

INTRODUCTION TO ABSTRACT MATHEMATICS

MATH 2230

Course Description:

This course provides a transition from the calculus to more abstract mathematics. Topics include logic, sets and functions, an introduction to mathematical proof, mathematical induction, relations. Important prerequisite material for a number of more advanced mathematics courses is studied. Credit will not be given for both MATH 2030 (or MATH 2040) and MATH 2230.

3 credits

Prerequisites:

MATH 1960 or permission

Overview of Content and Purpose of the Course:

The student will appreciate the difference between those mathematics courses that primarily involve problem solving and those that require a more abstract type of mathematical reasoning, and gain experience in the latter kind of thinking. The student will gain an understanding of the axiomatic method, the importance of definition, and methods of proof through deductive reasoning. To learn specific tools and techniques needed in certain future courses, such as working with sets and functions, symbolic logic, direct and indirect proofs and mathematical induction. The student will begin to develop a mathematical style for presenting proofs in a clear and concise manner.

Major Topics:

1) Symbolic logic

- a. Logical Connectives
- b. Truth Tables
- c. Implication and Equivalence
- d. Quantifiers – Especially Negation

2) Introduction to Proof

- a. Direct Proof
- b. Indirect Proof by Contradiction, by Contrapositive
- c. Counterexamples
- d. Mathematical Induction

3) Sets and Functions

- a. Union, Intersection, Complement, Set Difference
- b. Infinite Families of Sets
- c. Relations and Functions
- d. One-One, Onto Functions; Inverse Functions
- e. The Power Set and Induced Functions by $f:X \rightarrow Y$ Relation to Unions, Intersections, Complements

4) More on Relations

- a. Especially Equivalence Relations

5) Specific Topics, As Examples and Foundation for Later Courses

- a. Elementary Number Theory
- b. Elementary Topology of the Real Line

6) Additional Topics if Time Allows

- a. Elementary Counting and Probability
- b. Cardinality

Textbook:

Devlin, Keith. *Sets, Functions, and Logic: An Introduction to Abstract Mathematics, 3rd ed.*
Boca Raton: Chapman and Hall/CRC, 2003.

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