

# Math 544, Exam 1 Information

## Exam 1 will be based on:

- Sections 1.1 - 1.3, 1.5 - 1.7, and 1.9.
- The corresponding assigned homework problems (see <http://www.math.sc.edu/~boylan/SCCourses/math5442/544.html>). **At minimum, you need to understand how to do the homework problems.**
- Lecture notes: 1/17 - 2/12.

## Topic List (not necessarily comprehensive):

**You will need to know how to define vocabulary words/phrases defined in class.**

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

§1.2: Solving linear systems via **Gauss-Jordan elimination**: echelon and reduced echelon forms 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 reduced 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  $\iff A$  is non-singular), using inverses to solve systems, computing inverses by row reduction, formula for inverse of  $2 \times 2$  matrix, algebraic properties.