Advanced Topics in Mathematics introduces students to advanced functions, with a focus on developing a strong conceptual grasp of the expressions that define them. Additionally, students will be exposed to topics necessary for advanced mathematics such as conic sections, complex numbers, trigonometry, and probability. Throughout the course, students will learn through discovery and application, developing the skills they need to break down complex challenges and demonstrate their knowledge in new situations.

Course topics include quadratic functions; transformations of functions, polynomial functions; rational expressions and equations; exponential and logarithmic functions; right triangle trigonometry, trigonometric functions, perimeter and volume, polar coordinates, complex number arithmetic as well as probability and probability distributions.

This course supports all students as they develop computational fluency and deepen conceptual understanding. Students begin each lesson by discovering new concepts through guided instruction, and then confirm their understanding in an interactive, feedback-rich environment. Modeling activities equip students with tools for analyzing a variety of real-world scenarios and mathematical ideas. Journaling activities allow students to reason abstractly and quantitatively, construct arguments, critique reasoning, and communicate precisely. Performance tasks prepare students to synthesize their knowledge in novel, real-world scenarios and require that they make sense of multifaceted problems and persevere in solving them.

This course is built to Florida's Next Generation Sunshine State Standards and Benchmarks.

Length: Two Semesters

UNIT 1: QUADRATIC FUNCTIONS
- Lesson 1: Factoring $x^2 + bx + c$
- Lesson 2: Factoring $ax^2 + bx + c$
- Lesson 3: Special Cases
- Lesson 4: Solving Quadratic Equations
- Lesson 5: Completing the Square
- Lesson 6: The Quadratic Formula
- Lesson 7: Graphs of Quadratic Functions
- Lesson 8: Imaginary Numbers
- Lesson 9: Review of Complex Numbers
- Lesson 10: Performance Task: The Skid Distance Problem
- Lesson 11: Quadratic Functions Wrap-Up

UNIT 2: TRANSFORMING FUNCTIONS
- Lesson 1: Inverses
- Lesson 2: Graphs of Inverses
- Lesson 3: Parent Functions
- Lesson 4: Shifting Functions
- Lesson 5: Stretching Functions Vertically
- Lesson 6: Transformation of Parent Functions
- Lesson 7: Arithmetic of Functions
- Lesson 8: Performance Task: Transforming Functions
- Lesson 9: Transforming Functions Wrap-Up

UNIT 3: POLYNOMIAL FUNCTIONS
- Lesson 1: Polynomial Basics
Lesson 2: Polynomial Functions
Lesson 3: Factoring Polynomials Completely
Lesson 4: Solving Polynomial Equations
Lesson 5: Graphing Polynomial Functions
Lesson 6: Polynomial Identities
Lesson 7: Binomial Theorem
Lesson 8: Transformations of Polynomial Functions
Lesson 9: Polynomial Functions Wrap-Up

UNIT 4: RATIONAL EXPRESSIONS AND FUNCTIONS
Lesson 1: Inverse Variation
Lesson 2: Solving Rational Functions
Lesson 3: Vertical Asymptotes
Lesson 4: Graphing Rational Functions
Lesson 5: Rational Expressions and Functions Wrap-Up

UNIT 5: EXPONENTIAL AND LOGARITHMIC FUNCTIONS
Lesson 1: Geometric Sequences
Lesson 2: Exponential Functions
Lesson 3: Examples and Applications of Exponential Functions
Lesson 4: Graphs of Exponential Functions
Lesson 5: Logarithmic Functions
Lesson 6: Graphs of Logarithmic Functions
Lesson 7: Properties of Exponents and Logarithms
Lesson 8: Solving Exponential Equations
Lesson 9: Solving Logarithmic Equations
Lesson 10: Applications of Logarithms
Lesson 11: Comparing and Analyzing Function Types
Lesson 12: Exponential and Logarithmic Functions Wrap-Up

UNIT 6: SEMESTER 1 EXAM
Lesson 1: Semester 1 Exam

UNIT 7: TRIGONOMETRY
Lesson 1: Trigonometric Ratios and the Unit Circle
Lesson 2: Graphs of Sine and Cosine
Lesson 3: Graphs of Other Functions
Lesson 4: Simple Transformations of Sinusoids
Lesson 5: General Transformations of Periodic Graphs
Lesson 6: Inverse Trigonometric Functions
Lesson 7: Identities and Proof
Lesson 8: Trigonometric Identities
Lesson 9: Trigonometry Wrap-Up

UNIT 8: PERIMETER, AREA, AND VOLUME
Lesson 1: Circumference and Arc Length
Lesson 2: Area and Sectors
Lesson 3: What Is a Polyhedron?
Lesson 4: Volume
Lesson 5: Spheres
Lesson 6: Circles Without Coordinates Wrap-Up

UNIT 9: CONIC SECTIONS
Lesson 1: Introduction to Conic Sections
Lesson 2: Ellipses
Lesson 3: Hyperbolas
Lesson 4: Parabolas
Lesson 5: Conic Sections Wrap-Up

UNIT 10: COMPLEX NUMBERS
Lesson 1: Polar Coordinates
Lesson 2: Graphs of Polar Functions
Lesson 3: Polar Form of Complex Numbers
Lesson 4: Arithmetic of Complex Numbers
Lesson 5: Powers and Roots of Complex Numbers
Lesson 6: Complex Numbers Wrap-Up

UNIT 11: APPLICATIONS OF PROBABILITY
Lesson 1: What Is Probability?
Lesson 2: Counting Principles
Lesson 3: Permutations and Combinations
Lesson 4: Basic Rules of Probability
Lesson 5: Conditional Probability
Lesson 6: Independence
Lesson 7: Bayes's Theorem
Lesson 8: Simulations
Lesson 9: Applications of Probability Wrap-Up

UNIT 12: PROBABILITY DISTRIBUTIONS
Lesson 1: Discrete Random Variables
Lesson 2: Continuous Random Variables
Lesson 3: Binomial Probability Distributions
Lesson 4: Probability Distributions Wrap-Up

UNIT 13: SEMESTER 2 EXAM
Lesson 1: Semester 2 Exam