Math 2R03 Midterm 1 Info Sheet

The purpose of this handout is to help you study by listing the concepts, definitions, and results you will need to know for the midterm.

Midterm Information. The midterm will be on Thursday, February 11, 2021 The midterm will be 50 minutes long (during regular class time 12:30-1:20). The test will be given via CrowdMark. I will release the questions 10 minutes before the start time at 12:20PM, and I will give you 25 extra minutes (until 1:45PM) to upload your questions. I will be available online during that time via zoom to answer any questions.

The midterm will be open book. You can use your textbook, notes, class videos and notes, and Octave/Matlab. You may not use the help of any other person or website. There are 7 questions (4 short answer and 3 longer questions). The midterm is out of 25 points.

Material Covered. The midterm will cover the material we discussed in class in Lectures 1-11 (Chapters 1, 2, and 3.A-3.C). Below is a breakdown of what you will need to know from each section. Note that when you are learning definitions, it is good to know an example of that definition, and an example of an object that does not satisfy the definition.

Section 1.A Know the properties of $\mathbb{R}$ and $\mathbb{C}$. Know what we mean by F^n. Know addition in F^n, the zero element in F^n, the additive inverse, and scalar multiplication.

Section 1.B Know the definition of a vector space, a real and complex vector space, Theorems 1.24, 1.26, 1.29, 1.30, 1.31.

Section 1.C Know the definition of a subspace, and the conditions to check whether a subset is a subspace (Theorem 1.34). Know what it means to sum subsets, Theorem 1.39, and the definition of a direct sum. Also know the conditions to check whether a sum of subspaces is a direct sum (Theorems 1.44 and 1.45).

Section 2.A Know what we mean by a linear combination and a span. Know Theorem 2.7, and know what it means for a set of vectors to span V. Know what we mean by a finite and infinite dimensional vector space. Know about the vector space $\mathcal{P}_m(F)$ and $\mathcal{P}(F)$. Know what it means for a list of vectors to linearly independent and dependent. Know Theorems 2.21, 2.23, and 2.26.

Section 2.B Know what a basis is, and Theorem 2.29. Know Theorems 2.31, 232, 2.33, and 2.34.

Section 2.C Know Theorem 2.35 and the definition of dimension. Know Theorems 2.38, 2.39, 2.42, and 2.43.

Section 3.A Know the definition of a linear map, and the notation $\mathcal{L}(V, W)$. Know how to check if a function is a linear map. Know Theorems 3.5. Know the algebraic operations on $\mathcal{L}(V, W)$ that make $\mathcal{L}(V, W)$ a vector space. Also know Definition 3.8 and Theorem 3.11.

Section 3.B Know what the definitions of the null space and range. Know then an operator is injective or surjective. Know Theorems 3.14 and 3.19. Know the Fundamental Theorem of Linear Maps (Theorem 3.22). Know Theorems 3.23 and 3.24. You won't be tested on Theorems 3.26 of 3.29.

Section 3.C Know the definition of a matrix of linear map, and be able to compute this matrix from a given basis. Know how to add matrices and multiple matrices by scalars. Know what this means for the associated matrix (Theorems 3.36 and 3.38). Know Theorem 3.40. Know the definition of matrix multiplication and Theorem 3.43. You won't be tested on the material on pages 76-77.

If you have questions, please feel free to email me. Good luck!