Basic Info You will have 1 hour to complete the midterm. It will cover chapters 1-3,5-6 with an emphasis on chapters 1-5. Everything from the homework and the quizzes is fair game. You can bring in a single page of notes with writing on the front and a calculator. Note that you will not need the calculator and are expected to show your work.

Review by Topic Here is a more specific list of things to know and more study ideas.

- Ch 1

  - Know the language and notation of vectors and how to perform basic vector operations including rules of vector algebra.
  - Know the terminology of *linear combinations of vectors*, *inner product of vectors*, and *unit vectors*.
  - Recall familiar applications.

- Ch 2

  - Know the definition of a linear function and the basic strategies for determining if a function is or is not linear. Specifically, be able to show that a function is linear by exhibiting it in the form of ab inner product: $f(x) = a^T x$ and be able to show that a function is not linear by finding a counter-example.
  - Know the definition of an affine function and the basic strategy for determining if a function is or is not affine.
  - Review familiar applications and interpretations of linear/affine functions.

- Ch 3

  - Know how to compute the norm of a vector, the distance between two vectors, and the angle between two vectors.
  - Know how to tell if two vectors are orthogonal (perpendicular) or at an acute (or obtuse) angle.
  - Know the triangle inequality and the Cauchy-Schwartz inequality.
  - Be able to do algebraic manipulations involving norms and inner products

- Ch 5

  - Know the definition of linear independence and linear dependence and how to use them to *show* that a set of vectors is or is not linearly independent (dependent).
  - Know the **independence-dimension inequality** or **Fact A**.
  - Know the definition of a basis and an orthonormal basis. Understand how to determine if a set of vectors is a basis and how to write one vector as a linear combination of others. What are the advantages of an orthonormal set of vectors?
  - Know the Gram-Schmidt algorithm. Be able to implement it in a simple case (turn a_1, a_2, a_3 into q_1, q_2, q_3 with intermediate vectors $\tilde{q}_k$.) What properties do the q's have? How are those properties related to the a's?
  - If q_1, q_2 and q_3 are orthonormal in $\mathbb{R}^3$, explain how you know they form a basis. Since they do, given $x \in \mathbb{R}^3$ we can write $x = \alpha_1 q_1 + \alpha_2 q_2 + \alpha_3 q_3$ for some numbers α_1, α_2 and α_3. What are the numbers α_k? Hint: they can be expressed using inner products: equation (5.5) in the text.

- Ch 6

  - Know how to reference matrices and to do basic calculations including matrix-vector multiplication.