



### MATH 300 – Foundations of Mathematics Course Syllabus

**Course Description:** Set theory, relations, functions, mathematical structure, logic, and proof. Includes historical connections.

**Course Prerequisites and Corequisites:** MTH 129 and MTH 138.

<u>Course outline:</u>	<u>Approximate time spent</u>
<ul style="list-style-type: none"><li>• Formal Logic<ul style="list-style-type: none"><li>○ Statements and quantifiers</li><li>○ Negations, conjunctions, disjunctions, conditionals, and biconditionals</li><li>○ Truth tables</li><li>○ Converse, inverse, and contrapositive</li><li>○ Valid arguments and Euler diagrams</li><li>○ Historical and classroom connections</li></ul></li></ul>	15%
<ul style="list-style-type: none"><li>• Sets<ul style="list-style-type: none"><li>○ Basic definitions and properties</li><li>○ Venn diagrams</li><li>○ Cardinalities of sets</li><li>○ Historical and classroom connections</li></ul></li></ul>	15%
<ul style="list-style-type: none"><li>• Proof<ul style="list-style-type: none"><li>○ Direct proof</li><li>○ Proof by contradiction</li><li>○ Proof by contraposition</li><li>○ Proof by mathematical induction</li><li>○ Proof by counterexample</li><li>○ Historical and classroom connections</li></ul></li></ul>	40%
<ul style="list-style-type: none"><li>• Applications to Relations<ul style="list-style-type: none"><li>○ Definitions and properties<ul style="list-style-type: none"><li>▪ Inverse relations</li><li>▪ Equivalence relations</li></ul></li><li>○ Applications</li><li>○ Historical and classroom connections</li></ul></li></ul>	15%
<ul style="list-style-type: none"><li>• Applications to Functions<ul style="list-style-type: none"><li>○ Definitions and notation</li><li>○ Properties<ul style="list-style-type: none"><li>▪ One-to-one</li><li>▪ Onto</li><li>▪ One-to-one correspondence</li></ul></li><li>○ Function composition</li><li>○ Inverse functions</li><li>○ Binary operations: connections to arithmetic</li><li>○ Historical and classroom connections</li></ul></li></ul>	15%

**Student Learning Outcomes (SLO):** At the end of MTH 300, a student who has studied and learned the material should be able to:

1. Develop appropriate mathematical vocabulary. [SBEC: V]
2. Demonstrate a basic understanding of logic and valid reasoning. [SBEC: V]
3. Demonstrate an understanding of applications of logic to geometry. [SBEC: III, V]
4. Apply principles of inductive reasoning to make conjectures and use deductive measures to evaluate the validity of conjectures. [SBEC: V]
5. Communicate effectively about mathematics, with an ability to convey detailed information with clarity and accuracy, and to construct well-reasoned explanations. [SBEC: V]
6. Demonstrate strategies for proof and utilize counterexamples efficiently. [SBEC: V]
7. Demonstrate an understanding of applications of logic and proof to relations and functions. [SBEC: II, V]
8. Formulate well-designed proofs. [SBEC: V]
9. Demonstrate an understanding of the historical development of logic and proof. [SBEC: VI]

*There are no specific program learning outcomes for this major addressed in this course. It is a general education core curriculum course and/or a service course.*

**Texas State Board for Educator Certification (SBEC): Mathematics Standards**

*Standard II. Patterns and Algebra:* The mathematics teacher understands and uses patterns, relations, functions, algebraic reasoning, analysis, and technology appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in order to prepare students to use mathematics.

*Standard III. Geometry and Measurement:* The mathematics teacher understands and uses geometry, spatial reasoning, measurement concepts and principles, and technology appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in order to prepare students to use mathematics.

*Standard V. Mathematical Processes:* The mathematics teacher understands and uses mathematical processes to reason mathematically, to solve mathematical problems, to make mathematical connections within and outside of mathematics, and to communicate mathematically.

*Standard VI. Mathematical Perspectives:* The mathematics teacher understands the historical development of mathematical ideas, the interrelationship between society and mathematics, the structure of mathematics, and the evolving nature of mathematics and mathematical knowledge.