UC Berkeley, Physics 89
Mathematical Methods in Physics, Spring 2017
Syllabus (Updated: 4/2)

Week	**Topics**	**Notes**
Week 1 1/16 - 1/20	Introduction. **Taylor Expansions** and Approximations	*No Class on Monday, 1/16* *No Discussion Sections this week.*
Week 2 1/23 - 1/27	**Complex Numbers** and the Complex Plane Introduction to **Vectors** and Vector Spaces Vector Spaces	*Discussion Sections start.*
Week 3 1/30 - 2/3	Linear Independence, Span, and Bases "Direction" of a Vector "Magnitude" of a Vector - The Inner Product The Gram-Schmidt Procedure Introduction to **Matrices**	
Week 4 2/6 - 2/10	Matrix Multiplication Linear Systems of Equations as Matrix Equations Row Reduction (Gauss-Jordan) Existance and Uniqueness of Solutions	
Week 5 2/13 - 2/17	Images, Kernels, Ranks, and Nullities Classifications and Manipulations of Matrices Properties of Matrices (the trace, determinant)	
Week 6 2/20 - 2/24	Cramer's Rule for Solving Systems of Linear Equations The Wronskian -----*Here Ends Material for Midterm 1*----- The Matrix Inverse Computing Inverses with Row Reduction Computing Inverses with Determinants	*No Class on Monday, 2/20*
Week 7 2/27 - 3/3	The **Eigenvalue** Problem Quadratic Forms Finding Eigenvalues and Eigenvectors Eigenvalue/Eigenvector Theorems and Properties	**Midterm 1 - Monday, 2/27**
Week 8 3/6 - 3/10	Changes of Basis Similarity Transformations Active Transformations Diagonalization	
Week 9 3/13 - 3/17	Introduction to **Tensors** What is a Tensor? Tensors by Analogy - Scalars, Vectors, Matrices How Tensors Transform	
Week 10 3/20 - 3/24	The Tensor Product Contraction Deltas, Epsilons, Dots, and Crosses -----*Here Ends Material for Midterm 2*-----	
	No Class - Spring Break	
Week 11 4/3 - 4/7	Introduction to **Differential Equations** Classifying Differential Equations Linear Ordinary Differential Equations Solution Techniques for First-Order Linear ODEs	
Week 12 4/10 - 4/14	Solution Techniques for Higher-Order Linear ODEs Fourier Series The **Fourier Transform**	**Midterm 2 - Monday, 4/10**
Week 13 4/17 - 4/21	**Partial Differential Equations** Separation of Variables *• Physical System - The Wave Equation •*	
Week 14 4/24 - 4/28	Asymptotic solutions and series solutions Special Functions: Bessel, Hermite, Legendre	
5/1 - 5/5	*Reading/Review/Recitation Week*	
Finals Week 5/8 - 5/12	***Final Exam (Exam Group 7)*** ***Tuesday, May 9*** ***3:00pm - 6:00pm***	

This syllabus is subject to minor changes. Please pay attention to any announcements online or in lecture.

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