

Intro to Advanced Mathematics - Math 321 (3)

Course Description: Formal introduction to the concepts of logic, finite and infinite sets, functions, methods of proof and axiomatic systems. Learning mathematical expressions in writing is an integral part of the course.

Prerequisite: Math 243 (or concurrent) or 253A (or concurrent) or consent.

Possible Textbooks: *A Transition to Advanced Mathematics* by Smith, Eggen, St. Andre, *Passage to Abstract Mathematics* by M.E. Watkins and J.L. Meyer, *How to Prove It: A Structured Approach* by Daniel J. Velleman.

Topics: This course has two main foci:

- Teaching students to understand, devise and communicate mathematical arguments. This includes both methods of proof (including direct, contradiction, contraposition and by induction) and examples/counterexamples (to familiarize students with proofs of statements with quantifiers and iff statements).
- Covering a number of topics making up the mathematical content of the course: symbolic logic, naive set theory, functions and relations

Beyond this, the course should provide a number of examples of simple axiomatic systems. The systems considered could be from basic number theory, modular arithmetic, calculus, or any other subject that does not require an extensive background.

Approximate Timeline: Symbolic logic and methods of proof (3 weeks), Naive set theory and proofs involving sets (3 weeks), Functions and relations (2-4 weeks), Induction (1 week), Equivalence relations (2 weeks), Cardinality and more set theory (2 weeks).

Math 321 is a writing intensive class: Students will be required to do a substantial amount of mathematical writing. This course will be conducted so as to satisfy the hallmarks for writing-intensive classes, as described here:

<http://manoa.hawaii.edu/mwp/faculty/hallmarks> .

Course objectives. Upon successful completion of Math 321, the student will be able to

- Work with basic foundational concepts common to most 400-level mathematics courses
- Develop and write direct proofs, proofs by contradiction and contraposition, and proofs by induction.
- Understand the axiomatic approach to simple mathematical systems.

Program Objectives. In this junior level course students are introduced to basic methods of proof that are common to many areas of mathematics. Students will learn to write mathematical proofs (W) and may be required to do some reading without supervision. Understanding the language and the mathematical ideas presented in this class is prerequisite to most 400-level mathematics classes.