Math 221 Test 3 **Spring 2018**

Print Your Name Legibly:_____ Score:_____

Instructions: You must show supporting work to receive full and partial credits. No text book, notes, formula sheets allowed.

1(**10pts**) Use the definition of Laplace transform to find $\mathcal{L}\{f(t)\}(s)$ if $f(t) = \begin{cases} 0, & t < 2 \\ 2, & t \geq 2. \end{cases}$

2(**20pts**) Find the Laplace transform or inverse transform:

(a) $\mathcal{L}\{te^{2t}f(t)\}(s)$ given that $\mathcal{L}\{f(t)\}(s) = \frac{1}{\sqrt{s}}$.

(b) $\mathcal{L}^{-1}\left\{\dfrac{5-2s}{s(s^2-2s+5)}\right\}(t)$.

(Page 1. Continue on Next Page ...)

3(**15pts**) Use the Laplace method to solve the initial value problem: $x'' + x' = t,\ x(0) = 0,\ x'(0) = -1$.

4(**20pts**) Find two linearly independent eigensolutions and the general solution for the system of equations

$$\begin{cases} x' = x + 2y \\ y' = 4x + 3y. \end{cases}$$

(*Page 2. Continue on Next Page ...*)

5(**15pts**) Use the Laplace method to find the solution to the integral equation: $f(t) + \int_0^t (t-\tau) f(\tau) d\tau = 1$.

6(**20pts**) The eigenvalues for the matrix $A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$ are given as $0,\ 1,\ 2$. Find the general solution to the system of equations $\mathbf{x}' = A\mathbf{x}$.

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2 Bonus Points: The state fish of Nebraska is: (a) Channel catfish (b) Tilapia (c) Bluegill (d) Rainbow trout (... The End)