This is a graduate course essentially concerned with solving differential equations. The ultimate goal is to develop the formalism of Green’s functions for various linear partial differential equations. However, applying this formalism requires a sound understanding of various more elementary methods. Some of these should be familiar from previous work, including:

- linear algebra and diagonalization in Hilbert space,
- solution of ordinary differential equations,
- Fourier transforms and the Dirac delta function, and
- separation of variables for the Laplacian in 2 and 3 dimensions.

Students uncomfortable with any of this material should consult with the instructor as soon as possible.

**Organization**

The course will cover several mathematical topics that will be useful in other graduate physics courses. We focus on topics that will be useful in multiple other courses, and in research. These include

- complex variables with applications,
- integral transforms and generalized functions,
- Sturm–Liouville theory and special functions, and
- boundary-value problems and Green’s functions.

The course will follow loosely a traditional lecture format, with an emphasis on solving specific problems. Computer demonstrations will be used where possible.

**Grading**

Grades in this course will be calculated, via a curve, based on students’ performance on

- roughly weekly homework assignments (40%)
- the mid-term and final exams (40%), and
- a subjective assessment of class participation and engagement (20%).