Suggested background for Math 503

Necessary background for Math 503 includes the following material. Please note that although much of this material may be reviewed when it is first used in the course, the review would be very rapid and mostly be used for establishing notation. It would not be sufficient instruction for those learning the material for the first time.

- Good knowledge of elementary real analysis, including the ability to prove statements about uniform convergence of functions, and the ability to contrast uniform convergence with other kinds of converge, especially pointwise convergence. Appropriate theoretical acquaintance with the derivative and the Riemann integral.
- Good knowledge of the computations of several variable calculus: partial derivatives, the chain rule, line integrals, multiple integrals, the derivative of a function between (finite dimensional) vector spaces, some idea of the Inverse/Implicit Function Theorem(s). Facility with most of this material comes from comfortable mastery of several variable calculus, a standard part of every mathematician's life.
- Some acquaintance with the language and structures of point set topology and abstract algebra, including the following:

  Point set topology Knowledge of the elements of topological spaces, including the definitions and basic examples of compact and connected sets, and continuous and homeomorphic mappings; familiarity with metric spaces including open and closed balls, sequences and convergence, the Cauchy criterion, completeness.

  Abstract algebra At least the notion of vector space and linear mapping, and the representations of these using bases and matrices; good also would be knowledge of groups, subgroups, and quotient groups, and some simple examples of groups acting on sets.

The elementary real analysis and point set topology would usually be learned in a serious "beginning analysis" course. At Rutgers, such a course uses as text Rudin's *Principles of Mathematical Analysis* published by McGraw-Hill. The material needed is mostly in the first 5 chapters and some of chapter 7. Basic undergraduate linear algebra and abstract algebra courses would give sufficient knowledge of algebra.

- Previous acquaintance with computational aspects of complex analysis, as would be covered in a U.S. undergraduate complex analysis course. This is not absolutely necessary, but students without such knowledge must learn the computational material as well as the ideas of the subject in Math 503, and this can be burdensome. The text used at Rutgers now for the undergraduate course is *Complex Variables*, second edition, by Fisher, published by Dover. Most of the first 3 chapters are covered, with some additional material depending on the instructor. Another standard undergraduate text for this material is *Complex Variables and Applications* by Churchill & Brown, published by McGraw-Hill.