Marshall University

College of Science

Mathematics Department

MTH 300: Introduction to Higher Mathematics

Course catalog description

Transition between elementary calculus and higher mathematics with emphasis on techniques of proofs.

Credit hours

4 hours

Prerequisites

A grade of C or higher in MTH 230

List of topics

- Introduction to the axiomatic method and history of mathematics
- Mathematical statements and connectives. Symbolic logic and quantifiers.

Proof

- Direct proof, proof by contradiction, proof by contraposition
- Proof by induction
- Examples and counterexamples

Elementary set theory

- Subsets and set equality
- Set operations
- Power sets

- Russell's paradox

Functions

- Definitions of "function"
- Cartesian products and relations
- Function equality
- Bijective, injective, and surjective functions
- Compositions of functions
- Inverse functions and inverse images

Relations

- Order relations
- Equivalence relations

- Optional topics: number systems, abstract algebra, sequences and series, time scales

Course objectives

- Students will exhibit an understanding of mathematical logic
- Students will exhibit an understanding of a variety of proof writing techniques.
- Students will construct formal proofs of propositions that address concepts discussed during the course of the semester
- Students will present arguments clearly and concisely in both written and oral form.
- Students will recognize and appreciate various approaches to the same problem.

Suggested textbooks

- Ralph W. Oberste-Vorth, Aristides Mouzakitis, and Bonita A. Lawrence, *Bridge to Abstract Mathematics*, Mathematical Association of America
- Kevin Houston, *How to Think Like a Mathematician*, Cambridge University Press

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