

Math 250A

Sequences and Series; Linear Algebra

Chapters 9 and 10 are concerned with sequences and series, and approximation of functions via Taylor series. We thought that a nice idea might be to introduce sequences and series via discrete dynamical systems, both as an easy source of applications and as a way to foreshadow the later material in differential equations (continuous dynamical systems). While there will be some applications of series directly to problems in the life sciences, an important part of the applications in these chapters will be to obtain qualitative understanding of some models via Taylor series approximation.

The last few weeks of this new version of Math 250A will cover an introduction to linear algebra, rather than the traditional introduction to differential equations, since students will go on to study differential equations in some depth during the second semester. However, due to limited time, the topics in linear algebra will probably have to be presented as a collection of algorithms (perhaps like a course in matrix analysis), rather than an axiomatic development from the vector space perspective.

The rough syllabus for this portion of Math 250A is as follows:

Sequences and Series (Chapter 9)

- Discrete Dynamical Systems, e.g. population growth or a simple discrete reaction model
- Convergence of sequences (graphically, numerically, analytically)
- Series as sums of sequences; sequence of partial sums and convergence of series
- Geometric series, e.g. absorption of regular doses of a drug
- Tests for convergence of series and connections between series and improper integrals
- Power series and interval of convergence

Approximating Functions using Taylor Series (Chapter 10)

- Taylor polynomials and Taylor series
- Finding Taylor series; Taylor series for well-known functions
- Using Taylor polynomials to determine approximate behavior of functions
- Numerical integration using Taylor series; local vs. global approximation

Linear Algebra

- Vectors and matrices over \mathbb{R} ; linear transformations
- Linear dependence and independence of vectors
- Determinants and computation of the determinant
- Computing eigenvalues and eigenvectors, and their significance