Math 2210Q-004 Review Sheet for the Final Exam

The Final Exam is Monday, May 4, 2009, 8:00-10:00 am, MSB 215.

Covering text sections 1.1-1.5, 1.7-1.9, 2.1-2.5, 3.1-3.3, 4.1-4.7, 5.1-5.4, 6.1-6.4

Review Suggestions:

* Use the Review Sheets for the first two exams,
* Use Supplemental Exercises lists for Chapters 5 (p. 370) and 6 (p. 444) to assess your mastery of the material. Try the following questions from the Supplementary exercises:
  - Chapter 5: 1, 2, 3, 4, 5, 7, 9, 10
  - Chapter 6: 1a-q, 4, 5, 6, 13
* Reread and study class notes!
* Rework class quizzes with books and notes closed.
* Rework exercises from the various sections as time permits, again without referring to your notes or other parts of the text.

Things to concentrate on:

- Section 5.1: Eigenvalues and Eigenvectors of square matrices, of triangular matrices; when 0 is an eigenvalue; linear independence of eigenvectors corresponding to different eigenvectors; Eigenspace V_λ; the equivalence between V_0, the $\lambda = 0$ eigenspace of A, and Nul$A$.

- Section 5.2: The characteristic polynomial and the characteristic equation; similar matrices; the characteristic polynomial and similar matrices; the multiplicity of a root of the characteristic polynomial and the dimension of the corresponding eigenspace.

- Section 5.3: Diagonalization; how diagonalization depends on the number of linearly independent eigenvectors and not on the number of eigenvalues.

- Section 5.4: Viewing the diagonalization of an $n \times n$ matrix A as $[T]_{\mathcal{B}}$ where $\mathcal{B}$ is a basis of $\mathbb{R}^n$ consisting of eigenvectors of A and $T : \mathbb{R}^n \longrightarrow \mathbb{R}^n; \vec{x} \mapsto A\vec{x}$; The matrix representation $[T]_{\mathcal{C} \leftarrow \mathcal{B}}$ where $T : V \longrightarrow W$ and $\mathcal{B}$ is a basis of V and $\mathcal{C}$ is a basis of W. The figures in this section are very helpful in getting a picture of what this is all about.

- Section 6.1: Dot product; properties of the dot product; length, norm, distance; orthogonality; Orthogonal complements of vector subspaces.

- Section 6.2: Orthogonal sets of vectors; orthogonal basis of a vector space; calculation of the coordinate vector of $\vec{y}$ in terms of an orthogonal basis; orthogonal projection of $\vec{y}$ onto $\vec{u}$ and the component of $\vec{y}$ orthogonal to $\vec{u}$; Orthogonal matrices and properties of a linear transformation determined by an orthogonal matrix.

- Section 6.3: The (orthogonal) projection of a vector $\vec{y}$ onto a subspace W and the orthogonal decomposition of $\vec{y}$ into a sum of vectors, one from W and the other from $W^\perp$.

- Section 6.4: The Gram-Schmidt process of creating an orthogonal and an orthonormal basis from a given basis; The QR-factorization of a matrix.