Math 2568 Autumn 2019 Tentative schedule

(W 8/21) Introduction: solving linear equations. Vectors and matrices. Sections 1.1, 2.1 (We will repeat Section 2.1 again.)

(F 8/23) Vector and matrix addition and scalar multiplication, including geometry. MATLAB. Special kinds of matrices. Sections 1.2, 1.3, 1.4

(M 8/26) Solving linear equations. Geometry of low dimensional solutions. Sections 2.1, 2.2

(W 8/28) Gaussian elimination. Augmented matrices. Elementary row operations. Section 2.3

(F 8/30) Reduced row echelon form and uniqueness. Theorems 2.4.5 and 2.4.6. Sections 2.4 and 2.6

(M 9/2) NO CLASS

(W 9/4) The equation $Ax = b$. Matrix mappings (matrices multiplying vectors) L_A. Standard basis $\{e_i\}$ of $\mathbb{R}^n$. Ae_i is the i-th column of A. $A = B$ if and only if $Ae_i = Be_i$ for all i. Linearity of L_A. Sections 3.1, 3.2, 3.3.

(F 9/6) Linear transformations. Homogeneous equation $Lx = 0$. All linear maps $L : \mathbb{R}^n \to \mathbb{R}^m$ are matrix mappings by $m \times n$ matrices. Superposition. Sections 3.3, 3.4

(M 9/9) Composition of linear maps and matrix multiplication. Matrix multiplication is associative. Sections 3.5, 3.6

(W 9/11) Inverses of matrices, if they exist. Invertibility and uniqueness of solutions. Square matrix theorem (Theorem 3.7.8). Section 3.7

(F 9/13) 2×2 determinants, area of parallelograms, and invertibility. Review of all theorems. Section 3.8

(M 9/16) Vector spaces and subspaces. Examples. Section 5.1

(W 9/18) Row space, column space, and null space of a matrix. Span. Sections 5.2 and 5.3.

(F 9/20) Linear independence and dependence. Negation of linear independence is linear dependence. (Different definition of linear independence than the book!) Sections 5.4 and 5.5

(M 9/23) Dimension and bases. (Different definition of basis from the book!) Any basis has $\dim(V)$ elements. Some proofs. Sections 5.5 and 5.6

(W 9/25) Review for Exam 1

(F 9/27) EXAM 1

(M 9/30) Extension and Contraction Theorems. Some proofs. Sections 5.5 and 5.6

(W 10/2) Rank-Nullity Theorem. Find bases for row space, column space, and null space of a matrix. Sections 5.5 and 5.6

(F 10/4) Introduction to linear ODEs. Theorem 4.1.1. Section 4.1

(M 10/7) Exponential growth and decay. Uncoupled linear systems. Phase diagrams. Asymptotic stability and equilibria. Section 4.3

(W 10/9) Coupled linear systems. Eigendirections. Initial value problems and eigendirections. Sections 4.4 and 4.5

(F 10/11) NO CLASS

(M 10/14) The eigenvalue problem. Characteristic polynomial and eigenvalues of 2×2 matrices. Real and complex numbers. Eigenvectors. Sections 4.6 and 4.7

(W 10/16) Closed form solutions to ODEs. Distinct eigenvalues and eigenfunctions. Section 6.2.

(F 10/18) Closed form solutions to ODEs. Euler's formula. Complex eigenvalues and eigenfunctions. Section 6.2.

(M 10/21) Closed form solutions to ODEs. Repeated eigenvalues and eigenfunctions. Generalized eigenvectors Section 6.2.

(W 10/23) Similar matrices and Jordan normal form for 2×2 matrices. Section 6.3.

(F 10/25) Jordan normal form for 2×2 matrices. Sinks, saddles, and sources. Relationship between Jordan normal form and phase diagrams. Section 6.3 and 6.4.

(M 10/28) Cayley Hamilton Theorem for 2×2 matrices. Section 6.6

(W 10/30) Review for Exam 2

(F 11/1) EXAM 2

(M 11/4) Determinants. Effect of elementary row operations on determinants. An $n \times n$ matrix A is invertible if and only if $\det(A) \neq 0$. Section 7.1.

(W 11/6) Eigenvalues for $n \times n$ matrices. The multiple eigenvector equation $A_{n \times n} S_{n \times k} = S_{n \times k} D_{k \times k}$ for k eigenvectors. Fundamental Theorem of Algebra. Section 7.2

(F 11/8) An $n \times n$ matrix is diagonalizable if and only if there exists a basis of $\mathbb{R}^n$ consisting of eigenvectors for A.

(M 11/11) NO CLASS

(W 11/13) Linear maps, bases, and coordinates. Section 8.1

(F 11/15) Row rank and column rank. Rank nullity for linear maps. Section 8.2

(M 11/18) Vectors and matrices in coordinates. Section 8.3

(W 11/20) Coordinates for 2×2 matrices and Jordan form. Section 8.3

(F 11/22) Inner product spaces and orthonormal bases. Orthonormal coordinates. Section 9.1

(M 11/25) Graham-Schmidt Orthonormalization. Section 9.2

(W 11/27) Symmetric and Orthogonal matrices. Orthogonal diagonalization. Section 9.4

(M 12/2) Least squares approximation. Section 9.2

(W 12/4) Review for Final Exam.