# Physics 228: Elementary Mathematical Physics (part 2 of 2)

Based on W13-15 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, 3rd ed., 2006)

## Topics (approximate; chapters refer to Boas)

1. **Ch. 8 (4 lectures):** First-order linear ordinary differential equations (ODEs); Second order ODEs with constant coefficients.
2. **Ch. 14 (5 lectures)** Analytic functions, Cauchy-Riemann conditions; Complex contour integrals & Cauchy’s theorems; Method of residues & applications; Laurent series.
3. **Ch. 8 again (6 lectures)**: Laplace transforms; Inverse Laplace transforms; Dirac delta function & appications to ODEs; Green functions & applications; Solving ODEs by matching.
4. **Ch. 9 (3 lectures):** Calculus of variations; Lagrangian mechanics.
5. **Ch. 12 (5 lectures):** Series solutions to ODEs; Legendre’s equation; Generating functions; Legendre polynomials & applications; Legendre Series; Fuch’s theorem & Frobenius’ method for solving ODEs.
6. **Ch.** **11 (1 lecture):** Gamma and Beta functions.
7. **Ch. 12 again (1 lecture):** Bessel’s equation and it’s solutions.
8. **Ch. 13 (6 lectures):** Introduction to partial differential equations (PDEs); Separation of variables; Laplace’s equation in 2-d with Cartesian coordinates; Diffusion equation with Cartesian coordinates; Curvilinear coordinates in general (**Ch. 10)**; PDEs in cylindrical coordinates; PDEs in spherical coordinates & applications.
9. **Ch. 14 again (1 lecture):** conformal maps & applications.
10. **Review (2 lectures)**