MTH 165: Linear Algebra with Differential Equations

1st Midterm

February 23, 2012

NAME (please print legibly): _____

Your University ID Number: _____

Indicate your instructor with a check in the box:

Dan-Andrei Geba	MWF 10:00 - 10:50 AM	
Ang Wei	MW 2:00 - 3:15 PM	

- **The presence of of electronic devices (including calculators), books, or formula cards/sheets at this exam is strictly forbidden.**
- **Show your work and justify your answers. You may not receive full credit for a correct answer if insufficient work is shown or insufficient justification is given.**
- **Clearly circle or label your simplified final answers.**
- **You are responsible for checking that this exam has all 7 pages.**

QUESTION	VALUE	SCORE
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
TOTAL	60	

1. (10 points) Find the general solution for the equation

$$\frac{dy}{dt} + \frac{2t+1}{t}\, y = 2t.$$

2. (10 points) Solve the initial value problem

$$\frac{dy}{dx} = 2xy^2 + 3x^2y^2, \quad y(1) = -1.$$

3. (10 points) A 400-gal tank initially contains 100 gal of brine containing 50 lb of salt. Brine containing 1 lb of salt per gallon enters the tank at the rate of 5 gal/s, and the well-mixed brine in the tank flows out at the rate of 3 gal/s. How much salt will the tank contain when it is full of brine?

4. (10 points) Find the rank for the matrix

$$A = \begin{bmatrix} 1 & 2 & 1 & 0 \\ 2 & 5 & 5 & 1 \\ -2 & -3 & 0 & 3 \\ 3 & 4 & -2 & -3 \end{bmatrix}$$

by computing its **reduced row-echelon form**.

5. (10 points) Solve the following linear system of equations:

$$\begin{cases} x + y - z = 5 \\ 3x + y + 3z = 11 \\ 4x + y + 5z = 14 \end{cases}$$

6. (10 points) Find the inverse of the matrix

$$A = \begin{bmatrix} 4 & 3 & 2 \\ 5 & 6 & 3 \\ 3 & 5 & 2 \end{bmatrix}.$$