Calculus I

Prerequisites: Trig/Pre-Calculus
Level: 12th grade
Credits: 1.0 – Mathematics
Additional: This course is accepted as a math credit for h.s. graduation
This course is accepted as a math credit for college admission
This course is accepted as a math credit by the NCAA

Course Description

This course will serve as an introduction to the concepts and tools of calculus. The purpose of this course is to prepare students who will take calculus, or other mathematics courses, in college. Important topics that will be covered include limits, differentiation, integration and parametric equations and sequences.

Course Outline

- Review
  - Real Numbers/Cartesian Plane
  - Lines and Functions
  - Graphing Calculators
  - Solving Equations
  - Trigonometric Functions
  - Sinusoidal Graphs
  - Exponential and Logarithmic Functions
  - Transformations of Functions
- Limits and Continuity
  - Concept of Limit
  - Computation of Limits
  - Continuity and Its Consequences
  - Limits involving Infinity
  - Formal Definition of Limit
  - Limits and Loss-of-Significance Errors
- Differentiation: Algebraic, Trigonometric, Exponential and Logarithmic functions
  - Tangent Lines and Velocity
  - The Derivative
  - Computation of Derivatives: The Power Rule
  - The Product and Quotient Rules
  - Derivatives of Trigonometric Functions
  - Derivatives of Exponential and Logarithmic Functions
  - The Chain Rule
  - Implicit Differentiation and Related Rates
  - The Mean Value Theorem
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Applications of Differentiation
    - Linear Approximations and L'Hopital's Rule
    - Newton's Method
    - Maximum and Minimum Values
    - Increasing and Decreasing Functions
    - Concavity
    - Overview of Curve Sketching
    - Optimization
    - Rates of Change in Applications
- Integration
    - Anti-derivatives
    - Sums and Sigma Notation
    - Area
    - The Definite Integral
    - The Fundamental Theorem of Calculus
    - Integration by Substitution
    - Numerical Integration
- Applications of the Definite Integral
    - Area between Curves
    - Volume by Disk/Washer Methods
    - Volumes by Cylindrical Shells
    - Arc Length and Surface Area
    - Projectile Motion
    - Work, Moments and Hydrostatic Force
    - Probability
- Exponentials, Logarithms and other Transcendental Functions
    - The Natural Logarithm Revisited
    - Inverse Functions
    - The Exponential Function Revisited
    - Growth and Decay Problems
    - Separable Differential Equations
    - Euler's Method
    - The Inverse Trigonometric Functions
    - The Calculus of the inverse Trigonometric Functions
    - The Hyperbolic Functions
- Integration Techniques
    - Review of Formulas and Techniques
    - Integration by Parts
    - Trigonometric Techniques of Integration
    - Integration of Rational Functions Using Partial Fractions
    - Integration Tables and CAS
    - Indeterminate Forms and L'Hopital's Rule
    - Improper Integrals
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Infinite Series
- Sequences of Real Numbers
- Infinite Series
- The Integral Test and Comparison Tests
- Alternating Series
- Absolute Convergence and the Ratio Test
- Power Series
- Taylor Series
- Application of Taylor Series
- Fourier Series

Teaching Methods

This class is taught mainly through lecture, cooperative learning groups, and individual practice. Students are given comprehensive overviews of each section, which are followed by in-class practice. Students will often work in cooperative learning groups and communicate their results, usually through whiteboarding, to their peers. Students will use software to deepen their understanding and application of topics covered in class. Daily assignments are a major part of the mathematical learning process. Students are expected to complete every assignment and give full participation in class for successful completion of this course.

Assessment

Students will be assessed with the following:
- Assignments
- MyMathLab Assignments
- Projects
- Chapter and Semester Exams

Texts

Demana, Franklin D., et al. *Calculus: Graphical, Numerical, Algebraic*. 6th ed., Pearson, 2020.

Online Learning Platform

Students will be registered for Pearson MyMathLab, which provides tutorials, practice, and assessments to aid students in mastering Calculus.