

MATH-1580: PRECALCULUS

Cuyahoga Community College

Viewing: MATH-1580 : Precalculus

Board of Trustees:

March 2021

Academic Term:

Fall 2021

Subject Code

MATH - Mathematics

Course Number:

1580

Title:

Precalculus

Catalog Description:

Intensified course designed to prepare students for calculus. Study of real numbers, equations and inequalities, functions and graphs, sequences and series, theory of equations, systems of equations and inequalities, mathematical induction, conic sections, exponential and logarithmic functions, trigonometric functions and complex numbers. Applications and activities to build skills in problem solving also included.

Credit Hour(s):

5

Lecture Hour(s):

5

Lab Hour(s):

0

Other Hour(s):

0

Requisites

Prerequisite and Corequisite

Sufficient score on Math assessment test, or departmental approval: previous trigonometry or algebra/trigonometry course in high school or college.

Outcomes

Course Outcome(s):

Represent functions verbally, numerically, graphically and algebraically.

Essential Learning Outcome Mapping:

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. Define and identify relation, domain, range, function.
2. Identify and perform transformations of functions.
3. Define, identify, and analyze linear, quadratic, polynomial, rational, root/radical/power and piece-wise functions algebraically and graphically, including the domain and range.
4. Determine the vertex of a quadratic function.
5. Identify and determine asymptotes of rational functions.
6. Sketch graphs of rational functions.
7. Determine exact and/or approximate zeros and sketch the graphs of polynomial functions of degree greater than two.
8. Use the Remainder Theorem and Factor Theorems for polynomial functions including the Fundamental Theorem of Algebra and the Rational Zero Theorem.

9. Define and determine zeros or roots of a polynomial function including irrational and complex zeros, based on operations with complex numbers.
10. Determine intervals on which the function is increasing, decreasing or constant.
11. Determine algebraically and graphically whether the graph of an equation exhibits symmetry.
12. Use the vertical line test to identify functions.
13. Graph functions and their inverses.
14. Determine if a function is even or odd.
15. Identify and determine relative maximum and minimum values in an interval of a function.
16. Define exponential and logarithmic functions.
17. Determine the domain and ranges of exponential and logarithmic functions.
18. Graph exponential and logarithmic functions using their properties.
19. Identify Properties of Logarithmic functions including the Product, Quotient, Power, and Change of Base Rules and use the properties to rewrite logarithmic functions.
20. Define and evaluate common and natural logarithms.
21. Use functions to model quadratics, polynomials, rationals, and radicals to solve a variety of real-world problem-solving applications.
22. Use the horizontal line test to determine if a function is one-to-one.
23. Define and determine inverse functions algebraically.
24. Perform operations (sum, difference, product, and quotient) on functions and determine the domain of the resulting functions.
25. Divide a polynomial function by a linear function using synthetic division.
26. Divide a polynomial function by a polynomial function using long division.
27. Determine the composite of two functions and the domain of the composite function.
28. Decompose a function as a composite.

Course Outcome(s):

Solve mathematical equations, including linear, exponential, and logarithmic.

Essential Learning Outcome Mapping:

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. Apply the definition of absolute value to solve linear equations.
2. Use the one-to-one property of exponential functions to solve one-to-one exponential equations.
3. Use the Properties of Logarithms and the one-to-one property of logarithmic functions to solve one-to-one logarithmic equations.
4. Use the inverse relationship between the exponential function and logarithmic function to solve exponential and logarithmic equations.
5. Evaluate applications involving exponential and logarithmic functions and equations including exponential growth and decay and periodic and continuous compounding.
6. Model exponential growth and decay as real-world problem-solving applications.

Course Outcome(s):

Solve mathematical inequalities.

Essential Learning Outcome Mapping:

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. Solve quadratic, polynomial and rational inequalities in one variable.
2. Write the solution using set builder notation.
3. Write the solution using interval notation.
4. Graph the solution using the appropriate graph.
5. Apply the definition of absolute value to solve linear, polynomial, and rational absolute value inequalities.

Course Outcome(s):

Define and evaluate trigonometric functions.

Essential Learning Outcome Mapping:

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. Apply the arc length in problems concerning linear speed and angular speed.
2. Graph the six circular functions using transformations and state their properties including domain, range, period, phase shift, and amplitude.
3. Model linear speed and angular speed with real-world problem-solving applications.
4. Apply definition of radian measure and convert to and from degree measure of angles.
5. Use a calculator to find function values and angles.
6. Define the trigonometric functions using a unit circle.
7. Define and find the length of an arc of a circle and the measure of a central angle of a circle.

Course Outcome(s):

Analyze, define, and interpret analytic trigonometry and right triangles.

Essential Learning Outcome Mapping:

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. Solve various trigonometric equations using proven identities and algebra.
2. Use the Pythagorean Theorem to solve right triangles and the trigonometric functions.
3. Solve applied problems involving right triangles and trigonometric functions.
4. Solve trigonometric equations.
5. Apply and prove Pythagorean, Sum/Difference, Cofunction, and Double Angle trigonometric identities and more complex trigonometric formulas not proven in the text.
6. Define and evaluate the inverse trigonometric functions under domain restrictions.
7. Solve real-world trigonometric problems using inverse trigonometric functions.

Course Outcome(s):

Analyze, interpret, and solve applications of trigonometry.

Essential Learning Outcome Mapping:

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. Solve different triangles using the Law of Sines and/or the Law of Cosines.
2. Solve applied trigonometric problems using the Law of Sines and/or the Law of Cosines.
3. Define and express a complex number in algebraic, trigonometric, and graphical form.
4. Perform operations with complex numbers.
5. Define and graph polar coordinates and equations.
6. Define vectors and their properties.
7. Use technology such as a graphing calculator or computer algebra system to graph, compute, evaluate, and estimate, as appropriate.
8. Model the Law of Sines and/or the Law of Cosines using real-world problem-solving applications.

Course Outcome(s):

Define, determine, and graph conic sections and solve systems of linear equations and non-linear systems of equations and inequalities.

Essential Learning Outcome Mapping:

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. Define and use the distance and midpoint formulas.
2. Define and identify circles, ellipses, parabolas, and hyperbolas graphically.
3. Define and identify circles, ellipses, parabolas, and hyperbolas algebraically in standard and general forms.
4. Graph the conic sections centered at the origin and at the point (h, k) using the center, radius, major and minor axes, vertices, foci, directrix, axis of symmetry, and oblique asymptotes as necessary.
5. Solve a system of linear equations of with two and three variables using the substitution and elimination method.
6. Decompose a rational partial fraction.
7. Solve systems of nonlinear equations using the substitution and elimination methods.
8. Solve systems of non-linear inequalities graphically.

9. Model and solve real life application of conic sections including wheels, radar dish, support cables, and Earth's orbit.

Course Outcome(s):

Recognize and differentiate arithmetic and geometric sequences and series, and determine specified terms and their sums if they exist.

Essential Learning Outcome Mapping:

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. Define and identify arithmetic and geometric sequences and series.
2. Determine the general term of a sequence.
3. Determine the sum of a series.
4. Determine the sum of the first n terms of an arithmetic sequence.
5. Determine the sum of the first n terms of a geometric sequence.
6. Determine the sum of an infinite geometric sequence.

Methods of Evaluation:

1. Periodic exams
2. Quizzes
3. Homework
4. In class collaborative work
5. Comprehensive final exam

Course Content Outline:

1. Fundamental concepts of algebra
 - a. Properties and operations of real numbers
 - b. Absolute value equations and inequalities
 - c. Exponents and radicals
 - d. Algebraic expressions
 - e. Equations and inequalities
 - i. interval notation
 - ii. solutions of linear and higher degree equations and inequalities, including rational inequalities
 - f. Elementary analytic geometry
 - i. Cartesian plane
 - ii. distance and midpoint formulas
 - iii. symmetry
 - iv. equations of a line and circle
2. Functions and their graphs
 - a. Notation, definition, operations and domain of functions
 - b. Graphs of functions
 - i. horizontal and vertical shifts
 - ii. reflection, compression, and expansion
 - iii. even and odd functions
 - iv. increasing, decreasing and constant functions
 - c. Composite and inverse functions
3. Polynomial and rational functions
 - a. Synthetic division
 - b. Finding zeros, real and complex
 - i. Remainder and Factor Theorem
 - ii. Descartes' Rule of Signs
 - iii. Rational Root Theorem
 - iv. Complex and irrational zeros
 - v. Graphics calculator
 - c. Horizontal, vertical and oblique asymptotes
 - d. Graphing
4. Exponential functions

5. Logarithmic functions and their properties
6. Exponential and logarithmic equations and applications
7. Trigonometric functions
 - a. Radian and degree measure
 - b. Trigonometric functions of angles and the unit circle
 - c. Trigonometric graphs
 - d. Applications involving right triangles
 - e. Trigonometric identities
 - f. Trigonometric equations
 - g. Formulae for sum/difference and multiple angles
 - h. Inverse trigonometric functions
8. Applications of trigonometry
 - a. Law of Sines
 - b. Law of Cosines
 - c. Complex numbers, definitions and operations
 - d. DeMoivre's Theorem
 - e. nth roots of complex numbers
 - f. Vectors
 - i. Definition and geometric representation
 - ii. Applications
9. Systems of equations and inequalities
 - a. Systems of equations
 - b. Systems of linear equations in more than two variables
 - c. Partial fractions
10. Sequences and series
 - a. Sequence functions and summation notation
 - b. Arithmetic sequences and series
 - c. Geometric sequences and series
 - d. Mathematical induction
 - e. Binomial Theorem
11. Analytic geometry
 - a. Parabola
 - b. Ellipse
 - c. Hyperbola
 - d. Plane curves and parametric equations
 - e. Polar coordinates and graphs of polar equations
12. Optional topics:
 - a. Harmonic motion
 - b. Matrices

Resources

Beecher, Penna and Bittinger. (2016) *Precalculus, A Right Triangle Approach*, Pearson.

Blitzer, Robert. (2017) *Precalculus*, Pearson.

Trigsted, Kirk. (2018) *Precalculus, A Unit Circle Approach*, Pearson.

Resources Other

Software provided with textbook

Instructional Services

OAN Number:

Ohio Transfer 36 TMM002

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Key: 2857