

Name: _____ ID Number: _____

TA: _____ Section: _____

MTH 133
Exam 4 Practice
April 24, 2012
50 minutes
Sects: 7.1-7.6, 7.8,
10.1-10.5.

No calculators or any other devices allowed.
If any question is not clear, ask for clarification.
No credit will be given for illegible solutions.
If you present different answers for the same problem,
the worst answer will be graded. If you say something
wrong and it is not crossed over, we take points off.
Show all your work. Box your answers.

1. (a) (15 pts) Find the general solution \mathbf{x} to the 2×2 linear system

$$\mathbf{x}'(t) = A \mathbf{x}(t), \quad A = \begin{bmatrix} 2 & -5 \\ 1 & -2 \end{bmatrix}.$$

- (b) (5 pts) Sketch a qualitative phase portrait of the solution trajectories.

2. (15 pts) Find the solution \mathbf{x} to the initial value problem

$$\mathbf{x}'(t) = A \mathbf{x}(t), \quad \mathbf{x}(0) = \begin{bmatrix} 2 \\ 1 \end{bmatrix}, \quad A = \begin{bmatrix} 3 & -18 \\ 2 & -9 \end{bmatrix}.$$

3. (15 pts) Find the solution \mathbf{x} to the initial value problem

$$\mathbf{x}'(t) = A \mathbf{x}(t), \quad \mathbf{x}(0) = \begin{bmatrix} 2 \\ 4 \end{bmatrix}, \quad A = \begin{bmatrix} 1 & 3 \\ 3 & 1 \end{bmatrix}.$$

4. (15 pts) Find every positive eigenvalue λ and nonzero function y , solutions of the boundary value problem

$$y'' - 4y' + 4y = -\lambda y, \quad y(0) = 0, \quad y(3) = 0.$$

5. Consider the function $f(x) = -1$, defined for $-3 < x < 0$.

- (a) (5 pts) Sketch the graph of the odd periodic extension of period $T = 6$ of the function f above. Sketch the graph of this extension for at least three periods.
- (b) (15 pts) Determine the Fourier series of this odd periodic extension of f .

- 6.** (15 pts) Determine whether the separation of variables method can be used in the equation $(x/t)\partial_x^2 u - \partial_t u = 0$, where u is a function of t and x . If your answer is “yes”, find the ordinary differential equations which are obtained from the partial differential equation when the separation of variables method is used. You do not need to solve these equations.

#	Pts	Score
1	20	
2	15	
3	15	
4	15	
5	20	
6	15	
Σ	100	