

Integration Workshop Outline Douglas Ulmer

Audience: Incoming Math grad students

Goals: (i) Prepare students for core classes by getting them to think about undergrad material from a "graduate" point of view; (ii) establish an esprit de corps among the students; (iii) acquaint students with a few faculty and senior grad students (and conversely).

Model: Similar to that of the Arizona Winter School: a few days of intense activity including lectures, problem sessions, a project, and a concluding lecture by students.

Schedule: 9-12, 2-5, 7-10 M-Th and 9-12, 2-5 Fr. Morning and afternoon sessions will have 2 hours of lecture/discussion, one hour of problem solving. Evening sessions will be devoted to problem solving and projects. The last afternoon will be devoted to student presentations. (18 hours of lecture, 20 hours of problem solving, 3 hours of student presentations, 1 hour for a diagnostic exam.)

Topics: To be determined based on "What every incoming student is expected to know" and input from core instructors. Preliminary list:

Linear algebra (Vector spaces and linear transformations. Bases and matrices. Row reduction. Bilinear forms, Gram-Schmidt, spectral theorem)

Calculus (Derivative of a function $f: \mathbb{R}^n \rightarrow \mathbb{R}^m$. Inverse and implicit function theorems. Multivariable Riemann integral. Stokes in dimensions 1, 2, 3.)

Complex analysis (Holomorphic functions. Cauchy integral formula. Analytic continuation. Special functions.)

Algebra (Rings and modules. Modules over a PID. Application to finitely generated abelian groups and the Jordan form.)

Real Analysis (Sequences and series. Uniform convergence of sequences of functions. Existence and uniqueness of solutions of first order ODEs)

Topology (Topological spaces, continuous functions. Hausdorff and metric spaces. Compact and connected spaces. Heine-Borel theorem.)

Projects would ideally combine two or more areas. (E.g., Real analysis/algebra: Fourier series; Linear algebra/real analysis: function spaces; complex analysis/topology: Riemann surfaces, ...)

Personnel: 3 math faculty (ideally one each from analysis, geometry, algebra and not the upcoming core instructors). 3-6 senior grad students (from various areas).

Rewards: For students: \$150 meal card for the week. If workshop is completed, \$250 to spend at bookstore. For senior grads and faculty: some salary and the undying gratitude of the students.