

Exam 1 Preparation

MATH 204: Linear Algebra

REMEMBER: Our exam will be Monday, September 25th from 1:25PM until 2:50PM in Stern 303. RECALL THE EARLY START TIME!!!

NOTE: There will be short answer questions in addition to problems. For example, I could give you a few statements and ask you to determine whether each was true or false and to prove or give a counterexample for each. Similarly, I could ask you to give me an example of something or justify that no such example exists.

NOTE: The exam will be over all the material covered in Sections 1.1-1.5 and 1.7. This is a **rough** guideline. You should be sure to review your homework, group work, quizzes and notes from these sections.

Rules, Facts and Theorems: You should know and be able to use the following theorems and facts. Hopefully you already have these in your notes and/or on flashcards!

1. Number of Solutions in Linear Systems (Fact on page 4)
2. Linear Systems with Row Equivalent Matrices (Fact on page 7)
3. Uniqueness of Reduced Row-Echelon Form Theorem (Theorem 1, page 13)
4. Existence and Uniqueness Theorem (Theorem 2, page 21)
5. Parallelogram Rule for Addition (Rule on page 26)
6. Properties of Scalar Multiplication and Vector Addition (page 27)
7. (a) Equivalent Representations Theorem (Theorem 3, page 36): $A\mathbf{x} = \mathbf{b}$ is the same as a vector equation and is solved using the augmented matrix $[A\mathbf{b}]$.

(b) Corollary (Fact on page 37) : $A\mathbf{x} = \mathbf{b}$ has a solution if and only if $\mathbf{b}$ is a linear combination of the columns of A (if and only if $\mathbf{b}$ is in $\text{Span}\{\mathbf{a}_1, \dots, \mathbf{a}_n\}$.)
8. Spanning and Pivots Theorem (Theorem 4, page 37)
9. Row-Vector Rule for Computing $A\mathbf{x}$ (Rule on page 38)
10. Properties (Linearity) of Matrix-Vector Multiplication Theorem (Theorem 5, page 39)
11. Nontrivial Homogeneous Solutions Theorem (Fact on page 44)
12. Solution Sets of Nonhomogeneous Systems in Relation to Homogeneous Solutions Theorem (Theorem 6, page 47)
13. Independence of Matrix Columns Theorem (Fact on page 58)
14. Linear Independence of Sets of Two Vectors (Fact on page 59)
15. Characterization of Linearly Dependent Sets Theorem (Theorem 7, page 59)
16. Surplus of Vectors Theorem (Theorem 8, page 60)
17. Dependence of Sets Containing the Zero Vector Theorem (Theorem 9, page 60)

Definitions: You have been working hard on definitions! Be sure you have memorized these terms for the exam: row equivalent matrices, (in)consistent system, augmented matrix, coefficient matrix, echelon form, reduced row echelon form, basic and free variables, linear independence (dependence), pivot position, the span of a set of vectors, linear combination, homogeneous and nonhomogeneous systems, parametric vector form. You should know how to use these as well as have a good definition of them memorized.

Be sure to...

- (1) review your definitions and theorems.
- (2) practice finding examples that satisfy or do not satisfy particular requirements (some examples of this include Section 1.7 numbers 29, and 33-38)
- (3) practice problems **without** your book or notes or collaborators.
- (4) bring a pencil (or several!) with a good eraser.
- (5) ask me questions if you are stuck or need clarification.
- (6) breathe!