

Syllabus/achievement requirements

Book

Spaces — an introduction to real analysis by Tom Lindstrøm, AMS, 2017.

Fourier series with Riemann integration, chapter 10 of Spaces.

Syllabus

Chapter 1. Preliminaries: Proofs, Sets, and Functions

- 1.1. Proofs
- 1.2. Sets and Boolean operations
- 1.3. Families of sets
- 1.4. Functions
- 1.6. Countability

Chapter 2. The Foundation of Calculus

- 2.1. Epsilon-delta and all that
- 2.2. Completeness
- 2.3. Four important theorems

Chapter 3. Metric Spaces

- 3.1. Definitions and examples
- 3.2. Convergence and continuity
- 3.3. Open and closed sets
- 3.4. Complete spaces
- 3.5. Compact sets
- 3.6. An alternative description of compactness

Chapter 4. Spaces of Continuous Functions

- 4.1. Modes of continuity
- 4.2. Modes of convergence
- 4.3. Integrating and differentiating sequences
- 4.4. Applications to power series
- 4.5. Spaces of bounded functions
- 4.6. Spaces of bounded, continuous functions
- 4.7. Applications to differential equations

- 4.8. Compact sets of continuous functions
- 4.9. Differential equations revisited
- 4.10. Polynomials are dense in the continuous function

Chapter 5. Normed Spaces and Linear Operators

- 5.1. Normed spaces
- 5.2. Infinite sums and bases
- 5.3. Inner product spaces
- 5.4. Linear operators
- 5.5. Inverse operators and Neumann series

Chapter 6. Differential Calculus in Normed Spaces

- 6.1. The derivative
- 6.2. Finding derivatives
- 6.3. The Mean Value Theorem
- 6.4. The Riemann Integral
- 6.5. Taylor's Formula
- 6.7. The Inverse Function Theorem
- 6.8. The Implicit Function Theorem

Chapter 10. Fourier Series with Riemann Integration

- 10.1. Fourier coefficients and Fourier series
- 10.2. Convergence in mean square