

Midterm 2 Conceptual Review

MATH 290, Fall 2018

- Midterm 2 is in class on **Thursday, November 8**.
 - The exam is **cumulative**, but will focus on §2.5, §§3.1 – 3.4, and §§4.1 – 4.4.
 - We will have time on Tuesday's class to review some practice problems.
 - 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 **3" × 5" notecard**, 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.
 - Check out **extended office hours** that will be posted on the course website.
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§2.5: Markov chains

- **Concepts:** Stochastic matrix, matrix of transition probabilities, state matrix, Markov chain, steady state of a Markov chain, regular stochastic matrix, regular Markov chain, absorbing state, absorbing Markov chain
 - **Goals:** Determine state matrices associated to a Markov chain, find the steady state of a Markov chain (if it exists), determine whether a stochastic matrix is regular, determine whether a Markov chain is absorbing
 - **Practice problems:** §2.5: #7, 9, 13, 23, 25, 45; Ch 2 Review: #51, 63, 71
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§3.1: The determinant of a matrix

- **Concepts:** Determinant of a matrix, minors of a matrix, cofactors of a matrix
 - **Goals:** Find the determinant of a 2×2 matrix, find the minors and cofactors of a matrix, use expansion by cofactors to find a determinant, find the determinant of a triangular matrix
 - **Practice problems:** §3.1: #15, 18, 29, 41, 43, 67; Ch 3 Review: #17, 47
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§3.2: Determinants of elementary operations

- **Concepts:** Effect of row and column operations on determinants, conditions that yield zero determinant
 - **Goals:** Use elementary row or column operations to evaluate a determinant, recognize conditions that yield zero determinants
 - **Practice problems:** §3.2: #15, 31, 39, 42, 45; Ch 3 Review: #21
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§3.3: Properties of determinants

- **Concepts:** Formulas for determinants of matrices obtained from other matrices, the notion that a matrix is nonsingular if and only if its determinant is nonzero
- **Goals:** Find the determinant of a matrix product and a scalar multiple of a matrix, find the determinant of an inverse matrix and recognize equivalent conditions for a nonsingular matrix, find the determinant of the transpose of a matrix
- **Practice problems:** §3.3: #5, 13, 17, 21, 27, 33, 39, 47, 67; Ch 3 Review: #43, 76

§3.4: Applications of determinants

- **Concepts:** Matrix of cofactors, adjoint of a matrix, Cramer's rule
 - **Goals:** Find the adjoint of a matrix and use it to find the inverse of the matrix; use Cramer's Rule to solve a system of n linear equations in n variables; use determinants to find area, volume, and the equations of lines and planes
 - **Practice problems:** §3.4: #7, 17, 27, 29, 35, 37, 41, 51, 59, 61; Ch 3 Review: #35, 75, 77
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§4.1: Vectors in \mathbb{R}^n

- **Concepts:** Vectors in the plane \mathbb{R}^2 , in 3-space \mathbb{R}^3 , and in n -space \mathbb{R}^n ; components of a vector; vector addition; zero vector; scalar multiplication of a vector
 - **Goals:** Represent a vector as a directed line segment; perform basic vector operations in \mathbb{R}^2 and \mathbb{R}^3 , and represent them graphically; perform basic vector operations in \mathbb{R}^n , write a vector as a linear combination of other vectors
 - **Practice problems:** §4.1: #1, 17, 24, 31, 57
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§4.2: Vector spaces

- **Concepts:** Vector space, vector space operations, zero element in a vector space, the vector spaces \mathbb{R}^n , vector spaces of matrices, vector spaces of functions, properties of scalar multiplication on vector spaces
 - **Goals:** Define a vector space, recognize some important vector spaces, determine whether or not a given set with given operations is a vector space
 - **Practice problems:** §4.2: #2, 9, 11, 47, 24, 25, 29, 31, 37, 41, 49, 50; Ch 4 Review: #25, 26
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§4.3: Vector subspaces

- **Concepts:** Subspace of a vector space, test for being a subspace
 - **Goals:** Determine whether a given subset of a vector space V is a vector subspace of V , determine vector subspaces of \mathbb{R}^n
 - **Practice problems:** §4.3: #3, 7, 12, 16, 18, 19, 24, 27, 29, 35, 39, 43, 44; Ch 4 Review: #22, 23
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§4.4: Spanning sets and linear independence

- **Concepts:** Linear combination of vectors in a vector space, spanning set of a vector space, the span of a set in a vector space, linear dependent/independence
- **Goals:** Write a linear combination of a set of vectors in a vector space, determine whether a set of vectors in a vector space is a spanning set, find the span of a set in a vector space, determine whether a set of vectors in a vector space is linearly independent or linearly dependent, write a vector as a linear combination of other vectors
- **Practice problems:** §4.4: #7, 17, 27, 37, 45, 51, 57, 61, 63, 64