instructions:

0. Before you open the quiz, look at the hint at `http://faculty.oxy.edu/ron/math/110/07`
1. Once you open the quiz, **you have 60 minutes to complete it**.
2. You may not use your text or any other source, including course materials. You may use a calculator. You must work alone. Do not discuss the contents of this quiz with anyone.
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 or borrow one. UNSTAPLED PAPERS 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. **This bonus quiz is due on Monday, October 29**, at the beginning of class. NO LATE QUIZZES WILL BE ACCEPTED.

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.

Math 110 Fall 2007 **BONUS** Quiz 3

SHOW ALL YOUR WORK AND EXPLAIN EVERY ANSWER

1. (*5 points*). The speed S of blood that is r centimeters from the center of an artery is given by the equation

$$S = C(R^2 - r^2)$$

where C is a constant, R is the radius of the artery, and S is measured in centeimeters per second. Suppose a drug is administered and the artery begins to dilate at a rate of $\frac{dR}{dt}$. At a constant distance r, find the rate at which S changes with respect to t for $C = 1.76 \times 10^5$, $\quad r = 1.2 \times 10^{-2}$ and $\frac{dR}{dt} = 10^{-5}$.

2. (*5 points*). Suppose we define two new functions, called hyperbolic trigonometric functions, where hyperbolic cosine is denoted $\cosh(x)$ and hyperbolic sine is denoted $\sinh(x)$. Given that

$$\frac{d}{dx}\sinh(x) = \cosh(x) \text{ and } \frac{d}{dx}\cosh(x) = \sinh(x) \text{ and } \cosh(0) = 1 \text{ and } \sinh(0) = 0$$

Show that $\cosh^2(x) - \sinh^2(x) = 1$ for every value of x.

HINT: show that $\frac{d}{dx}[\cosh^2(x) - \sinh^2(x)] = 0$ **and explain why that means** $\cosh^2(x) - \sinh^2(x) = 1$