

Course Outline for MATH 2031

Transition to Advanced Mathematics

MATH 2031 Transition to Advanced Mathematics (3 units)

Prerequisite: One of the following: MATH 143, [MATH 1262](#), [MATH 1263](#), or DATA/[MATH 1265](#).

Set theory, logic, quantified statements, indexed sets. Methods of proof: direct, contrapositive, contradiction, mathematical induction. Equivalence relations and partitions. Functions, cardinality, countable, and uncountable sets. Proofs in number theory, algebra, geometry, or analysis. 3 lectures. Formerly MATH 248.

Course Learning Objectives	
1	Determine the logical truth value of compound statements.
2	Determine the logical truth value of quantified statements.
3	Construct and analyze sets using set operations.
4	Prove results using the standard methods of proof: direct, contradiction, contrapositive, induction.
5	Prove results about equivalence relations, partitions and functions.
6	Prove theorems about countable and uncountable sets.

Expanded Course Content

Textbooks, materials, and/or other resources
Chartrand, Polimeni and Zhang, Mathematical Proofs: A Transition to Advanced Mathematics.

Week	Readings	Topics of Discussion
1	Sections 1.1 - 1.3	Sets, subsets, set operations
2	Sections 1.4, 1.6	Indexed families of sets, Cartesian products
3	Sections 2.1 - 2.4	Statements, negation, disjunction, conjunction
4	Sections 2.5 - 2.10	Implications, biconditional, logical equivalence, quantified statements.

Week	Readings	Topics of Discussion
5	Sections 3.1 - 3.5, 4.1 - 4.3	Direct proof, proof by contrapositive
6	Sections 4.4 - 4.6, 5.1 - 5.5	Proofs involving set operations, proof by contradiction.
7	Sections 6.1 - 6.4	Mathematical induction
8	Sections 8.1, 8.2	Relations
9	Sections 8.3, 8.4	Equivalence relations, partitions
10	Sections 9.1 - 9.3	Functions, injectivity, surjectivity
11	Section 9.4 - 9.6	Bijections, composition, inverses.
12	Sections 10.1, 10.2	Numerical equivalence of sets, countable sets
13	Sections 10.3, 10.4	Uncountable sets, comparing cardinalities of sets, Cantor's theorem, uncountability of the real numbers.
14	Sections 11.1 - 11.7	Proofs in number theory
15	Sections 12.1 - 12.6	Proofs in calculus

Method of Assessment

The possible methods of assessment are written individual examinations, quizzes, in-class worksheets or presentations, projects, and homework. All exams are to be proctored in-person, and one or more midterms and a cumulative final exam are required.

Instructional Mode

The instructional mode for this class is face-to-face. This designation means that the essential academic standards of the course require in-class student engagement, and thus remote instruction is not appropriate.