Math 341 Spring 2005

Quiz **4** **Differential Equations**

Name: ______________________________

Friday February 11
Ron Buckmire

Time Begun: ____________________
Time Ended: ____________________

Topic : Bifurcations

The idea behind this quiz is to provide you with an opportunity to illustrate your understanding of bifurcations in first-order ordinary differential equations.

Reality Check:

EXPECTED SCORE : __________**/10** ACTUAL SCORE : __________**/10**

Instructions:

0. Please look for a hint on this quiz posted to `blackboard.oxy.edu`
1. Once you open the quiz, you have **30 minutes** to complete it, 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.
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 on Monday February 14**, in 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.

1. Consider the following one-parameter family of nonlinear first-order differential equations where α is a known real parameter value

$$\frac{dy}{dx} = y^2 - \alpha y + 1.$$

(a) *2 points.* Show that this DE has no equilibrium points for $|\alpha| < 2$.

(b) *2 points.* For what values of α will the DE have exactly one equilibrium point? Classify the equilibrium point in this case and give the constant solution.

(c) *4 points.* Show that when $|\alpha| > 2$ the DE has exactly one stable equilibrium point (sink) and one unstable equilibrium point (source). Give all the constant solutions.

(d) *2 points.* Use your answers from above to sketch the bifurcation diagram for the given DE. (HINT: think about what happens to equilibrium solutions as $\alpha \to \pm\infty$!)