MA 232 – Spring 2008 – Samples of problems on Second Test
Exam 2 is Tuesday, April 1, 2008, from 8:30 – 9:30 p.m.

From Chapter 3

1. For the vector $\vec{\mathbf{x}} = [2, -1, 5, 0]$, determine $\|\vec{\mathbf{x}}\|$.

2. Given the matrices $\mathbf{A} = \begin{bmatrix} 2 & -1 \\ 3 & 0 \\ 1 & -1 \end{bmatrix}$ and $\mathbf{B} = \begin{bmatrix} -3 & 0 & 2 & 0 \\ 1 & 4 & -1 & 2 \end{bmatrix}$, find the value of the product **AB** or explain why it is not possible.

3. Using the matrices $\mathbf{A} = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$ and $\mathbf{B} = \begin{bmatrix} 6 & 7 \\ 8 & 9 \end{bmatrix}$, illustrate that $(\mathbf{A} + \mathbf{B})^T = \mathbf{A}^T + \mathbf{B}^T$.

4. Given the following system of equations:

$$\begin{aligned} x - 3y + 2z &= 4 \\ 2x + y - 3z &= 1 \\ -x - y + z &= -2 \end{aligned}$$

Write the system in matrix-vector form, and also write the augmented matrix that would be used to represent the system. (*Do not solve the system.*)

5. Find the inverse of the matrix $\mathbf{A} = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 2 \\ 2 & 1 & 1 \end{bmatrix}$.

6. For the matrix $\mathbf{A} = \begin{bmatrix} 3 & 5 \\ 7 & 9 \end{bmatrix}$, what is the value of $|\mathbf{A}|$?

7. Use Cramer's Rule to solve the system of equations:

$$\begin{aligned} 2x - 5y &= 4 \\ 3x + 2y &= -2 \end{aligned}$$

8. Use matrix augmentation and Gauss-Jordan reduction to find the inverse of the upper-triangular matrix $\begin{bmatrix} 1 & -2 & 2 \\ 0 & 1 & -1 \\ 0 & 0 & -1 \end{bmatrix}$. (*Probably 10 points.*)

From Chapter 4

9. Solve the homogeneous DE: $y''' - 5y'' + 17y' - 13y = 0$.

10. A 7-lb object is suspended from a beam by a frictionless spring. The object stretches the spring 4 inches as it comes to its rest state. The object is pushed down 3 inches from its equilibrium, and given a downward velocity of 1.5 feet per second. Find and solve the equation of motion.

11. A third-order homogeneous differential equation has two characteristic roots of –4 and $2 - i$. Write the differential equation, using y as a function of the independent variable t. Further, write the general solution for the DE.

12. Find the general solution to the linear, second-order differential equation:

$$2y''+4y'-6y = 3\cos t + t^2 - 5t$$

Your solution process will make use of the superposition principle, the nonhomogeneous principle, and the method of undetermined coefficients.

13. Use variation of parameters, combined with the nonhomogeneous principle, to solve the following differential equation: $y''+2y'+y = e^{-t}\ln t$.

14. Use Reduction of Order to find a second, linearly independent solution function y_2 for the differential equation $t^2 y''-ty'+y = 0$, where $y_1 = t$.

<u>From Chapter 5</u>

15. Find the eigenvalues (and their corresponding eigenvectors) of the 2x2 matrix $\begin{bmatrix} 2 & -1 \\ -6 & 1 \end{bmatrix}$.