Math 114 Fall 2005

Quiz **3** — Experienced Calculus I

Name: _____

Date: _____ — Math 114 **Friday, September 9, 2005**

Time Begun: _____ — Ron Buckmire

Time Ended: _____ — Angela Gallegos

Topic: Euler's Method and a System of Rate Equations

This quiz is intended to illuminate your deep understanding of Euler's Method and its applications to IVPs.

Reality Check:

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

Instructions:

0. Before you open the quiz, look for hints online at `http://faculty.oxy.edu/ron/math/114/05`.
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 quiz is due on Monday, September 12**, 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.

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EXPLAIN YOUR ANSWERS

We will consider the following rate equations and initial conditions on the interval $[0, 1]$.

$$S' = C, \quad C' = -S$$

$$S(0) = 0, \quad C(0) = 1$$

a. *(6 points.)* Use Euler's method with $\Delta t = 0.5$ to estimate the solutions $S(t)$ and $C(t)$ of the above initial value problem. Fill in the following table, which will help you find the approximating functions $\tilde{S}(t)$ and $\tilde{C}(t)$, which approximate the functions $S(t)$ and $C(t)$ which exactly solve the IVP.

t	S	C	S'	C'	ΔS	ΔC
0	0	1				
$\frac{1}{2}$						
1			XXXXXX XXXXXX XXXXXX	XXXXXX XXXXXX XXXXXX	XXXXXX XXXXXX XXXXXX	XXXXXX XXXXXX XXXXXX

Note: You should not need to use a calculator for this problem, but if you must use your calculator, DO NOT round off any decimal points.

b. *(4 points.)* Show that $S(t) = \sin(t)$, $C(t) = \cos(t)$ are the exact solutions to the IVP.

c. **BONUS** *(5 points.)* Show that, from the IVP alone, we can tell that the functions $S(t)$ and $C(t)$ obey the expression $S^2 + C^2 = 1$ (HINT: Differentiate this expression with respect to time and use information from the differntial equations and the initial condition.)