Math 2568 Spring 2019 Tentative schedule

(M 1/7) Introduction: solving linear equations and ODEs. Vectors and matrices. Sections 1.1, 2.1 (we will repeat this section again.)

(W 1/9) Vector and matrix addition and scalar multiplication, including geometry. MATLAB. Special kinds of matrices. Sections 1.2, 1.3, 1.4

(F 1/11) Solving linear equations. Geometry of low dimensional solutions. Sections 2.1, 2.2

(M 1/14) Gaussian elimination. Augmented matrices. Elementary row operations. Section 2.3

(W 1/16) Reduced row echelon form and uniqueness. Theorems 2.4.5 and 2.4.6. Sections 2.4 and 2.6

(F 1/18) 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 $Ae_i = B_i$ for all i. Linearity of L_A. Sections 3.1, 3.2, 3.3.

(W 1/23) 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

(F 1/25) Composition of linear maps and matrix multiplication. Matrix multiplication is associative. Sections 3.5, 3.6

(M 1/28) Inverses of matrices, if they exist. Invertibility and uniqueness of solutions. Square matrix theorem (Theorem 3.7.8). Section 3.7

(W 1/30) Class cancelled for weather

(F 2/1) 2×2 determinants, area of parallelograms, and invertibility. Review of all theorems. Section 3.8

(M 2/4) Introduction to linear ODEs. Theorem 4.1.1. Section 4.1

(W 2/6) Exponential growth and decay. Uncoupled linear systems. Phase diagrams. Asymptotic stability and equilibria. Section 4.3

(F 2/8) Coupled linear systems. Eigendirections. Initial value problems and eigendirections. Sections 4.4 and 4.5

(M 2/11) The eigenvalue problem. Characteristic polynomial and eigenvalues of 2×2 matrices. Real and complex numbers. Eigenvectors. Section 4.6

(W 2/13) Review for Exam 1

(F 2/15) EXAM 1

(M 2/18) Initial value problems revisited. Section 4.7

(W 2/20) Vector spaces and subspaces. Examples. Section 5.1

(F 2/22) Row space, column space, and null space of a matrix. Span. Sections 5.2 and 5.3.

(M 2/25) 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

(W 2/27) Dimension and bases. (Different definition of basis from the book!) Any basis has $\dim(V)$ elements. Some proofs. Sections 5.5 and 5.6

(F 3/1) Extension and Contraction Theorems. Some proofs. Sections 5.5 and 5.6

(M 3/4) Rank-Nullity Theorem. Find bases for row space, column space, and null space of a matrix. Sections 5.5 and 5.6

(W 3/6) Closed form solutions to ODEs. Distinct eigenvalues and eigenfunctions. Section 6.2.

(F 3/8) Closed form solutions to ODEs. Euler's formula. Complex eigenvalues and eigenfunctions. Section 6.2.

(M 3/19) Closed form solutions to ODEs. Repeated eigenvalues and eigenfunctions. Generalized eigenvectors Section 6.2.

(W 3/21) Similar matrices and Jordan normal form for 2×2 matrices. Section 6.3.

(F 3/22) 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 3/25) Cayley Hamilton Theorem for 2×2 matrices. Section 6.6

(W 3/27) Review for Exam 2

(F 3/29) EXAM 2

(M 4/1) 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 4/3) 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 4/5) Linear maps, bases, and coordinates. Section 8.1

(M 4/8) Row rank and column rank. Rank nullity for linear maps. Section 8.2

(W 4/10) Vectors and matrices in coordinates. Section 8.3

(F 4/12) Coordinates for 2×2 matrices and Jordan form. Section 8.3

(M 4/15) Inner product spaces and orthonormal bases. Orthonormal coordinates. Section 9.1

(W 4/17) Least squares approximation. Section 9.2

(F 4/19) Graham-Schmidt Orthonormalization. Section 9.2

(M 4/22) Symmetric and Orthogonal matrices. Diagonalization. Section 9.4