









**Syllabus**  
**MATH 1600**  
**Calculus I and Analytic Geometry**  
**2024**

**Committee Members:**

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**Facilitator: Beth Welke**

**The Institution agrees to the contents in this syllabus including course prefix, number, course description and other contents of this syllabus.**

 Chief Academic Officer, Central Community College	04/19/2024	Adopt
 Chief Academic Officer, Little Priest Tribal College	04/25/2024	Adopt
 Chief Academic Officer, Metropolitan Community College	05/09/2024	Decline
 Chief Academic Officer, Mid-Plains Community College	04/19/2024	Adopt
 Chief Academic Officer, Nebraska Indian Community College	05/01/2024	Adopt
 Chief Academic Officer, Northeast Community College	04/21/2024	Adopt
 Chief Academic Officer, Southeast Community College	04/29/2024	Adopt
 Chief Academic Officer, Western Nebraska Community College	04/19/2024	Adopt

## **I. CATALOG DESCRIPTION**

MATH 1600

Calculus I and Analytic Geometry

Prerequisite: College Algebra & Trigonometry or PreCalculus or appropriate placement score.

This course is a study of single variable calculus and analytical geometry. Topics include limits, continuity, derivatives, applications of derivatives, integrals, and applications of integrals.

5.0 semester credit hours/ 7.5 quarter credit hours/75 contact hours

## **II. COURSE OBJECTIVES/COMPETENCIES**

The course will:

1. Present analytical, numerical and graphical techniques to establish limits.
2. Introduce analytical, numerical and graphical techniques to verify continuity.
3. Present the definition to find derivatives.
4. Provide the rules of differentiation to calculate derivatives.
5. Relate the concepts of differentiation to analyze increasing and decreasing functions, locate extrema and determine concavity.
6. Use the concepts of differentiation to calculate rates of change.
7. Apply techniques of differentiation to optimize functions.
8. Develop the definition of integrals using approximation.
9. Provide the rules of integration to calculate integrals.
10. Apply the concepts of integration to calculate area between curves.
11. Use the concepts of integration to calculate volumes of solids.

### III. STUDENT LEARNING OUTCOMES

#### Limits and Continuity

Outcomes: Students will be able to:

- ◆ Calculate rates of change
- ◆ Find the equation of a tangent to a curve
- ◆ Calculate limits of a function using the limit laws
- ◆ Evaluate one-sided limits and limits at infinity
- ◆ Evaluate infinite limits and find vertical asymptotes
- ◆ Verify continuity of functions

#### Derivatives

Outcomes: Students will be able to:

- ◆ Find derivatives and equations of tangents at a point
- ◆ Express the derivative as a function
- ◆ Utilize differentiation rules for polynomials, products, and quotients
- ◆ Interpret the derivative as a rate of change
- ◆ Find the derivatives of transcendental functions
- ◆ Utilize the chain rule
- ◆ Determine higher order derivatives
- ◆ Use implicit differentiation
- ◆ Utilize the mean value theorem

#### Applications of Derivatives

Outcomes: Students will be able to:

- ◆ Determine absolute extrema
- ◆ Solve related rates problems
- ◆ Utilize linearization and differentials
- ◆ Use the first and second derivatives to identify local extrema and sketch curves
- ◆ Solve applied optimization problems
- ◆ Utilize Newton's Method

## **Integrals**

Outcomes: Students will be able to:

- ◆ Estimate with finite sums
- ◆ Use sigma notation and limits of finite sums
- ◆ Evaluate definite integrals
- ◆ Utilize the fundamental theorem of calculus
- ◆ Evaluate indefinite integrals
- ◆ Use the substitution method to evaluate integrals

## **Applications of Definite Integrals**

Outcomes: Students will be able to:

- ◆ Find the area under a curve and between curves
- ◆ Determine volumes of solids

## **IV. CONTENT/TOPICAL OUTLINE**

### **A. Limits and Continuity**

1. Rates of change
2. Limits of functions
3. Continuity

### **B. Derivatives**

1. Derivative at a point
2. Derivative as a function
3. Differentiation Rules
4. Derivative as Rate of Change
5. Derivatives of Transcendentals Functions
6. Chain Rule
7. Implicit Differentiation
8. Higher Order Derivatives
9. Linearization and Differentials

C. Applications of Derivatives

1. Extreme values of functions
2. Mean value theorem
3. First and Second Derivative Test
4. Concavity
5. Applied Optimization
6. Related Rates
7. Newton's Method
8. Antiderivatives

D. Integrals

1. Finite sums
2. Definite integral
3. Fundamental Theorem of Calculus
4. Indefinite Integrals
5. Substitution Method

E. Applications of Definite Integrals

1. Area between curves
2. Volumes of solids

V. **INSTRUCTIONAL MATERIALS**

**SUGGESTED TEXTBOOKS and/or MATERIALS**

1. Thomas' Calculus Early Transcendentals; Weir, Pearson
2. Thomas' Calculus; Hass, Pearson
3. Calculus; Larson & Edwards, Cengage
4. University Calculus; Hass, Pearson
5. Calculus; Stewart-Thomson, Brooks/Cole
6. Calculus Early Transcendentals; Briggs/Cochran, Pearson
7. Calculus Volume 1; Herman & Strang, Openstax Rice University

**Equipment:** Graphing calculator recommended

## **VI. METHODS OF PRESENTATION/INSTRUCTION**

- A. Methods of presentation are determined by the instructor. They traditionally include some combination of the following:*
1. Lecture
  2. Class Discussion
  3. Presentation and discussion of solutions to problems and exercises

## **VII. METHODS OF EVALUATION**

- A. Methods of evaluation are determined by the instructor. Evaluation traditionally include some combination of the following:*
1. Unit Tests
  2. Comprehensive final exam
  3. Quizzes
  4. Assignments
- B. Students will receive a course outline/syllabus indicating the instructor's specific attendance policy, course timeline, course requirements, and grading criteria.*

## **VIII. INSTITUTIONAL DEFINED SECTION**

*(To be used at the discretion of each community college as deemed necessary)*