Math 114 Fall 2005

BONUS Quiz **3** EXPERIENCED CALCULUS I

Name: ______________________________

Date: ______________________________
Time Begun: ______________________________
Time Ended: ______________________________

Math 114
Friday, September 23, 2005
Ron Buckmire
Angela Gallegos

Topic: A S-I-R Model of Disease

This quiz is intended as an opportunity for you to illustrate your understanding of the S-R-R model.

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/114/05/quiz.html`
1. Once you open the quiz, **you have 30 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, September 26**, 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.

SHOW ALL YOUR WORK

1. *(10 points total)* **Question 1, Exam 1, Fall 1998.** Suppose we are trying to model a disease, with the following assumptions:

(i) All infected people recover in ten days. After recovery, you will always have immunity, and will never become susceptible again.

(ii) The total population does not change, i.e. there are no births or deaths.

(iii) The transmission coefficient, a, is .00002 .

(iv) Right now there are 3200 people who have not had the disease, 2000 who currently have it and 850 who have had it already.

(a) *(3 points)* Write down a system of initial value problems which represent the S-I-R model for this disease, using the above assumptions.

(b) *(2 points)* What is the threshold value for this model?

(c) *(3 points)* Calculate how many people per day are currently getting infected right now. (BE CAREFUL! You should try reading this question *twice* before answering it.)

(d) *(2 points)* As time goes on, will the number of susceptible people decrease at a faster and faster rate, or more and more slowly? **Explain why.** (BE CAREFUL! Think about exactly what mathematical quantity related to S this question is asking about or perhaps try to visualize the graph of S to assist you in answering this question.)