Quiz **3** — Differential Equations

Name: ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯

Friday February 4
Ron Buckmire

Time Begun: ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯
Time Ended: ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯

Topic : Solving First Order Differential Equations

The idea behind this quiz is to provide you with an opportunity to illustrate your understanding of solution techniques for 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 January 7**, 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 nonlinear first-order differential equation

$$\frac{dy}{dx} = \left(\frac{y}{x}\right)^2 + 2\frac{y}{x}.$$

(a) *3 points.* Show that this equation is **not** an exact differential equation when written in the form $M(x,y)\ dx + N(x,y)\ dy = 0$.

(b) *2 points.* Show that when the differential form of the equation in part (a) is multiplied by y^{-2}, to produce $y^{-2}M(x,y)\ dx + y^{-2}N(x,y)dy = \tilde{M}(x,y)\ dx + \tilde{N}(x,y)\ dy = 0$, the DE with $\tilde{M}$ and $\tilde{N}$ becomes exact.

(c) *4 points.* Solve the exact DE from (b) to show that the family of solutions to the differential equation is $y = \dfrac{x^2}{C-x}$.

(d) *1 point.* Are there any "extra solutions" that were lost in the use of the integrating factor in part (b)? If so, what are they? EXPLAIN YOUR ANSWER.