Final Exam Conceptual Review

MATH 290, Fall 2018

- Our Final Exam is from **7:30 - 10 am** on **Tuesday, December 11**.
- The exam is **cumulative**. We have covered Sections

$$1.1 - 1.3,\ 2.1 - 2.5,\ 3.1 - 3.4,\ 4.1 - 4.6,\ 6.1 - 6.2,\ \text{and}\ \ 7.1.$$

  The exam will have an emphasis on the material that has not been tested on midterms, Sections 4.5−4.6, 6.1−6.2, and 7.1. Conceptual Reviews for the material before Midterm 1, and between Midterm 1 and Midterm 2 are also posted on the course website.
- We will have a **Review Session** on **Stop Day from 10:30 - 11:30 am**.
- The best preparation is to **practice, practice, practice** problems. This includes **quiz problems**, **WebAssign problems**, and **book problems**.
- **Solutions** to odd-numbered additional practice problems can be found in the back of the textbook, and solutions to WebAssign problems can be found through WebAssign.
- You may use a **calculator** and a **full** $8.5'' \times 10''$ **page of notes**, but cannot replace any class methods.
- To create your own **practice exam**, choose 1-2 problems from each section that cover a variety of the topics listed.
- We will have **additional office hours** on **Monday from 10 - 11 am and 2 - 3 pm**.

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§4.5: Basis and dimension

- **Concepts**: Basis of a vector space; standard basis of $\mathbb{R}^n$, $M_{m\times n}(\mathbb{R})$, and $P_n(\mathbb{R})$; dimension of a vector space; dimension of a subspace
- **Goals**: Find a basis for a vector space, complete a basis for a vector space, determine the dimension of a vector space or subspace, show that a set on dimension-many vectors is a basis for a vector space by showing it spans the space or is linearly independent
- **Practice problems**: §4.5 : #29, 37, 51, 61, 71, 78, 84; Chapter 4 Review: #29, 35

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§4.6: Rank of a matrix and systems of linear equations

- **Concepts**: Row/column space of a matrix, basis for the row/column space, rank of a matrix, nullspace of a matrix, nullity of a matrix, rank-nullity theorem for matrices, solutions to nonhomogeneous systems in terms of the corresponding homogeneous system
- **Goals**: Determine/find a basis for the row/column space of a matrix, determine the rank of a matrix, determine the nullspace/nullity of a matrix, find all solutions to a nonhomogeneous system from the null space of a matrix
- **Practice problems**: §4.6 : #15, 25, 37, 41, 53, 73, 77, 81; Chapter 4 Review: #45, 47

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§6.1: Introduction to linear transformations

- **Concepts**: Linear transformation between vector spaces, linear transformation defined by the image of a basis, linear transformation defined by a matrix, projection

- **Goals**: Determine whether a function between vector spaces is a linear transformation, apply properties of linear transformations, find the image of a vector under a linear transformation defined by the image of basis vectors, calculate the image of a vector under a linear transformation defined by a matrix
- **Practice problems**: §6.1 : #14, 15, 19, 27, 37, 45, 54, 56, 65, 68, 71, 73 ; Chapter 6 Review: #99

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§6.2**: The kernel and range of a linear transformation**

- **Concepts**: The kernel/range of a linear transformation, the rank/nullity of a linear transformation, rank-nullity theorem for linear transformations, isomorphism of vector spaces
- **Goals**: Find and describe the kernel/range of a linear transformation, determine the rank/nullity of a linear transformation, determine whether a linear transformation is an isomorphism
- **Practice problems**: §6.2 : #10, 15, 23, 39, 45, 47, 58, 61; Chapter 6 Review: #72

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§7.1**: Eigenvalues and eigenvectors**

- **Concepts**: Eigenvalue and corresponding eigenvector(s) of matrices or linear transformations, eigenspace corresponding to an eigenvalue, characteristic equation of a matrix, characteristic polynomial of a matrix
- **Goals**: Verify that a scalar-vector pair are an eigenvalue and corresponding eigenvector of a matrix, find the eigenspace of an eigenvalue and describe it geometrically, determine and solve the characteristic equation/polynomial of a matrix, find the eigenvalues and corresponding eigenvectors of a matrix, find eigenvalues of a triangular matrix
- **Practice problems**: §7.1 : #5, 11, 21, 25, 43, 65, 66, 67, 69