

**Syllabus**  
**Math 01.301 Structures of Mathematics II**

**CATALOG DESCRIPTION:**

Math 01.301 Structures of Mathematics II 3 s.h.

Prerequisites: Structures of Mathematics I (Math 01.201)

This course is designed primarily for elementary education majors. The course will require students to investigate problems in order to deepen their conceptual and procedural understanding in the areas of algebra, data analysis, probability, geometry, measurement, and systematic listing and counting.

**OBJECTIVES:**

This course is intended to provide students with the opportunity to develop their knowledge of the content and discourse of mathematics, including:

- mathematical concepts and procedures and the connections among them;
- multiple representations of mathematical concepts and procedures;
- ways to reason mathematically, solve problems, and communicate mathematics effectively at different levels of formality;
- the nature of mathematics, the contributions of different cultures toward the development of mathematics, and the role of mathematics in culture and society;
- the changes in the nature of mathematics and the way we teach, learn, and do mathematics resulting from the availability of technology;
- the place of "school mathematics" (what students have learned in elementary school and high school) within the discipline of mathematics;
- the relationship of mathematics to other subjects and its applications in society.

Students in the course will use physical materials and models to explore topics in algebra, geometry, probability, and statistics. They will use mathematics to describe real-world relationships and develop conjectures and intuitive proofs. This course is especially appropriate for those students preparing to be elementary or special education teachers.

**CONTENT:**

1. Algebraic Thinking (4 weeks)

1.1. Reasoning about Algebra (Ch. 12. 1, 12.2, 12.5)

- 1.1.1. Multiple representations for proportional reasoning
- 1.1.2. Quantitative models
- 1.1.3. Operations with polynomials and their properties

1.2. Linear Functions (Ch. 13.1, 13.2)

- 1.2.1. Modeling relationships between quantities
- 1.2.2. Slopes and intercepts

1.3. Linear Equations and Inequalities (Ch. 15.1 – 15.3)

- 1.3.1. Reasoning about solving linear equations and inequalities
- 1.3.2. Systems of linear equations (optional)

## 2. Geometry & Measurement (7 weeks)

### 2.1 Geometric properties (Ch. 16.1-16.3, 17.1 – 17.3, 18.1)

2.1.1 Review of properties of lines, angles, and planes

2.1.2 Angle relationships

2.1.3 Polygons, with focus on triangles and quadrilaterals

2.1.4 Three-dimensional geometric figures, including nets, projections, slicing, and use of isometric dot paper

### 2.2 Geometric transformations (Ch. 20.1-20.3, 22.1-22.4) (optional)

2.2.1 Reflections and the coordinate plane

2.2.2 Rotations and translations as compositions of reflections

2.2.3 Dilations

2.2.4 Congruence

2.2.5 Similarity

### 2.3 Pythagorean Theorem (26.1) (optional)

2.3.1 Proof of theorem and its converse

2.3.2 Distance between two points

2.3.3 Applications

### 2.4 Measurement (Ch. 23.1-23.2, 24.1-24.2, 25.1)

2.4.1 Review of systems of measurement, including customary and metric units

2.4.2 Development of formulas for perimeters, areas, surface areas, and volumes of common geometric shapes

2.4.3 Composing & decomposing shapes to solve measurement problems in the plane and space

2.4.4 Similarity and scaling real objects [Type text]

## 3. Statistics and Probability (4 weeks)

### 3.1. Random Sampling (Ch. 29.1-29.3)

### 3.2. Descriptive Statistics (Ch. 30.1-30.6)

3.2.1. Summarize and describe data distributions (center, spread, overall shape)

3.2.2. Statistical questions and exploratory data analysis

3.2.3. Measures of central tendency and variability

3.2.3.1 Mean, and mean absolute deviation

3.2.3.2 Median and interquartile range

3.2.3.3 Comparing populations

3.2.3.4 Normal distribution & standard deviation (optional)

### 3.3 Bivariate Data (Ch. 31.1-2)

3.3.1 Categorical data and two-way tables

3.3.2 Scatterplots and informal lines of best fit – graphical description, with connections to slope-intercept forms of equations

### 3.4 Systematic Listing and Counting (Ch. 33.2)

3.4.1 Venn diagrams, sets, and counting techniques

3.4.2 Multiplication Principle of Counting

3.4.3 Permutations, including use of factorials (optional)

3.4.4 Combinations (optional)

### 3.5 Probability (Ch. 27.1-27.3, 28.1-28.4)

3.5.1 Frequency concept of probability

3.5.2 Mathematical descriptions of probability, including applications

3.5.3 Probability models

3.5.4 Expected value (optional)

**POSSIBLE TEXT:**

Sowder, J., Sowder, L., & Nickerson, S. Reconceptualizing Mathematics for Elementary School Teachers (2nd edition). New York: W. H. Freeman and Company, 2014