Math 20 Fall 2003
Midterm 2 Review Sheet

Listed below are the tasks per section that you should be prepared to do on the midterm. Most of the problems on the midterm will be similar to the homework problems previously assigned. For more practice, try the "additional exercises" for each section listed below.

§3.1 Introduction to Vectors

- Perform the following operations on vectors
  - addition
  - scalar multiplication
- Find the components of a vector with given initial and terminal points
- *Additional Exercises: #3, 5, 6, 7*

§3.2 Norm of a Vector; Vector Arithmetic

- Apply the properties of vector arithmetic listed in Theorem 3.2.1
- Compute the norm of a vector
- *Additional Exercises: #1, 3*

§3.3 Dot Product; Projections

- Find the dot product of two vectors
- Find the angle between two vectors
- Determine if two vectors are orthogonal
- Apply the properties of the dot product listed in Theorems 3.3.1 and 3.3.2
- Find the components of a vector both along and orthogonal to a given vector
- *Additional Exercises: #1, 2, 8, 10, 12*

§3.4 Cross Product

- Find the cross product of two vectors
- Apply the properties of the cross product listed in Theorems 3.4.1 and 3.4.2
- Find a vector orthogonal to two given vectors
- *Additional Exercises: #1, 13*

§3.5 Lines and Planes in 3-Space

- Find an equation of a plane in 3-space
- Find a normal vector to a plane in 3-space given an equation of the plane
- Find the parametric equations of a line in 3-space
- Find a vector parallel to a line in 3-space given the parametric equations of the line
- *Additional Exercises: #17, 21, 22, 24, 27, 31, 44*

§4.1 Euclidean n-Space

- Perform the following operations on vectors in n-space
  - addition

    - scalar multiplication
    - Euclidean inner product
- Find the norm of a vector in n-space
- Determine if two vectors in n-space are orthogonal
- Apply the properties of vector arithmetic and norms listed in Theorems 4.1.1, 4.1.2, 4.1.3, 4.1.4, and 4.1.7
- *Additional Exercises: #1, 2, 6, 9, 16, 28*

§4.2 Linear Transformations from $\boldsymbol{R}^n$ to $\boldsymbol{R}^m$

- Determine the image of a vector under a linear transformation
- Find the standard matrix for any of the following linear operators.
    - reflections
    - projections
    - rotations in 2-space
    - rotations about the positive x-, y-, or z-axis in 3-space
    - dilations and contractions
- Find the standard matrix for a composition of linear operators
- *Additional Exercises: #7, 15, 18, 19*

§4.3 Properties of Linear Transformations from $\boldsymbol{R}^n$ to $\boldsymbol{R}^m$

- Determine if a given linear operator is one-to-one
- Find the inverse of a given one-to-one linear operator
- Use Theorem 4.3.2 to determine if a given transformation is linear
- Use Theorem 4.3.3 to find the standard matrix of a given linear transformation
- Interpret the eigenvectors of a linear operator geometrically
- *Additional Exercises: #5, 6, 13, 19, 21, 22*

§7.1 Eigenvalues and Eigenvectors

- Find the eigenvalues and eigenvectors of a matrix
- Use Theorems 7.1.1 and 7.1.3 to find the eigenvalues and eigenvectors of a matrix.
- *Additional Exercises: #4, 5, 12, 23(a)*

§7.2 Diagonalization

- Determine if a matrix is diagonalizable and, if it is, find a matrix that diagonalizes it
- Compute a power of a diagonalizable matrix using the matrix that diagonalizes it
- Know the statements of the Big Theorem thus far: Theorem 7.1.5 (a–i, u)
- *Additional Exercises: #8, 10, 12, 13, 18*

§11.3 Geometric Linear Programming

- Determine if a two-variable linear programming problem has an optimal solution
- Solve a two-variable linear programming problem
- *Additional Exercises: #4, 5*

§11.9 Leontief Economic Models

- Model a simple closed input-output economy by an exchange matrix
- Find an equilibrium price vector for a given exchange matrix