MATH-153H: HONORS COLLEGE ALGEBRA

Cuyahoga Community College

Viewing: MATH-153H : Honors College Algebra
Board of Trustees:
January 2023

Academic Term:
Fall 2023

Subject Code
MATH - Mathematics

Course Number:
153H

Title:
Honors College Algebra

Catalog Description:
Topics include extensive function (linear, quadratic, polynomial, radical, roots , power, piece-wise, exponential, logarithmic) representation including verbal, numeric, graphic, and algebraic, identifying properties of the different function types, transformation of functions, solve linear, polynomial, rational, absolute value, exponential and logarithmic equations. Solve quadratic, polynomial and rational inequalities in one variable. Determine and graph conic sections, solve non-linear systems of equations and inequalities and solve systems of equations using matrices. Includes applications and activities to build skills in problem solving.

Credit Hour(s):
4

Lecture Hour(s):
4

Requisites

Prerequisite and Corequisite
MATH-0965 Intermediate Algebra or qualified math placement; or departmental approval: equivalent coursework.

Note: MATH-1200 or 1280 taken prior to Fall 2016, or MATH-1270 taken prior to Summer 2017 will be accepted to meet prerequisite requirements for this course.

Outcomes

Course Outcome(s):
Represent functions verbally, numerically, graphically and algebraically.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.
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 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.
29. Incorporate use of technology when analyzing and contrasting functions.

Course Outcome(s):

Solve Equations.

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.
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Apply the definition of absolute value to solve linear, polynomial, and rational absolute value 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.

Course Outcome(s):

Solve inequalities.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.
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.
5. Apply the definition of absolute value to solve linear, polynomial, and rational absolute value inequalities.
6. Write the solution using set builder notation.
7. Write the solution using interval notation.
8. Graph the solution.

Course Outcome(s):

Define, Determine, and Graph Conic Sections and solve Non-linear Systems of Equations and Inequalities.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.
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. Solve systems of nonlinear equations using the substitution and elimination methods.
5. Solve systems of non-linear inequalities graphically.
6. Solve real life application of conic sections including wheels, radar dish, support cables, and Earth's orbit.

Course Outcome(s):

Solve systems of linear equations using matrices.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.
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. Describe and use the basic properties of matrices.
2. Introduce Gaussian and Gauss-Jordan elimination methods.

Methods of Evaluation:

  A. Periodic exams.
        B. Quizzes.
        C. Homework.
        D. In-class collaborative work.
        E. Research assignments
F. In-Class presentations.
        G. Comprehensive final exam
        H. Take-home projects

Course Content Outline:

 a. Represent functions verbally, numerically, graphically and algebraically
    i. Relation, domain, range, function
    ii. Vertical line test
    iii. Horizontal line test
    iv. Inverse functions
    v. Sum, difference, product, and quotient of functions and their domain
    vi. Synthetic division
    vii. Long division
    viii. Composite of functions and the domain
    ix. Decompose a function as a composite
    x. Transformations of functions
    xi. Linear, quadratic, polynomial, rational, root/radical/power and piece-wise functions, range and domain
    xii. Vertex of quadratic functions
    xiii. Asymptotes of rational functions
    xiv. Graphs of rational functions
    xv. Exact and/or approximate zeros and graphs of polynomial functions

    xvi. Remainder Theorem and Factor Theorems, the Fundamental Theorem of Algebra and Rational Zero Theorem
    xvii. Zeros or roots of a polynomial function, irrational and complex zeros using operations with complex numbers
   xviii. Increasing, decreasing, constant intervals of functions
    xix. Symmetry algebraically and graphically
    xx. Graph functions and inverses
    xxi. Even or odd functions
    xxii. Relative maximum and minimum values in an interval of a function
   xxiii. Exponential and logarithmic function definition
   xxiv. Domain and range of exponential and logarithmic function
    xxv. Graphs, properties of exponential and logarithmic functions
   xxvi. Properties of logarithmic functions including the Product, Quotient, Power, and Change of Base Rules and use these properties to rewrite logarithmic functions
       1. Common and natural logarithms
       2. Functions to model a variety of real-world problem-solving
       3. Students choose and applying technology to assist in analyzing functions
  b. Solve Equations
    i. Solve absolute value equations
    ii. One-to-one property of exponential functions to solve one-to-one exponential equations
    iii. One-to-one property of logarithmic functions to solve one-to-one logarithmic equations
    iv. Inverse relationship of exponential and logarithmic function to solve exponential and logarithmic functions
    v. Applications of exponential and logarithmic functions and equations including exponential growth and decay and   periodic and continuous compounding
  c. Solve inequalities
    i. Absolute value, quadratic, polynomial and rational inequalities in one variable
    ii. Set builder notation with inequalities
    iii. Interval notation with inequalities
    iv. Graph solutions of inequalities
    v. Solve linear, polynomial, and rational absolute value inequalities
    vi. Set builder notation with absolute value inequalities
    vii. Interval notation with absolute value inequalities
    viii. Graph solutions with absolute value inequalities
  d. Graph Conic Sections and solve Non-linear Systems of Equations and Inequalities
    i. Distance and midpoint formulas
    ii. Circles, ellipses, parabolas, and hyperbolas graphically
    iii. Circles, ellipses, parabolas, and hyperbolas algebraically
    iv. 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
    v. Substitution and elimination methods to solve systems of nonlinear equations
    vi. Graphing to solve systems of non-linear inequalities
    vii. Real life application of conic sections including wheels, radar dish, support cables, and Earth's orbit
  e. Systems of equations using matrices
    i. Basic properties of matrices
    ii. Introduce Gaussian and Gauss-Jordan elimination methods

Resources

Blitzer. *Precalculus*. 6th ed. Prentice Hall, 2018.

Beecher, Penna, Bittinger. *Precalculus*. 3rd ed. Addison Wesley, 2008.

Dugopolski. *Precalculus: Functions and Graphs*. 4th ed. Addison Wesley, 2013.

Larson. *Precalculus*. 10th ed. Cengage Learning, 2018.

Sullivan. *Algebra and Trigonometry*. 11th ed. Boston, MA: Pearson Education, 2020.

Instructional Services

OAN Number:
Ohio Transfer 36 TMM001 and TMM002 (1 of 2 courses, both must be taken)

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