
Prerequisite: Grade of C or higher in Calculus II (MA2320) and Discrete Mathematics (MA3030)

COURSE DESCRIPTION: An introduction to concepts commonly used in advanced mathematics with an emphasis on writing proofs. Topics include logic, set theory, relations, functions, and cardinality as well as selected topics from other areas of advanced mathematics such as number theory, abstract algebra, topology, and real analysis.

GOALS & OBJECTIVES: The main goal of this course is to prepare students for higher level courses in mathematics. This is done by engaging students in problem solving techniques and mathematical reasoning that presage higher level topics. Through examples and exercises, students will develop their mathematical reasoning ability – the ability to read and write proofs. The mathematical reasoning is practiced on fundamental topics that are needed for success in advanced mathematics courses. These topics include sets, relations, functions, properties of numbers, and cardinalities of sets. After successful completion of the course students should be able to demonstrate the ability to write mathematical proofs that are convincing, readable, notational consistent, and grammatically correct.

COURSE EVALUATION & GRADING: Course grade will be based on midterm exams, quizzes, assignments, and Final Exam. The Final exam is cumulative and it counts at least 30% of the course grade. The grading scale is as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>[94, 100]</td>
</tr>
<tr>
<td>A-</td>
<td>[90, 93]</td>
</tr>
<tr>
<td>B</td>
<td>[84, 86]</td>
</tr>
<tr>
<td>B-</td>
<td>[80, 83]</td>
</tr>
<tr>
<td>C</td>
<td>[74, 76]</td>
</tr>
<tr>
<td>C-</td>
<td>[70, 73]</td>
</tr>
<tr>
<td>D</td>
<td>[64, 66]</td>
</tr>
<tr>
<td>D-</td>
<td>[60, 63]</td>
</tr>
<tr>
<td>F</td>
<td>[0, 59]</td>
</tr>
</tbody>
</table>

TUTORIAL: Drop-in tutorial is available in the Mathematics Learning Center.
TOPICS TO BE COVERED


Review of Proof Methods
   Mathematical Induction

Equivalence Relations
   Relations
      Properties of Relations
      Equivalence Relations
      Properties of Equivalence Classes
      Congruence Modulo \( n \)
      The Integers Modulo \( n \)

Functions
   The Definition of Function
   One-to-one and Onto Functions
   Bijective Functions
   Composition of Functions
   Inverse Functions
   Permutations

Cardinalities of Sets
   Numerically Equivalent Sets
   Denumerable Sets
   Uncountable Sets
   Comparing Cardinalities of Sets
   The Schröder-Bernstein Theorem

Number Theory
   Divisibility Properties of Integers
   The Division Algorithm
   Greatest Common Divisors
   The Euclidean Algorithm
   Relatively Prime Integers
   The Fundamental Theorem of Arithmetic
Group Theory
   Binary Operations
   Groups
   Permutation Groups
   Fundamental Properties of Groups
   Subgroups
   Isomorphic Groups

Calculus
   Limits of Sequences
   Infinite Series
   Limits of Functions
   Fundamental Properties of Limits of Functions
   Continuity
   Differentiability

Topology (*Time permitting*)
   Metric Spaces
   Open Sets in Metric Spaces
   Continuity in Metric Spaces
   Topological Spaces
   Continuity in Topological Spaces