

Introduction

Precalculus combines the trigonometric, geometric, and algebraic techniques needed to prepare students for the study of calculus, and strengthens students' conceptual understanding of problems and mathematical reasoning in solving problems. Facility with these topics is especially important for students intending to study calculus, physics, and other sciences, and/or engineering in college. Because the standards for this course are (+) standards, students selecting this Model Precalculus course should have met the college and career ready standards.

For the high school Model Precalculus course, instructional time should focus on four critical areas: (1) extend work with complex numbers; (2) expand understanding of logarithms and exponential functions; (3) use characteristics of polynomial and rational functions to sketch graphs of those functions; and (4) perform operations with vectors.

Students continue their work with complex numbers. They perform arithmetic operations with complex numbers and represent them and the operations on the complex plane. Students investigate and identify the characteristics of the graphs of polar equations, using graphing tools. This includes classification of polar equations, the effects of changes in the parameters in polar equations, conversion of complex numbers from rectangular form to polar form and vice versa, and the intersection of the graphs of polar equations.

Students expand their understanding of functions to include logarithmic and trigonometric functions. They investigate and identify the characteristics of exponential and logarithmic functions in order to graph these functions and solve equations and practical problems. This includes the role of e , natural and common logarithms, laws of exponents and logarithms, and the solutions of logarithmic and exponential equations. Students model periodic phenomena with trigonometric functions and prove trigonometric identities. Other trigonometric topics include reviewing unit circle trigonometry, proving trigonometric identities, solving trigonometric equations, and graphing trigonometric functions

Students investigate and identify the characteristics of polynomial and rational functions and use these to sketch the graphs of the functions. They determine zeros, upper and lower bounds, y -intercepts, symmetry, asymptotes, intervals for which the function is increasing or decreasing, and maximum or minimum points. Students translate between the geometric description and equation of conic sections. They deepen their understanding of the Fundamental Theorem of Algebra

Students perform operations with vectors in the coordinate plane and solve practical problems using vectors. This includes the following topics: operations of addition, subtraction, scalar multiplication, and inner (dot) product; norm of a vector; unit vector; graphing; properties; simple proofs; complex numbers (as vectors); and perpendicular components

The Standards for Mathematical Practice complement the content standards so that students increasingly engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle, and high school years.

Objective	OK C ³ Standards
The Complex Number System	
Perform arithmetic operations with complex numbers.	N.NC.3
Represent complex numbers and their operations on the complex plane.	N.NC.4, N.NC.5, N.NC.6
Vector and Matrix Quantities	
Represent and model with vector quantities.	N.VM.1, N.VM.2, N.VM.3
Perform operations on vectors.	N.VM.4a, b, c; N.VM.5a, b
Perform operations on matrices and use matrices in applications.	N.VM.8, N.VM.9, N.VM.10, N.VM.11,
Algebra	
Arithmetic with Polynomials and Rational Expressions	
Use polynomial identities to solve problems.	A.APR.5
Rewrite rational expressions.	A.APR.6, A.APR.7
Reasoning with Equations and Inequalities	
Solve systems of equations	A.REI.8, A.REI.9
Interpreting Functions	
Analyze functions using different representations	F.IF.7d
Building Functions	
Build a function that models a relationship between two quantities	F.BF.1c
Build new functions from existing functions	F.BF.4b,c,d; F.BF.5

Pre-Calculus Objectives

Trigonometric Functions	
Extend the domain of trigonometric functions using the unit circle.	F.TF.3, F.TF.4
Model periodic phenomena with trigonometric functions	F.TF.6, F.TF.7, F.TF.9
Geometry	
Similarity, Right Triangles, and Trigonometry	
Apply trigonometry to general triangles.	G.SRT.9, G.SRT.10, G.SRT.11
Circles	
Understand and apply theorems about circles.	G.C.4
Expressing Geometric Properties with Equations	
Translate between the geometric description and the equation for a conic section.	G.GPE.3
Geometric Measurement and Dimension	
Explain volume formulas and use them to solve problems.	G.GMD.2
Visualize relationships between two-dimensional and three-dimensional objects.	G.GMD.4
Standards for Mathematical Practice	
Make sense of problems and persevere in solving them.	
Reason abstractly and quantitatively.	
Construct viable arguments and critique the reasoning of others.	
Model with mathematics.	
Use appropriate tools strategically.	
Attend to precision.	

Pre-Calculus Objectives

Look for and make use of structure.	
Look for and express regularity in repeated reasoning.	