

## Physics 227: Elementary Mathematical Physics (part 1 of 2)

Based on A17 as taught by Aurel Bulgac and A12-14 as taught by Steve Sharpe.

### Overview

This course introduces the mathematical tools needed for advanced undergraduate and beginning graduate physics classes. The emphasis is on problem solving rather than on rigorous proofs. There are 4 lectures per week, plus a Mathematica and problem-solving tutorial. Basic use of a computer mathematics program such as Mathematica is now an integral part of this course and its discussion might be included in the lectures.

### Evaluation

Weekly written quizzes, two midterms and one final exam. Weekly homeworks are assigned but not graded.

### Texts

1. **Required:** *Mathematical Methods in the Physical Sciences*, Mary L. Boas (Wiley, 3<sup>rd</sup> ed., 2006)

### Topics (approximate; chapters refer to Boas)

1. **Ch. 1 (4 lectures):** Series, convergence tests, power series, truncation errors.
2. **Ch. 2 (4 lectures)** Complex numbers, equations & series; applications.
3. **Ch. 3 (19-20 lectures):** Vectors, scalar & vector products; Matrices & linear transformations, index notation; Rotation matrices; General classes of matrices; Determinant and inverse; Solving linear equations; General vector spaces & inner products; Schwartz inequality; Gram-Schmidt orthogonalization; Eigenvalues & eigenvectors; Application to normal modes; Introduction to group theory.
4. **Ch. 6 (7-8 lectures):** Triple vector product; Directional derivative; Grad, Div, Curl & Laplacian in various coordinate systems; Line integrals & conservative forces; Stokes & divergence theorems & applications.
5. **Ch. 7 (4 lectures):** Fourier Series, Fourier transforms & applications