

Name _____

Class time _____

Applied Differential Equations 2250-1 and 2250-2 Midterm Exam 1, Spring 2004, Revised

Problem 1 due 9 Feb, Problem 2 due 9 Feb

In-class Exam Date: Wednesday, 11 February, 2004

Instructions. There are 4 versions: A-D, E-K, L-Q, R-Z. Choose the version based upon your last name.

The two problems below are due at class time. The take-home portion of the exam is 40% of the exam score. Answer checks are expected. If `maple` assist is used, then please attach the `maple` output as an appendix. Handwritten reports are expected from each person.

The remaining 60% of the exam is in class, 50 minutes. A sample exam is supplied separately. Not allowed on the in-class exam: calculators, computers, notes and books.

1. (**Quadrature Equations**) Let $y'(t)$ denote the speedometer reading and $y(t)$ the odometer reading in a PT Cruiser. At the start of a 1-hour trip the odometer reads 36455 miles ($t = 0$). Speedometer readings at 3-minute intervals are collected in the table below, $t = 0, 0.05, 0.10, \dots, 1.0$ hours. Let $f(t)$ be a piecewise linear function that reproduces the data points of the table (e.g., $f(t) = 40t/0.05$ for $0 \leq t < 0.05$, version A-D). (a) Represent the solution to $y'(t) = f(t)$, $y(0) = 36455$ by an integral formula. (b) Plot by computer $y(t)$ for $t = 0$ to $t = 1$. (c) Report the trip distance for this model. (d) Determine the average speed on the trip.

A-D: 0,0,40,65,67, 61,70,69,70, 75,75,74,0, 0,45,65,70, 71,55,70,69

E-K: 0,0,35,60,67, 61,71,69,70, 71,70,74,0, 0,45,65,70, 71,57,71,69

L-Q: 0,0,37,61,64, 61,71,69,70, 71,68,74,0, 0,45,66,70, 71,58,71,72

R-Z: 0,0,34,59,66, 61,73,69,72, 71,68,74,0, 0,45,69,74, 71,59,74,71

2. (**Separable Equations**) Solve the separable problem for equilibrium and non-equilibrium solutions. Report an *implicit* solution, an *explicit* solution, all equilibrium solutions. Show all derivation details. An answer check is required.

A-D: $y' = 24 + 10y + y^2 + 48x + 20xy + 2xy^2 + 24 \sin(x) + 10y \sin(x) + y^2 \sin(x)$

E-K: $y' = 10 + 7y + y^2 + 10x^2 + 7x^2y + x^2y^2 + 10 \cos(x) + 7y \cos(x) + y^2 \cos(x)$

L-Q: $y' = 3 + 4y + y^2 + 3x^2 + 4x^2y + x^2y^2 + 3 \tan(x) + 4y \tan(x) + y^2 \tan(x)$

R-Z: $y' = 4 - 3y - y^2 + 4x^3 - 3x^3y - x^3y^2 + 4 \sin(2x) - 3y \sin(2x) - y^2 \sin(2x)$

Please attach this exam or a copy to the front of your submitted exam on the due date. Kindly staple the left upper corner and write your name on all pages. Circle 2250-1 (7:30) or 2250-2 (10:45) at the top of the exam.