Course content

This course is a foundational core subject for mathematics majors, distinct from Advanced Mathematics for non-math majors in its emphasis on rigorous reasoning and proof of mathematical problems. The course trains students in logical and abstract mathematical thinking, equipping them with problem-solving skills and a strong understanding of mathematical analysis concepts and methods.

Key topics covered include:

1. Real numbers, functions, and supremum principle

2. Sequences and function limits

3. Continuity and uniform continuity

4. Derivatives, higher-order derivatives, and differentials

5. Mean value theorems, Taylor series, and applications

6. Integration theory, including definite, indefinite, and improper integrals

7. Applications of integration, such as area, volume, curve length, and numerical approximations

Course objectives

Knowledge

1. Understand the theoretical foundations of single-variable calculus, including real numbers and functions, limits, continuity, derivatives, definite/indefinite integrals, and improper integrals.

2. Learn rigorous mathematical reasoning and proof methods.

3. Build a strong mathematical foundation for further studies in mathematics and computer science.

Skills

1. Solve problems involving single-variable calculus using rigorous reasoning and precise methods.

2. Analyze and prove mathematical concepts, including the properties of limits, derivatives, and integrals.

3. Apply calculus concepts to solve problems in related fields, such as computer science and engineering.

Competencies

1. Develop logical and abstract mathematical thinking, enhancing problem-solving and independent work abilities.

2. Apply mathematical knowledge to analyze and solve complex problems in mathematics and engineering.

3. Use calculus as a tool to support interdisciplinary learning and research in computer science and related fields.