# Math 2280 - Exam 3 

University of Utah

Spring 2013

## Name:

This is a 50 minute exam. Please show all your work, as a worked problem is required for full points, and partial credit may be rewarded for some work in the right direction.

## 1. (15 points) An RLC Circuit

For the RLC circuit pictured below:


Calculate $I(t)$ for the values:

$$
\begin{gathered}
L=10 H \quad R=20 \Omega \quad C=0.02 F \\
E(t)=50 \sin 3 t \mathrm{~V}
\end{gathered}
$$

More room, if necessary, for Problem 1.
2. (15 points) An Endpoint Problem

The eigenvalues for this problem are all nonnegative. First, determine whether $\lambda=0$ is an eigenvalue; then find the positive eigenvalues and associated eigenfunctions.

$$
\begin{gathered}
y^{\prime \prime}+\lambda y=0 \\
y^{\prime}(-\pi)=0 \quad y^{\prime}(\pi)=0
\end{gathered}
$$

More room, if necessary, for Problem 2.
3. (10 points) Converting to First-Order Systems

Transform the given differential equation into an equivalent system of first-order differential equations:

$$
x^{(4)}+6 x^{\prime \prime}-3 x^{\prime}+x=\cos 3 t
$$

4. (25 points) Systems of First-Order ODEs

Find the general solution to the system of ODEs:

$$
\mathbf{x}^{\prime}=\left(\begin{array}{ll}
2 & 3 \\
2 & 1
\end{array}\right) \mathbf{x}+\binom{5}{-2 t}
$$

More room, if necessary, for Problem 4.

Even more room, if necessary (you might need it!), for Problem 4.
5. (20 points) Multiple Eigenvalues ${ }^{1}$

Find the general solution to the system of ODEs:

$$
\mathbf{x}^{\prime}=\left(\begin{array}{cc}
7 & 1 \\
-4 & 3
\end{array}\right) \mathbf{x}
$$

[^0]More room, if necessary, for Problem 5.
6. (15 points) Matrix Exponentials

Calculate the matrix exponential $e^{A}$ for the matrix:

$$
\left(\begin{array}{lll}
2 & 0 & 0 \\
3 & 1 & 0 \\
4 & 3 & 1
\end{array}\right)
$$

More room, if necessary, for Problem 6.


[^0]:    ${ }^{1}$ This is a hint.

