Exam 1 Information
Math 544, Sections 401 and 501

Exam 1 will be based on:

- Sections 1.1 - 1.3, 1.5 -1.7, 1.9, 3.2.
- The corresponding assigned homework problems
  (see http://www.math.sc.edu/~boylan/SCCourses/math544/544.html). At minimum, you
  need to understand how to do the homework problems.
- Lecture notes: 1/11 - 2/3.

Topic List (not necessarily comprehensive):

§1.1: Matrix representation of a linear system: coefficient matrix, augmented matrix, ele-
mentary row operations, row equivalence.

§1.2: Solving linear systems via Gauss-Jordan elimination: reduced row echelon form of
a matrix, identifying dependent and independent variables, recognizing when a system is
consistent/inconsistent.

§1.3: Relationship between # nonzero rows and # columns in an augmented matrix in re-
duced row echelon form. Homogeneous linear systems. # possible solutions to

1. a general linear system.
2. an $m \times n$ system with $m < n$.
3. a homogeneous system.

§1.5: Matrix operations: addition, multiplication, multiplication by scalars, scalar (dot)
product in $\mathbb{R}^n$.

§1.6: Properties of matrix addition, multiplication, and multiplication by scalars. The matrix
transpose and its properties, scalar (dot) product and its relation to vector norm (length).

§1.7: Linear combinations, linear dependence/independence: determination of whether a
given set of vectors is linearly dependent/independent. Non-singular matrices; conditions
equivalent to non-singularity of $A \in \text{Mat}_{n \times n}$:

1. $Ax = \theta$ has only the trivial solution $x = \theta$
2. columns of $A$ are linearly independent
3. $\forall b \in \mathbb{R}^n, Ax = b$ has a unique solution.
4. $A$ is invertible.
5. $A$ is row equivalent to the identity, $I_n$. 
§1.9: Matrix inverses: existence of inverses (see above, e.g., \( A \) is invertible if and only if \( A \) is non-singular), using inverses to solve systems, computing inverses by row reduction, formula for inverse of \( 2 \times 2 \) matrix, algebraic properties.

§3.2: Vector space axioms:
1. closure properties (2)
2. addition properties (4)
3. multiplication properties (4)

Subspaces: how to determine whether a given subset of \( \mathbb{R}^n \) is a subspace.