Eastern WV Community & Technical College
Master Course Record

Course Prefix and Number: MTH 137
Course Title: Pre-Calculus
Recommended Transcript Title: Pre-Calculus
Date Approved/Revised: 6/30/05; 10/13/16; 10/5/17
Credit Hours: 5 **Contact hours per week (Based on 15 week term)** **Lecture:** 5 **Lab:**
Prerequisite: Math ACT score 19 or higher; SAT math score 500 or higher; or ACCUPLACER Elementary Algebra score of 76 or higher. **Corequisite:** **Pre/Corequisite:**
Grading Mode: Letter Grade
Catalog Description: A study of algebraic and trigonometric functions and their applications including: an exploration of polynomial, exponential, logarithmic and circular functions and their graphs; right triangle trigonometry; trigonometric identities; vectors; polar equations; systems of linear and nonlinear equations; an introduction to sequences and series; matrix algebra; the binomial theorem and mathematical induction.
Course Outcomes: 1. Define, evaluate, analyze, and perform operations on functions 2. Graph linear and nonlinear functions 3. Solve linear, absolute value, quadratic, polynomial, and rational equations and inequalities 4. Solve problems involving exponential and logarithmic functions 5. Solve systems of equations and inequalities 6. Define, evaluate, and graph trigonometric functions and their inverses 7. Verify trigonometric identities and solve trigonometric equations 8. Solve applications using trigonometric functions 9. Graph polar and parametric equations 10. Graph and perform operations with vectors 11. Graph and write equations for conic sections 12. Apply the basic concepts of sequences, series, the binomial theorem, and mathematical induction
Implementation Cycle: Spring
Role in College Curriculum: (Check all that apply) **Ξ General Education Core:** Mathematics **□ Technical Core (Specify Program)** **□ Restricted Elective (Specify program)**

□ **General Elective** □ **Workforce Education** □ **Other (Please specify)**
Course Fee: None
Instructor's Qualifications: Master's Degree with 18 graduate level mathematics credits.
Expanded Course Description: In this course, the focus will be on problem solving skills and developing abilities to think mathematically. The general purpose of the course is to prepare the student for a course in a rigorous calculus sequence by providing them with the necessary competencies in algebra and trigonometry, and competence in using a graphing utility. Expanded course outcomes: 1. Define, evaluate, analyze, and perform operations on functions a. Find the domain and range of a relation b. Define function c. Identify functions d. Recognize function notation and evaluate functions e. Find the domain and range of a function f. Write inequalities in interval and set-builder notation g. Recognize where a function is increasing and where it is decreasing h. Perform operations on functions i. Perform composition of functions j. Define and identify a one-to-one function k. Find the inverse of a one-to-one function symbolically and graphically l. Determine whether a function is a polynomial m. Identify the degree of a polynomial n. Identify the leading coefficient of a polynomial o. Divide polynomials using long division p. Divide polynomials using synthetic division q. Factor polynomials r. Write a polynomial with the given zeros s. Determine whether a function is a rational function t. Find the domain of a rational function 2. Graph linear and nonlinear functions a. Write the equation of a line b. Calculate the distance between two points c. Find the midpoint of two points d. Graph a circle from its equation

e. Graph linear functions
f. Identify the x- and y-intercepts of a linear function
g. Find the slope of the line between two points
h. Evaluate piecewise functions
i. Graph piecewise functions
j. Graph horizontal and vertical lines and give their slope
k. Identify parallel and perpendicular lines
l. Analyze the graph of a quadratic function
m. Convert a quadratic function between vertex form and standard form
n. Graph quadratic functions
o. Graph functions using transformations
p. Locate the extrema of a function
q. Identify a turning point of a function
r. Describe the graph of a polynomial based on its degree and leading coefficient
s. Recognize the connection among *x*-intercepts, zeros, and factors of a polynomial
t. Use a graph of a polynomial to find the number of real zeros and the number of imaginary zeros
u. Graph equations by plotting points

3. Solve linear, absolute value, quadratic, polynomial, and rational equations and inequalities
    a. Solve variation problems
    b. Solve linear equations
    c. Solve linear equations graphically
    d. Solve an equation for a specified variable
    e. Solve linear inequalities
    f. Solve absolute value equations and inequalities
    g. Solve quadratic equations by factoring
    h. Solve quadratic equations using the square root property
    i. Solve quadratic equations by completing the square
    j. Solve quadratic equations using the quadratic formula
    k. Use the discriminant to determine the number and type of solutions to a quadratic equation
    l. Perform operations with complex numbers
    m. Solve quadratic inequalities
    n. Solve polynomial equations
    o. Solve polynomial inequalities

p. Solve rational equations
q. Solve rational inequalities

4. Solve problems involving exponential and logarithmic functions
    a. Find an exponential function to model the given data
    b. Recognize the properties of an exponential function from its graph
    c. Evaluate exponential functions
    d. Solve application problems modeled by an exponential or logarithmic function
    e. Evaluate a logarithmic expression
    f. Recognize the properties of a logarithmic function from its graph
    g. Find the domain of a logarithmic function
    h. Solve exponential and logarithmic equations
    i. Convert an equation to from exponential form to logarithmic form and vice versa
    j. Use the properties of logarithms to expand or condense expressions
    k. Use the change of base formula to evaluate logarithms
5. Solve systems of equations and inequalities
    a. Solve a system of equations by graphing
    b. Solve a system of equations by substitution
    c. Solve a system of equations by elimination
    d. Solve a system of nonlinear equations
    e. Graph a linear inequality in two variables
    f. Graph a system of linear inequalities in two variables
    g. Identify an ordered pair that is a solution to a system of linear inequalities
    h. Use linear programming to maximize or minimize a quantity
    i. Represent a system of equations with a matrix
    j. Solve a system of equations using row-echelon form and backward substitution
    k. Perform operations on matrices
    l. Find the inverse of a matrix
    m. Solve a system of equations using an inverse matrix
    n. Find the determinant of a matrix
    o. Solve a system of equations using Cramer's Rule
6. Define, evaluate, and graph trigonometric functions and their inverses
    a. Convert from degrees to radians and from radians to degrees
    b. Recognize coterminal angles
    c. Find the arc length of a circle

d. Find the area of a sector of a circle
e. Find linear speed and angular speed
f. Define each of the trig functions in terms of a point on the unit circle
g. Find exact values of trig functions of common angles
h. Approximate trig values with a calculator
i. Identify the domain and the range of trig functions
j. Identify the period of trig functions
k. Find the exact value of trig expressions using periodic properties
l. Determine the quadrant of an angle given the signs of its trig values
m. Find the exact value of trig expressions using identities
n. Find the exact value of trig functions given the value of one function and the quadrant of the angle
o. Graph trig functions, employing transformations when necessary
p. Identify the amplitude of trig functions
q. Find exact values of trig functions using sum and difference formulas
r. Find exact values of trig functions using double-angle and half-angle formulas
s. Define each of the trig functions in terms of a right triangle
t. Find exact values of trig functions given a right triangle
u. Define inverse trig functions
v. Identify the domain and range of inverse trig functions
w. Find exact values of the inverse trig functions
x. Approximate inverse trig values with a calculator
y. Find exact values when composing trig functions and inverse a trig functions
z. Solve equations involving inverse trig functions

7. Verify trigonometric identities and solve trigonometric equations
   a. Use algebraic techniques to simplify trig expressions
   b. Verify trig identities
   c. Solve trig equations algebraically
   d. Use a graphing utility to solve trig equations
8. Solve applications using trigonometric functions
   a. Solve a right triangle
   b. Solve applied problems involving right triangles
   c. Use the law of sines or the law of cosines to solve an oblique triangle
   d. Find the area of a triangle
9. Graph polar and parametric equations
   a. Plot points using polar coordinates

b. Convert from polar coordinates to rectangular coordinates and vice versa
c. Convert a polar equation to a rectangular equation and vice versa
d. Identify and graph polar equations
e. Convert a complex number from rectangular form to polar form
f. Plot points in the complex plane
g. Find products and quotients of complex numbers in polar form
h. Use De Moivre's Theorem
i. Find complex roots
j. Graph parameter equations
k. Find a rectangular equation for a parametric curve
l. Find parametric equations for a rectangular equation

10. Graph and perform operations with vectors
    a. Add and subtract vectors algebraically and graphically
    b. Perform scalar multiplication of vectors algebraically and graphically
    c. Find the components of a vector
    d. Find the magnitude of a vector
    e. Find a unit vector
    f. Find a vector from its direction and magnitude
    g. Compute the dot product of two vectors
    h. Find the angle between two vectors
11. Graph and write equations for conic sections
    a. Graph parabolas
    b. Write the equation of a parabola
    c. Graph ellipses
    d. Write the equation of an ellipse
    e. Graph hyperbolas
    f. Write the equation of a hyperbola
    g. Recognize and graph polar equations of conics
12. Apply the basic concepts of sequences, series, the binomial theorem, and mathematical induction
    a. Find the *n*th term of a sequence
    b. Use summation notation and the properties of sums
    c. Find the sum of a finite sequence
    d. Find the *n*th term of an arithmetic sequence
    e. Find the sum of a finite arithmetic series
    f. Find the *n*th term of a geometric sequence
    g. Find the sum of finite and infinite geometric series

h. Calculate binomial coefficients
i. Use the binomial theorem to expand binomial expressions
j. Find a specific term of a binomial expansion
k. Use mathematical induction to prove statements

Prepared by: Andrea Williams, Mathematics Faculty 10/5/17

Name, Title Date

Approved Per LOT Minutes

Dean of Teaching and Learning Date