

List of Topics and Course Outline for Math 787.03, Summer 2003

9 weeks x 3 days per week minus 1 holiday = 26 class days.

1. Topics in Rudin, Principles of Mathematical Analysis:
 - 1.1. Basic Topology
 - 1.2. Sequences and Series of Numbers
 - 1.3. Continuity
 - 1.4. Differentiability
 - 1.5. Integration
 - 1.6. Sequences and Series of Functions
2. Topics in Berkeley Problems in Mathematics, Chapter 1
 - 2.1. Elementary Calculus
 - 2.2. Limits and Continuity
 - 2.3. Differential Calculus
 - 2.4. Integral Calculus
 - 2.5. Sequences of Functions
 - 2.6. Convex Functions
3. Topics in Kaczor–Nowak Volume I
 - 3.1. Real numbers
 - 3.1.1. Sup and Inf of sets of real numbers; continued fractions
 - 3.1.2. Some Elementary Inequalities
 - 3.2. Sequences of Real Numbers
 - 3.2.1. Monotonic Sequences
 - 3.2.2. Limits. Properties of Convergent Sequences
 - 3.2.3. The Toeplitz Transformation, the Stolz Theorem and their Applications
 - 3.2.4. Limit Points. Limit Superior and Limit Inferior
 - 3.2.5. Miscellaneous Problems
 - 3.3. Series of Real Numbers
 - 3.3.1. Summation of Series
 - 3.3.2. Series of Nonnegative Terms
 - 3.3.3. The Integral Test
 - 3.3.4. Series of Positive and Negative Terms—Convergence, Absolute Convergence. Theorem of Leibniz.
 - 3.3.5. The Dirichlet and Abel Tests
 - 3.3.6. Cauchy Product of Infinite Series

- 3.3.7. Rearrangement of Series. Double Series
- 3.3.8. Infinite Products

4. Kaczor and Nowak Volume II:

4.1. Limits and Continuity

- 4.1.1. The limit of a Function
- 4.1.2. Properties of Continuous Functions
- 4.1.3. Intermediate Value Property
- 4.1.4. Semicontinuous Functions
- 4.1.5. Uniform Continuity
- 4.1.6. Functional Equations
- 4.1.7. Continuous Functions in Metric Spaces

4.2. Differentiation

- 4.2.1. The Derivative of a Real Function
- 4.2.2. Mean Value Theorems
- 4.2.3. Taylor's Formula and L'Hospital's Rule
- 4.2.4. Convex Functions
- 4.2.5. Applications of Derivatives
- 4.2.6. Strong Differentiability and Schwarz Differentiability

4.3. Sequences and Series of Functions

- 4.3.1. Sequences of Functions, Uniform Convergence
- 4.3.2. Series of Functions, Uniform Convergence
- 4.3.3. Power Series
- 4.3.4. Taylor Series

5. Rough Classification of Topics Observed on OSU Qualifying Exams (roughly in order of observed occurrence) together with relevant sections from Berkeley Book (B), Kaczor and Nowak (KNI, KNII).

- 5.1. Uniform Convergence of Sequences and Series of Functions (B, §1.6, KNII Chap. 3).
- 5.2. Differentiation (B, §1.4, KNII Chap. 2).
- 5.3. Series of Real Numbers (B, §1.3, KNI Chap. 3).
- 5.4. Improper Integrals (B, §1.5)
- 5.5. Sequences of Real Numbers (B, §1.3, KNI Chap. 2).
- 5.6. Inequalities (KNI, Chap. 1).
- 5.7. "Other"
- 5.8. Limits and Integrals (B, §1.5).
- 5.9. Uniform Continuity (B, §1.2, KNII Chap. 1.5).

- 5.10. Power Series (KNII Chap. 3.3).
 - 5.11. Polynomial Approximation (B, §1.5, KNII Chap. 3.1).
 - 5.12. Prove a well-known result
 - 5.13. Integrals and Inequalities (B, §1.5)
 - 5.14. Uniform Convergence and Differentiation.
 - 5.15. Riemann Integral
 - 5.16. Calculus (B, §1.1).
 - 5.17. Continuity (B, §1.2, KNII, Chap. 1).
 - 5.18. Infinite Products (KNI, §3.8).
6. General Plan for the course:
- 6.1. Week 1: Elementary Calculus (B, §1.1), Elementary inequalities (KNI, Chap. 1.2).
 - 6.2. Week 2 and 3: Sequences and Series of Real Numbers (B, §1.3, KNI, Chap. 2 and 3).
 - 6.3. Week 4: Limits and Continuity (B, §1.2, KNII Chap. 1).
 - 6.4. Week 5: Differentiation (B, §1.4, KNII, Chap 2).
 - 6.5. Week 6: Sequences and Series of Functions (B, §1.6, KNII, Chap. 3).
 - 6.6. Week 7: Integration (B, §1.5).
 - 6.7. Week 8: Other topics
 - 6.8. Week 9: OSU Qualifying Exams from past years.