Mathematical Foundations II - Overview

Mathematical Foundations II is the second course in a sequence specially crafted for adults seeking the most direct path to prepare for university math courses. Building on the basic algebra covered in [Mathematical Foundations I](#), students in Mathematical Foundations II generalize their understanding of algebra to more advanced functions (including trigonometry) and become acquainted with limits and derivatives in calculus. Upon completing the course, students will be prepared for [Mathematical Foundations III](#), the final stepping stone in preparing for university-level math.

Overview

Master the algebra of advanced functions including quadratics, logarithms, and trigonometry. Dive deep into the theory of polynomials, learn the basics of limits, derivatives, and integrals from calculus, and explore a variety of concepts from higher math including complex numbers, vectors, probability, and statistics.

Outcomes

Upon completeing our Mathematical Foundations II course, students will

Logarithms

- Understand the relationship between logarithms and exponents and use this understanding to evaluate logarithms.

Trigonometry

- Apply trigonometric functions to solve for unknown sides and angles in right triangles.
- Leverage the unit circle as a conceptual framework for evaluating special trigonometric ratios.
- Graph and describe properties of trigonometric functions by relating them to the unit circle.
- Use the law of sines and the law of cosines to solve for unknown angles and sides in general triangles.

Nonlinear Equations and Graphing

- Leverage factoring and the quadratic formula as complementary techniques for solving quadratic equations and graphing quadratic functions.
- Extend previous knowledge of algebraic techniques to solve nonlinear equations involving polynomials, radicals, exponents, and logarithms.
- Understand how transformations affect the shape of a function's graph and use this understanding to graph transformed quadratic, absolute value, exponential, radical, logarithmic, and trigonometric functions.

Polynomial Division and Factoring

- Understand the relationship between zeros and factors of polynomials.
- Divide polynomials using synthetic and long division.

- Understand the relationship between the value of a polynomial at a given input and the remainder obtained when dividing the polynomial by the corresponding binomial.
- Leverage the rational roots theorem as a strategy to factor polynomials.

Graphing Polynomials and Rational Functions

- Understand how the multiplicity of a root of a polynomial relates to the shape of the graph near the root.
- Sketch graphs of polynomial functions by identifying end behavior, roots, and behavior near roots.
- Sketch graphs of rational functions by identifying asymptotes.

Limits, Derivatives, and Integrals

- Estimate limits from graphs and compute limits using algebraic manipulation.
- Identify continuous functions from graphs and define continuity in terms of limits.
- Interpret the derivative as the instantaneous rate of change or the slope of the tangent line.
- Apply rules to compute derivatives of a variety of algebraic functions, including higher-order derivatives.
- Evaluate indefinite integrals by finding antiderivatives.

Sequences

- Evaluate terms of a sequence and compute sums given in sigma notation.
- Determine the formula of an arithmetic or geometric sequence.

Complex Numbers and Vectors

- Manipulate complex numbers algebraically and visualize them geometrically in the complex plane.
- Generalize prior intuitions about arithmetic to vectors.

Probability and Statistics

- Define probability using the formal language of sets.
- Apply combinatorial techniques to compute probabilities in real-world modeling contexts.
- Understand independent events both conceptually and quantitatively from the perspective of conditional probability.
- Compute statistical measures of the center and spread of a data set.
- Fit a linear regression to a data set and use it to make predictions.