

Mathematics 4322 – A Survey of Mathematics

Student Learning Outcomes

- 1. The students will demonstrate factual knowledge including the mathematical notation and terminology used in this course.** Learn the vocabulary, symbolism, and basic definitions used in this course including definitions and terminology used in algebra; plane geometry; trigonometry; analytic geometry; logic; transformational geometry; calculus; probability and statistics; finance; linear programming; and graph theory.
- 2. The students will describe the fundamental principles including laws and theorems arising from concepts covered in this course.** Become familiar with the laws and formulas that result directly from the definitions used in algebra; plane geometry; trigonometry; analytic geometry; logic; transformational geometry; calculus; probability and statistics; finance; linear programming; and graph theory.
- 3. The students will apply course material along with techniques and procedures covered in this course to solve problems.** Use the facts, formulas, and techniques learned in this course to solve application problems in a variety of fields to include physics; chemistry; business; life sciences; and social sciences.
- 4. The students will develop specific skills, competencies, and thought processes sufficient to support further study or work in this field or related fields.** Acquire a level of proficiency in the fundamental concepts and applications necessary for further study in academic fields requiring a solid background in mathematics as a prerequisite, or for work in occupational fields requiring a solid background in mathematics. These fields might include teaching mathematics in the secondary schools; engineering; physics; business; life sciences; and social sciences.

Course Content

Textbook: *Precalculus*, Seventh Edition, by Demana, Waits, Foley, and Kennedy. The following chapters including the particular sections listed are covered. (See textbook “Contents”)

P. Prerequisites. Real numbers; Cartesian coordinates; lines; graphing

- 1. Functions and Graphs.** Linear functions and their graphs; using graphs to study the characteristics of functions; applications.
- 2. Polynomial Functions, Power and Rational Functions.** Quadratic functions; power functions with modeling; polynomial functions of higher degree; remainder theorem; factor theorem; fundamental theorem of algebra; complex numbers; applications; rational functions, inequalities.
- 3. Exponential, Logistic, and Logarithmic Functions.** Comparison of exponential functions, logistic functions, and power functions; properties of logarithmic functions; modeling, mathematics of finance.
- 4. Trigonometric Functions.** Trigonometric functions; graphs of the trigonometric functions; advanced trigonometric graphs; inverse trigonometric functions; applications.
- 5. Analytic Trigonometry.** Identities, law of sines; law of cosines; solving trigonometric equations; applications.
- 6. Applications of Trigonometry:** Vectors in a plane, dot products, parametric equations, polar coordinates, De Moivre’s Theorem
- 7. Systems of Equations and Matrices.** Solving systems of equations with matrices; linear programming.

8. **Analytic Geometry in Two and Three Dimensions.** Parabolas, Ellipses, Hyperbolas, polar equations of conics; 3-D Cartesian coordinate system.
9. **Discrete Mathematics.** Probability; statistics; sequences and series; mathematical induction.
10. **An Introduction to Calculus.** Limits; derivatives; and integrals.

Additional Topics taught by Unit Modules

1. **Logic.** Conjunction; disjunction; implication; biconditional; negation; simple statements; compound statements; truth tables; tautology; inverse; converse; contrapositive; quantifiers.
2. **Curriculum Standards for Grades 9 through 12.** Mathematics as problem solving; mathematics as communication; mathematics as reasoning; mathematical connections; algebra; functions; geometry from a synthetic perspective; geometry from an algebraic perspective; trigonometry; statistics; probability; discrete mathematics; conceptual underpinnings of calculus; mathematical structure.
3. **Additional Mathematics of Finance.** Simple interest; compound interest; annuities; amortization schedules.
4. **Transformational Geometry.** Reflections; translations; rotations; dilations; isometries; composite transformations.
5. **Graph Theory.** Simple graphs; connected graphs; disconnected graphs; edges; loops; vertices; traceable graphs; walk; trail; path; Euler Circuit; Hamilton Circuit; weighted graph; network; tree; spanning tree; digraph.
6. **Additional Calculus.** Derivatives; integrals; applications of derivatives and integrals; limits.
7. **Set Theory.** Union; intersection; subsets; disjoint sets; Venn diagrams.
8. **Additional Probability and Statistics.** Multiplication Principle; permutations; combinations; general and special addition rule; general and special multiplication rule; mutually exclusive events; independent events; conditional probabilities; probability distributions and their means and standard deviations; odds; measures of central tendency; standard deviation; normal distribution; percentile; percentile rank; linear regression, confidence intervals, hypothesis tests.
9. **Technology.** Graphing calculators; CBL; CBR; Geometer's Sketchpad; graph link; TI presenter, TI Interactive.
10. **Number Theory.** Properties of real numbers, complex numbers, matrices, and vectors; place value; base arithmetic; groups; fields; Fundamental Theorem of Arithmetic; prime numbers; least common multiples; greatest common factors; Euclidean Algorithm; Rules for Divisibility; Modular Arithmetic.
11. **Euclidean Geometry.** Parallel lines cut by a transversal; congruent figures; inequalities in triangles; quadrilaterals; similar figures; right triangles; circles; constructions and loci; area and volumes of solids; coordinate geometry; geometry in 3- D.
12. **Non-Euclidean Geometry.** Riemannian Geometry; Lobachevsky Geometry.
13. **Mathematical Processes and Perspectives.** Mathematical reasoning and problem solving; Polya's problem solving steps; mathematical connections; mathematical communication.
14. **Mathematical Learning, Instruction, and Assessment.** Understanding of how children learn mathematics; understanding of how to plan, organize, and implement instruction using knowledge of students, subject matter, and statewide curriculum; understanding assessment both formal and informal.