Math 4377, Linear Algebra, Review for Exam 1  
Summer 2010, Dr. Min Ru, University of Houston

Part I: Review (Warning: This is only a partial review. You still need to read the textbook to see all the topics we have covered. Read key to HWs and do more practices using exercises on the textbook)

1. Fields: You need to know the definition of fields (and be able to write it down by yourself); know some examples; with a given set $F$, be able to verify (decide) whether it is a field or not, be able to prove some (simple properties) using the definition and some theorems. See HW#1 Problem 6, 8.

2. Functions $f : A \rightarrow B$. Know the definition of functions. Domain, codomain and range. Know how to prove a (given) function is one-to-one, and a (given) function is onto. Know how to find inverse. See HW#1 Problem 4, 5.


4. Know on how to solve a (given) system of linear equations.

5. Vector space. Know the definition. Know how to see whether a set $V$ is a space and is not a space? (Example 7 on P. 11 on how to prove that a set is NOT a vector space). Know how to prove some simple properties and theorems using the definition of a vector space (see Theorem 1.1 and Theorem 1.2 on P. 12).

6. How to verify (prove) a subset set is a subspace? (many practices).

7. How to verify dependency and independency if a set $S$ is given? How to express a given vector as a linear combination of the given vectors, how to find the coordinate of a vector if a basis is given (See P. 80 on the textbook).
8. How to verify a given set \( S \) is a basis? (Practice: See Example 13, 14, 15, 16 on P. 49). You need to verify (1) Span, (2) linearly independent. Know how to find the coordinate of a vector if a basis is given (See P. 80 on the textbook).

9. How to find a basis for \( S = \text{Span}\{v_1, \ldots, v_k\} \). (Practice: See Example 6, Exercise 1.6 problem 7, 13, ..).

10. Given a basis, know how to find the coordinate of a vector \( v \) with respect to the given basis (See P. 80 on the textbook).

11. Given a transformation \( T: V \to W \), how to verify whether \( T \) is linear. How to find Null space, range space. How to verify whether it is one-to-one, onto, and how to find an inverse (see the subject of "function" as well). If you know \( T \) is linear, how to find the value of \( T \) (see Problem 11 and 12 on P. 75).

12. Practice proofs (see Problem 8 on HW1, Problem 19 on P. 21, Problem 14 on P. 34, Problem 15 on P. 35, Problem 13 on P. 42, Problem 11 and 12 on P. 55.)