

**NOVA COLLEGE-WIDE COURSE CONTENT SUMMARY  
MTH 166 - PRECALCULUS WITH TRIGONOMETRY (5 CR.)**

**Course Description**

Presents college algebra, analytic geometry, trigonometry, and algebraic, exponential, and logarithmic functions. Lecture 5 hours per week.

**General Course Purpose**

The general purpose of this one-semester course is to prepare the student for a course in a rigorous calculus sequence by providing them with the necessary competencies in algebra, functions (including polynomial, rational, exponential, logarithmic, and trigonometric functions), and analytic geometry, as well as competence in using a graphing utility. At NVCC, this course will prepare the student for the calculus sequence, MTH 173-174 - "Calculus with Analytic Geometry I-II".

**Course Prerequisites/Corequisites**

Prerequisites: Competency in Math Essentials Units MTE 1-9 as demonstrated through the placement and diagnostic tests, or by completion through unit 9 in an MTT course. Credit will not be awarded for both MTH 163 and MTH 166

**Course Objectives**

As a result of the learning experience in this course, the student should be able to:

- Solve problems involving equations, inequalities, and systems of equations
- Operate on functions (addition, multiplication, composition, and inverses)
- Graph linear, quadratic, exponential, logarithmic, and trigonometric functions
- Graph conic sections
- Factor polynomials and find zeroes of polynomials
- Evaluate trigonometric and inverse trigonometric functions
- Use trigonometric formulas to prove trigonometric identities, solve triangles, and trig equations
- Use a graphing utility as an aid to problem solving

**Major Topics to be Included**

***Optional Review of Algebraic Expressions***

Algebraic Expressions

- A. Polynomials
- B. Factoring
- C. Rational Expressions
- D. Rules of Exponents for positive integer exponents
- E. Solution of linear equations
- F. Quadratic Formula and Quadratic-type equations
- G. Use of the theorem: Solutions of  $p=q$  are a subset of the solutions of  $p^2=q^2$

***Required Topics***

- A. Exponents and radicals
  - 1. Definitions
    - a. The zero exponent

- b. Negative integer exponents
    - c. Rational exponents
  - 2. Rules for rational exponents
    - a. Simplifying radicals
    - b. Rationalizing numerator or denominator
- B. Inequalities and Absolute Value
  - 1. Inequalities
    - a. Definition
    - b. Interval notation
    - c. Graphing on the number line
    - d. Solution of linear, quadratic, and rational inequalities
  - 2. Absolute Value
    - a. Definition
    - b. Solution of equations and inequalities containing absolute values
- C. Complex Numbers
  - 1. Definition
  - 2. Arithmetic operations
- D. Functions
  - 1. Definitions, including domain and range
  - 2. Operations
    - a. Arithmetic
    - b. Composition
  - 3. Inverses with respect to composition
- E. Polynomial Functions
  - 1. Definition
  - 2. Graphs (including transformations and symmetry)
  - 3. Remainder Theorem and Factor Theorem
  - 4. Division of Polynomials
  - 5. Fundamental Theorem of Algebra
  - 6. Finding zeros of polynomial functions with integral coefficients
- F. Rational Functions
  - 1. Definitions
  - 2. Graphs (including asymptotes)
- G. Exponential and Logarithmic Functions
  - 1. Definitions
  - 2. Graphs
  - 3. Finding common and natural logarithms and antilogarithms
  - 4. Solution of equations involving exponentials and/or logarithms
  - 5. Growth and Decay Problems and other applications
- H. Analytic Geometry
  - 1. Basic Concepts
    - a. distance between two points in the plane
    - b. midpoint of line segment
  - 2. Linear Functions
    - a. slope
    - b. intercepts
    - c. graphs of linear functions
    - d. parallel and perpendicular lines
    - e. derive line equations
  - 3. Conic sections of form  $Ax^2 + By^2 + Cx + Dy + E = 0$

- a. parabolas
  - (1) finding vertex
  - (2) graphing
- b. circles
  - (1) finding center and radius by completing the square
  - (2) graphing
- c. ellipses
  - (1) find axes and center
  - (2) graphing
- d. hyperbolas
  - (1) axes and asymptotes
  - (2) graphing

I. Solving systems of equations

- 1. Algebraically
- 2. Graphically

J. Trigonometric Functions

- 1. Unit circle
- 2. Circular functions
  - a. definitions
  - b. simple properties (Pythagorean, Reciprocal, Complementary)
- 3. Formulae for  $f(x+y)$ ,  $f(2x)$ ,  $f(x/2)$
- 4. Graphs of trigonometric functions
- 5. Inverses of trigonometric functions
- 6. Proving trigonometric identities
- 7. Solution of trigonometric equations
- 8. DeMoivre's Theorem

K. Applications of Trigonometric Functions to triangles

- 1. Trigonometric functions for right triangles
- 2. Solution of right triangles
- 3. Law of Sines
- 4. Law of Cosines

**Extra Topics (optional)**

A. Matrices and Determinants

- 1. Definition of Matrices
- 2. Operations on matrices
  - a. addition
  - b. transpose
  - c. scalar multiplication
  - d. matrix multiplication
- 3. Multiplicative Inverses
- 4. Determinants
- 5. Solving systems of linear equations
  - a. Cramer's Rule
  - b. row reduction of augmented matrices
  - c. using the multiplicative matrix inverse

B. Sequences and series

- 1. Arithmetic
- 2. Geometric

C. Binomial Theorem

D. Mathematical Induction