

## Syllabus

Week 1

Caltech - Winter 2012

The following is a (rough) syllabus for the seven-week Winter 2011 run of Math 1d. The contents of our actual lectures may vary. Note that our course will be running through weeks 2-8 of this quarter, due to the timing of New Year's and the seven-week nature of the course.

- **Week 2: Sequences.** In this week's lectures (which will be a quick review/summary of the sequences material you've seen in Ma1a) we will discuss the various methods we have for showing that a given sequence converges.
- **Week 3: Series.** In these talks, we introduce the concept of a mathematical **series**. Specifically, we will define the concept of **convergence** for series, discuss seven or so tools that allow us to tell whether a series converges, and calculate examples that will illustrate how and when to use these tools.
- **Week 4: Functions and Convergence.** In this section, we extend our earlier discussion of convergence from sequences of **numbers** to sequences of **functions**; here, we will illustrate the concepts of **pointwise** and **uniform** convergence, ideas that will show up in ACM 95 / later mathematics courses.
- **Week 5: Power Series and Fourier Series.** In a similar vein to last week's work, this series of lectures will deal with series of **functions**, and the question of where they converge. In particular, we'll focus on series of polynomials (power series) and series of trigonometric polynomials (Fourier series,) and use the HW to discuss some applications to signal processing and other applied fields of mathematics.
- **Week 6: Taylor Series.** This week's lectures will discuss the uses, applications, and limits of Taylor series. In particular, we will calculate the Taylor series for several functions, and use these Taylor series to calculate some derivatives and integrals.
- **Week 7: Complex Analysis.** In this week's lectures, we'll provide a whirlwind tour of the field of complex analysis (previewing several future courses in your mathematical career, like ACM 95 and Ma 2). In particular, we will start by using complex power series to define the trigonometric functions on the complex plane, deduce Euler's formula, and use series to define and study the **integral** of a complex-valued function.
- **Week 8: Generating Functions.** As a coda for the course, we'll make a detour into mathematical field of **combinatorics**, my area of study. Here, we'll examine things like the Fibonacci sequence, tiling problems, and possibly some open questions in mathematics, using the language and tools of series.