

Name: _____

Lecture Section ____

Ma 221

Exam IIIB

09S

I pledge my honor that I have abided by the Stevens Honor System.

You may not use a calculator, cell phone, or computer while taking this exam. All work must be shown to obtain full credit. Credit will not be given for work not reasonably supported. When you finish, be sure to sign the pledge.

Score on Problem #1 _____

#2 _____

#3 _____

#4 _____

Total Score _____

Note: A table of Laplace Transforms is given at the end of the exam.

Name: _____

Lecture Section ____

1 (25 pts.) Use Laplace Transforms to solve

$$y'' + 10y' + 9y = 8t \quad y(0) = -1 \quad y'(0) = 1$$

Name: _____

Lecture Section ____

2a (15 pts.) Use the definition of the Laplace transform to find $\mathcal{L}\{f(t)\}$ where

$$f(t) = \begin{cases} 6 & 0 \leq t \leq 6 \\ t & t \geq 6 \end{cases}$$

2b (10 pts.) Find

$$\mathcal{L}^{-1} \left\{ \frac{1 + 3s}{s^2 - 8s + 21} \right\}$$

Name: _____

Lecture Section ____

3 (25 pts.) Find the first six non-zero terms in the series solution near $x = 0$ of the equation

$$y'' + xy = 0$$

Be sure to give the recurrence relation. Indicate the two linearly independent solutions and give the first *six* nonzero terms of the solution.

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Name: _____

Lecture Section ____

4 (25 pts.) Find the eigenvalues and eigenfunctions for

$$y'' + \lambda y = 0; \quad y(0) = 0, \quad y(3\pi) = 0$$

Be sure to consider all values of λ .

Name: _____

Lecture Section ____

Table of Laplace Transforms

$f(t)$	$F(s) = \mathcal{L}\{f\}(s)$		
$\frac{t^{n-1}}{(n-1)!}$	$\frac{1}{s^n}$	$n \geq 1$	$s > 0$
e^{at}	$\frac{1}{s-a}$		$s > a$
$\sin bt$	$\frac{b}{s^2 + b^2}$		$s > 0$
$\cos bt$	$\frac{s}{s^2 + b^2}$		$s > 0$
$e^{at}f(t)$	$\mathcal{L}\{f\}(s-a)$		
$t^n f(t)$	$(-1)^n \frac{d^n}{ds^n}(\mathcal{L}\{f\}(s))$		