M511: Linear Algebra (Spring 2018)
Instructor: Justin Ryan
Unit III Exam: Chapter 6 (In Class)

WICHITA STATE UNIVERSITY

Instructions. *Read and follow all instructions. You may not use a calculator or any other electronic device. You may use a two-sided 8.5" × 11" page of your own hand-written notes.*

Part I. True/False [2 points each] *Neatly write* **T** *on the line if the statement is always true, and* **F** *otherwise. In the space provided below the statement, give sufficient explanation of your answer.*

_____**1.a.** If $A, B \in \mathbb{R}^{n \times n}$ are similar matrices, then A and B have the same eigenvalues.

_____**1.b.** If $A, B \in \mathbb{R}^{n \times n}$ are similar matrices, then A and B have the same eigenvectors.

_____**1.c.** If $A \in \mathbb{R}^{n \times n}$ is singular, then $\lambda = 0$ is an eigenvalue.

_____**1.d.** The matrix exponential, e^A, exists for every $A \in \mathbb{R}^{n \times n}$.

_____**1.e.** If $A \in \mathbb{R}^{n \times n}$ has characteristic polynomial $p(\lambda) = \lambda^2 + b\lambda + c$, then $b = \det(A)$.

Part II. Written Problems [17.5 points each] *Complete all problems, showing enough work in the space provided.*

2. Find the eigenvalues and corresponding eigenspaces of the matrix.

$$A = \begin{pmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}$$

3. Use the eigenvalue methods of this chapter to find the particular solution of the second order differential equation.

$$\begin{cases} y'' - 4y' - 5y = 0, \\ y(0) = 1, \quad y'(0) = -1 \end{cases}$$

4. Use the definition of the matrix exponential to compute e^A, where

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ -1 & 0 & 1 \end{pmatrix}$$