

# Foundations of Mathematics (3)

(Effective Fall 2015)

**Prerequisite:** Math 251 or departmental approval.

**Catalog Description:** Proof techniques, sets, propositional calculus, functions, relations, properties of integers.

**Learning Outcomes for Major:** This course addresses one or more of the student learning outcomes for the major. Upon completion of his/her degree from the University of Tennessee at Martin with a major in mathematics, the graduate will be able to:

- i. apply mathematical concepts and principles to perform numerical and symbolic computations.
- ii. use technology appropriately to investigate and solve mathematical and statistical problems.
- iii. write clear and precise proofs.
- iv. communicate effectively in both written and oral form.
- v. demonstrate the ability to read and learn mathematics and/or statistics independently.

**Teaching Objectives:** The student will:

1. Understand abstract definitions by analyzing them carefully and constructing examples
2. Recognize a rigorous proof
3. Identify and correct weaknesses in invalid and incomplete proofs
4. Construct proofs using a variety of proof techniques including: direct proofs, proofs by contraposition and contradiction, proofs by mathematical induction
5. Present proofs both orally and in written form using correct and concise English and mathematical grammar
6. Understand and apply the basic terminology, notation, and concepts associated with each of the following areas:
  - (a) the algebra of sets
  - (b) propositional calculus (including quantifiers)
  - (c) relations (especially equivalence and recurrence relations)
  - (d) the algebra of functions (especially in/sur/bi-jections)
  - (e) properties of the integers (including division algorithm, gcd, prime factorization)

**Text(s):** Book of Proof (edition 2.2), Richard Hammack, Virginia Commonwealth University, available from the author for free at <http://www.people.vcu.edu/~rhammack/BookOfProof/> or a printed version as ISBN: 978-0-9894721-0-4.

<b>Outline:</b>	Chapter	Title (Sections)	Days
	1	Sets (1-8)	7
	2	Logic (1-8,9-10)	4
	3	Counting (1-5)	4
	4	Direct proof (1-5)	2
	5	Contrapositive proof (1-3)	2
	6	Proof by contradiction (1-4)	2
	7	Proving Non-Conditional Statements (1-4)	1
	8	Proofs involving sets (1-3)	2
	9	Disproof (1-3)	1
	10	Mathematical Induction (1-3)	3
	11	Relations (1-5)	4
	12	Functions (1-5)	5
		One period tests	4
		Total days	<hr/> 41

**Disability Services:**

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