

Common Core Pre-Calculus

Syllabus

Course Number: MA1104

Grade level: 9–12

Prerequisite Courses: Common Core Algebra II

Credits: 1.0

Course Description

With an emphasis on function families and their representations, Precalculus is a thoughtful introduction to advanced studies leading to calculus. The course briefly reviews linear equations, inequalities, and systems and moves purposefully into the study of functions. Students then discover the nature of graphs and deepen their understanding of polynomial, rational, exponential, and logarithmic functions. Scaffolding rigorous content with clear instruction, the course leads students through an advanced study of trigonometric functions, matrices, and vectors..

Course Objectives

Throughout the course, you will meet the following goals:

- Analyze and interpret the structure of polynomial, rational, and exponential functions
- Communicate effectively using graphic, numeric, symbolic, and verbal representations
- Explore mathematical reasoning used in trigonometric functions
- Demonstrate and understanding of matrices and solve systems using matrix equations
- Explore and calculate theoretical probabilities and develop a probability distribution for a random variable
- Classify conic equations and construct graphs of conic sections

Student Expectations

This course requires the same level of commitment from you as a traditional classroom course would. Throughout the course, you are expected to spend approximately 5–7 hours per week online on the following activities:

- Interactive lessons that include a mixture of instructional videos and tasks

- Assignments in which you apply and extend learning in each lesson
- Assessments, including quizzes, tests, and cumulative exams

Communication

Your teacher will communicate with you regularly through discussions, email, chat, and system announcements. You will also communicate with classmates, either via online tools or face to face, as you collaborate on projects, ask and answer questions in your peer group, and develop your speaking and listening skills.

Grading Policy

You will be graded on the work you do online and the work you submit electronically to your teacher. The weighting for each category of graded activity is listed below.

Grading Category	Weight
Lesson Quizzes	30%
Unit Tests	30%
Cumulative Exams	20%
Assignments	20%

Scope and Sequence

When you log into Edgenuity, you can view the entire course map—an interactive scope and sequence of all topics you will study. The units of study are summarized below:

Unit 1: Systems of Equations

Unit 2: Matrices

Unit 3: Functions and Their Graphs

Unit 4: The Nature of Functions

Unit 5: Complex Numbers

Unit 6: Polynomial Functions

Unit 7: Rational Functions

Unit 8: Right Triangle and Circular Trigonometry

Unit 9: Graphing Trigonometric Functions

Unit 10: Analytic Trigonometry

Unit 11: Additional Topics in Trigonometry

Unit 12: Vectors

Unit 13: Conics and Analytic Geometry

Unit 14: Sequences and Series

Unit	Lesson	Lesson Objectives
------	--------	-------------------

Systems of Equations**Exploration of the Graphing Calculator**

- Identify the basic features of the graphing calculator.
- Use the graphing calculator to investigate graphs.
- Use the graphing calculator to perform basic calculations.

Solving Equations Graphically

- Solve equations using the intersect method
- Solve equations using the x-intercept method

Solving Linear Systems Graphically

- Classify systems of two-variable equations as dependent, independent, consistent, or inconsistent.
- Solve systems of two-variable linear equations graphically.
- Solve systems of two-variable linear inequalities.

Solving Linear Systems by Elimination

- Solve systems of two-variable linear equations using elimination.

Solving 3 x 3 Linear Systems

- Classify systems of three-variable equations as dependent, independent, consistent, or inconsistent.
- Solve 3×3 linear systems algebraically.

Modeling with Linear Systems

- Model and solve real-world problems using systems of linear equations and inequalities.

Linear Programming

- Maximize a function given constraints.
- Represent and solve real-world problems using linear programming.

Mixed Degree Systems

- Solve linear-quadratic systems of equations.
- Solve quadratic-quadratic systems of equations.

Modeling with Systems

- Model and solve real-world problems using linear-quadratic or quadratic-quadratic systems of equations.

Unit	Lesson	Lesson Objectives
------	--------	-------------------

Matrices**Introduction to Matrices**

- Determine if two matrices are equal.
- Identify types of matrices.
- Represent and interpret data in matrices.

Adding and Subtracting Matrices

- Apply matrix addition to model problems and solve matrix equations.
- Identify and apply the properties of matrix addition.
- Perform matrix addition and subtraction.

Scalar and Matrix Multiplication

- Perform multiplication of a scalar and a matrix.
- Perform multiplication of two matrices.

Determinants

- Apply determinants to solve problems.
- Evaluate determinants of 2×2 and 3×3 matrices.

Matrices and Their Inverses

- Find the inverse of a matrix.

Solving Matrix Equations

- Solve matrix equations by taking the inverse of a matrix.
- Solve matrix equations using operations with matrices.

Matrices and Row Operations

- Perform row operations in matrices.
- Solve a linear system using reduced row echelon form.

Modeling with Matrices

- Model and solve real-world problems using matrices.

Modeling Motion with Matrices

- Use Matrices to determine the coordinates of polygons under a given transformation

Unit	Lesson	Lesson Objectives
------	--------	-------------------

Functions and Their Graphs**Linear Functions**

Determine if a function is linear.

Represent a linear relationship numerically, algebraically, and graphically.

Quadratic Functions

Find the line of symmetry and vertex of a parabola given its function rule.

Identify a quadratic function from the function rule.

Use key attributes of a quadratic function to solve word problems.

Monomial Functions

Analyze the key attributes of monomial functions.

Graphs of Polynomial Functions

Describe the key features of a polynomial function.

Identify the key features of a polynomial function from a given graph.

Graphing Radical Functions

Determine the domain and range of square root and cube root functions.

Relate transformations to the graphs of square root and cube root functions to their parent function.

Graphing Exponential Functions

Determine the domain and range of exponential functions.

Graph exponential functions.

Identify exponential functions.

Graphing Logarithmic Functions

Determine the domain and range of logarithmic functions.

Identify and analyze the graphs of logarithmic functions.

Identify logarithmic functions.

Absolute Value Functions

Analyze absolute value functions to determine key features of the graph.

Model and solve mathematical and real-world problems with absolute value functions.

Piecewise Defined Functions

Determine the domain, range, and continuity of piecewise defined functions.

Evaluate piecewise defined functions.

Graph piecewise defined functions.

Unit	Lesson	Lesson Objectives
------	--------	-------------------

Step Functions

- Analyze step functions to determine key features of the graph.
- Evaluate step functions.
- Use step functions to model real-world problems.

The Nature of Functions**Function Operations**

- Combine functions using arithmetic operations, expressing the results both algebraically and graphically.
- Evaluate sums, differences, products, and quotients of functions.

Composition of Functions

- Evaluate the composition of functions.
- Find the domain of the composition of functions.
- Write an expression for the composition of functions.

Symmetry

- Determine the symmetry of a function algebraically.
- Determine the symmetry of a relation from a graph.

Function Inverses

- Find the inverse of a function.
- Use composition to verify that functions are inverses.

Domain and Range

- Determine the domain and range of a function in both mathematical and real-world contexts.

Transformations of Functions

- Analyze a function rule or graph to determine transformations of the parent function.
- Identify a function as belonging to a family of functions.

Analyzing Compositions of Functions

- Determine the domain and range of the composition of functions.
- Find compositions of functions from a variety of function families.

Modeling with Functions

- Find the equation of a function that best models a data set.
- Use function models to solve problems.

Unit	Lesson	Lesson Objectives
------	--------	-------------------

Complex Numbers**Complex Numbers**

- Determine the absolute value of a complex number.
- Represent complex numbers in the form $a + bi$ or in the complex plane.
- Represent square roots of negative numbers as multiples of i .
- Simplify powers of i using their cyclic nature.

Performing Operations with Complex Numbers

- Identify the field properties of complex numbers.
- Perform addition, subtraction, multiplication, and division of complex numbers.

Distance and Midpoints in the Complex Plane

- Calculate the modulus of a complex number.
- Solve problems involving distances and midpoints in the complex plane.
- Use the average to find the midpoint of a segment in the complex plane.
- Use the modulus to find the distance between any two complex numbers in the plane.

Completing the Square

- Find complex solutions to quadratic equations by completing the square.
- Recognize the pattern of a perfect-square trinomial as the square of a binomial.
- Use the square root property to solve equations.

The Quadratic Formula

- Find real and complex solutions of quadratic equations using the quadratic formula.
- Use the discriminant to determine the number and type of roots of a quadratic equation.

Polynomial Functions**Factoring Polynomials Completely**

- Analyze polynomial expressions to factor them completely.

Division of Polynomials

- Use inverse operations to check the result of polynomial division
- Use long division to find quotients of polynomials

Synthetic Division and the Remainder Theorem

- Apply the remainder theorem.
- Use synthetic division to divide a polynomial by a linear factor.

The Rational Roots Theorem

- Determine the roots of and factor a polynomial function.
- Use the rational root theorem to determine possible roots of a polynomial function.

Unit	Lesson	Lesson Objectives
------	--------	-------------------

The Fundamental Theorem of Algebra

Apply the fundamental theorem of algebra to determine the number of roots of a polynomial function.

Use the complex conjugate theorem to factor and solve polynomial equations.

Writing Polynomial Functions from Complex Roots

Write polynomial functions from complex roots.

Graphing Polynomial Functions

Graph polynomial functions using key features.

Solving Polynomial Equations using Technology

Use technology to solve or approximate solutions of one-variable polynomial equations.

Rational Functions**Vertical Asymptotes of Rational Functions**

Determine the vertical asymptotes and holes in the graph of a rational function having the x-axis as its only horizontal asymptote.

Solve problems involving inverse variation.

Graphing Rational Functions

Determine the horizontal asymptotes of a rational function.

Graph rational functions that have only vertical or horizontal asymptotes.

Rational Inequalities

Solve rational inequalities algebraically and determine extraneous solutions.

Modeling with Rational Functions

Model and solve real-world problems using rational functions.

Right Triangle and Circular Trigonometry**Right Triangle Trigonometry**

Use special right triangle relationships to solve right triangles.

Use the Pythagorean theorem, and the trigonometric functions and their inverses to solve right triangles.

Solving Right Triangles

Solve problems involving right triangles in modeling situations

Use trigonometric ratios to find missing parts of a right triangle

Angles in Standard Position

Determine angles that are coterminal.

Identify characteristics of angles in standard position.

Radian Measure

Convert between degree and radian measure.

Use the definition of radian measure to calculate arc lengths, radii, and angle measures.

Unit	Lesson	Lesson Objectives
------	--------	-------------------

The Unit Circle

- Compare sine, cosine, and tangent values for angles having the same reference angle.
- Find the sine, cosine, and tangent values of angle measures using the unit circle.

Reciprocal Trigonometric Functions

- Evaluate the six trigonometric functions for special angles.
- Simplify expressions involving the six trigonometric functions using reciprocal relationships.
- Solve right triangle trigonometry problems involving reciprocal trigonometric functions.

Graphing Trigonometric Functions**Graphing Sine and Cosine**

- Analyze key features of sine and cosine functions from equations and graphs.

Changes in Period and Phase Shift of Sine and Cosine Functions

- Relate transformations of the graphs of the sine and cosine functions to the equation.

Graphing Cosecant and Secant Functions

- Analyze key features of secant and cosecant functions from equations and graphs.

Graphing Tangent and Cotangent

- Analyze key features of tangent and cotangent functions from equations and graphs.

Trigonometric Inverses and Their Graphs

- Find principal values of inverse trigonometric functions
- Graph inverse trigonometric functions

Modeling with Periodic Functions

- Model and solve real-world problems using periodic functions.

Analytic Trigonometry**Evaluating the Six Trigonometric Functions**

- Evaluate the six trigonometric functions for angles in degrees or radians based on one or more given trigonometric function values.
- Evaluate the six trigonometric functions for angles in degrees or radians given a point on the terminal ray.

Basic Trigonometric Identities

- Identify and use reciprocal identities, quotient identities, Pythagorean identities, symmetry identities, and opposite-angle identities

Verifying Trigonometric Identities

- Find numerical values of trigonometric functions
- Use the basic trigonometric identities to verify other identities

Sum and Difference Identities

- Use the sum and difference identities for the sine, cosine, and tangent functions

Double-Angle and Half-Angle Identities

- Use the double- and half-angle identities for the sine, cosine, and tangent functions

Unit	Lesson	Lesson Objectives
------	--------	-------------------

Solving Trigonometric Equations

Analyze key features of inverse trigonometric functions from equations and graphs.

Evaluate inverse trigonometric functions over a specified domain.

Solve trigonometric equations over a specified domain.

Additional Topics in Trigonometry**Law of Sines**

Apply the law of sines to solve mathematical and real-world problems.

Determine whether a triangle has zero, one, or two solutions using the ambiguous case of the law of sines.

Law of Cosines

Apply the law of cosines to solve mathematical and real-world problems.

Law of Sines and Law of Cosines — a Deeper Look

Use right triangle trigonometry to develop and prove the Law of Cosines.

Use right triangle trigonometry to develop and prove the Law of Sines.

Use the Law of Cosines to solve problems.

Use the Law of Sines to solve problems.

Polar Coordinates

Convert points and equations from polar to rectangular coordinates and vice versa

Graphs of Polar Equations

Graph polar equations and determine the maximum r-value and the symmetry of a graph

De Moivre's Theorem and nth Roots

Represent complex numbers in trigonometric form and perform operations on them

Vectors**Geometric Vectors**

Add and subtract vectors geometrically

Find equal, opposite, and parallel vectors

Algebraic Vectors

Add, subtract, multiply, and find the magnitude of vectors algebraically.

Find ordered pairs that represent vectors

Vector Multiplication Using Matrices

Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector.

Solve problems involving transformations of vectors using matrices.

Dot Products of Vectors

Calculate dot products and projections of vectors

Unit	Lesson	Lesson Objectives
------	--------	-------------------

Vectors in Three-Dimensional Space

- Add and subtract vectors in three-dimensional space
- Find the magnitude of vectors in three-dimensional space

Conics and Analytic Geometry**Circles and Parabolas**

- Find the standard form equation, focus, and directrix of a parabola.

Ellipses

- Define an ellipse
- Graph ellipses
- Identify important characteristics of ellipses
- Write the equation of an ellipse

Hyperbolas

- Define a hyperbola
- Graph hyperbolas
- Identify important characteristics of hyperbolas
- Write the equation of a hyperbola

Classifications and Rotations of Conics

- Apply translated conics to real-world problems
- Determine the shape of a translated conic without graphing
- Graph a translated conic
- Write the equation of a translated conic

Polar Equations of Conics

- Understand the general focus-directrix definition of a conic section and will be able to write equations of conic sections in polar form

Sequences and Series**Sequences**

- Describe a pattern represented by a sequence.
- Find terms of a sequence from a general formula.
- Find the explicit formula of a sequence.
- Represent a sequence graphically.

Arithmetic Sequences

- Apply the formula of an arithmetic sequence.
- Determine if a sequence is arithmetic.
- Find the common difference of an arithmetic sequence.
- Find the terms of an arithmetic sequence.

Unit	Lesson	Lesson Objectives
Geometric Sequences		
Apply the formula of a geometric sequence.		
Determine if a sequence is geometric.		
Find terms of a geometric sequence.		
Find the common ratio of a geometric sequence.		
Summation Notation		
Convert between series in summation notation and expanded form.		
Evaluate a summation by expanding it.		
Arithmetic Series		
Solve problems using the formula for the sum for an arithmetic series.		
Finite Geometric Series		
Solve problems using the formula for the sum of a finite geometric series.		
Infinite Geometric Series		
Determine if an infinite geometric series converges.		
Evaluate the sum of an infinite geometric series.		
Find a partial sum of an infinite geometric series.		
Recursive Formulas		
Write a rule for a recursively defined function.		
Write the first n terms of a recursive function given a formula and a term.		
The Binomial Theorem		
Use the Binomial theorem to expand binomials.		
Use the Binomial theorem to find a specific term in an expansion.		
Modeling with Sequences and Series		
Determine if a sequence or series is arithmetic or geometric.		
Solve real-world problems involving sequences.		
Solve real-world problems involving series.		