

MA 711      REAL ANALYSIS      Tom Hawkins

The course begins with the theory of Lebesgue measure and integration on  $\mathbb{R}^1$ , including the study of functions of bounded variation, absolutely continuous functions and the fundamental theorem of the calculus. Abstract theories of measure and integration are then developed and applied to the study of  $L^p$  spaces, product measures and Lebesgue–Stieltjes measures.

**TEXT:** H. L. Royden, *Real Analysis*, 3rd. edn., New York (Macmillan).

**MATERIAL COVERED IN TEXT:** Chapters 1–6 and 11–12.

**PREREQUISITE:** Familiarity with the fundamentals of theoretical real analysis, e.g. as presented in MA 511–12 or in Rudin’s *Principles of Mathematical Analysis*, 3rd. edn., McGraw-Hill, New York 1976, *including familiarity with giving theoretical proofs in real analysis*.

**OFFICE HOURS** (MCS 251, tel. 3–4591, email:twh@math): See my homepage:  
<http://math.bu.edu/people/twh/>

**GRADING POLICY:** Problems are usually assigned to accompany each lecture. *To master real analysis you should do them all.* Periodically, and without more than a few days advance notice, a **problem set** will be collected and graded. The problems on the problem set will be drawn from those that have been assigned so that, if you have been regularly doing the assigned problems, the short advance notice should offer no difficulties. There will not be a final examination per se, but the **last problem set plays the role of final exam** *in the sense from the outset that all the work on those problems is to be yours alone*, i.e., no collaboration or consultation of other books or persons. At the end of the semester I will have a problem set average for you, and your final letter grade will be based upon that.

**POLICY ON COLLABORATION AND CONSULTATION:** Students in MA711 may collaborate with one another on the regularly assigned problems. Here “collaboration” means a sharing of ideas, not one person telling another how to solve a problem step-by-step. *Once a problem set is announced no further collaboration on the problems included on the set is permitted.* From that point on, you are on your own. *No collaboration on the extra credit problems is permitted at any time. The same is true of the final problem set.* If you think you have a solution to a problem of any kind—regular assigned problem or problem set problem—but are not 100% certain about the validity of your proof or the acceptability of what it takes for granted without proof, you are welcome to come to my office and present it to me and get some feedback.

**BIBLIOGRAPHIC COMMENTS:** Royden’s text is excellent and should meet most of your needs. For more on the historical background of the theory see my book, which is [7] in Royden’s bibliography. A standard reference on abstract measure and integration is Halmos’ book [5]. Rudin’s book [12] is noteworthy for the way it unites real and complex analysis—and for the perverse difficulty of its exercises. A good source of information about applications to probability theory is P. Billingsley, *Probability and Measure*, New York (Wiley). Also an especially valuable text for those with an interest in mathematical finance is R. M. Dudley’s *Real Analysis and Probability* (Cambridge University Press).