# MATH 310 – Introduction to Mathematical Proof – SYLLABUS

Department of Mathematics
Millersville University

## Description

Emphasizes mathematical reasoning and communication of mathematical ideas both orally and in writing. Symbolic logic. Techniques of mathematical proof. Algebra of sets, binary relations and functions. Infinite sets, both countable and uncountable. (3 credits)

This course may be taken for general education credit (W).

## Prerequisites

ENGL 110 and C- or higher in MATH 211.

## Course Objectives

By the conclusion of this course the successful student will be able to:

- Demonstrate an understanding of mathematical logic.
- Compose mathematical proofs involving abstract mathematical structures that:
  - articulate ideas clearly in writing
  - demonstrate the ability to determine an appropriate method of proof
  - demonstrate understanding of inferences or causalities in “if ... then” statements
  - reference previous definitions and theorems in their writing of proofs
  - improve as the semester progresses.
- Write a minimum of 2500 words of revisable prose.

## Assessment

Assessment of student achievement of the course objectives will vary from one instructor to another. Typical assessment will be made through work in class, homework, and examinations.

## Use of Technology

Mathematical technology (such as calculators or software) are not typically needed for this class, but may be required at the discretion of the instructor.

## Topics

1. Logic
    a. Logical connectives
    b. Truth tables
    c. Tautologies and logical equivalence
    d. Conditionals and biconditionals
    e. Quantifiers
2. Proof techniques
    a. Direct proof
    b. Conditional proof
    c. Proof by cases
    d. Existence proofs
    e. Induction
    f. Counterexamples
3. Functions
    a. Functions
    b. Composition and inverse
    c. Injective, surjective, and bijective functions
4. Set theory and cardinality
    a. Sets
    b. Counting
    c. Cardinality
    d. Set algebra
    e. Set proofs
5. Relations
    a. Binary relations
    b. Equivalence relations
    c. Divisibility and modular
    d. Arithmetic Partitions
    e. Order relations
6. Miscellaneous topics
    a. Inequality proofs
    b. Binary operations