CANON CITY HIGH SCHOOL
COURSE GUIDE

Department: Mathematics

Course Title: Calculus

Date: Fall 2003

Grade Level: 12

Prerequisite/Requirements: C or better in Pre-Calculus

Costs to Students: Graphing calculator, graph paper, paper, and pencils

Course Description: This course permits students to master the following topics of Calculus: functions, rates of change, limits, velocity, derivatives (polynomial, implicit, applications, maximum and minimum, product, and quotient), and integrals (definite and indefinite).

General Course Outcomes:

Upon completion of this course the proficient student will know and be able to: (core concepts/essential skills).

1. graph and discuss critical attributes of functions
2. find velocity and other rates of change
3. find limits
4. find and apply derivatives
5. integrate functions
6. use integration to find areas and volumes

Standards:
List State Standards addressed in this course. (Identify the course outcomes that support those standards.)

COLORADO MODEL CONTENT STANDARDS FOR MATHEMATICS

STANDARD 1:
Students develop number sense and use numbers and number relationships in problem-solving situations and communicate the reasoning used in solving these problems.

Outcomes 1-6 support this standard.

STANDARD 2:
Students use algebraic methods to explore, model, and describe patterns and functions involving numbers, shapes, data, and graphs in problem-solving situations and communicate the reasoning used in solving these problems.

Outcomes 1-6 support this standard.

STANDARD 3:
Students use data collection and analysis, statistics, and probability in problem-solving situations and communicate the reasoning used in solving these problems.

No outcomes support this standard

STANDARD 4:
Students use geometric concepts, properties, and relationships in problem-solving situations and communicate the reasoning used in solving these problems.

Outcomes 1-6 support this standard.

STANDARD 5:
Students use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.

Outcomes 1-6 support this standard.
STANDARD 6:
Students link concepts and procedures as they develop and use computational techniques, including estimation, mental arithmetic, paper-and-pencil, calculators, and computers, in problem-solving situations and communicate the reasoning used in solving these problems.

Outcomes 1-6 support this standard.

Required Unit of Study:
Themes within the course/Specific concepts being targeted

The rate of change of a function

- Coordinates for the plane
- The slope of a line
- Equations and line
- Functions and graphs
- Absolute values
- Tangent lines and the slopes of quadratic and cubic curves
- The slope of the curve y = f(x): derivatives
- Velocity and other rates of change
- Limits
- Infinity as a limit
- Continuity

Derivatives

- Polynomial functions and their derivatives
- Products, powers, and quotients
- Implicit differentiation and fractional powers
- Linear approximations and differentials
- The chain rule
- Review of trigonometry
- Derivatives of trigonometric functions
- Parametric equations
- Newton's Method for approximating solutions of equations
- Derivative formulas in differential notation

Application of Derivatives

- Curve sketching with the first derivative
- Concavity and points of inflection
- Asymptotes and symmetry
- Maxima and minima: theory
- Maxima and minima: problems
- Related rates of change
- The Mean Value Theorem
- Indeterminate forms and l'Hôpital's Rule
- Quadratic approximations and approximation errors: extending the Mean Value Theorem

Integration

- Indefinite integrals
- Selecting a value for the constant of integration
- Substitution method of integration
- Integrals of trigonometric function
- Definite integrals: The area under a curve
- Calculating definite integrals by summation
- The fundamental theorems of integral calculus
- Substitution in definite integrals

Rules for approximating definite integrals

Applications of definite integrals

The net change in position and distance traveled by a moving body
Areas between curves
Calculating volumes by slicing
Volumes of revolution
Volumes modeled with washers and cylindrical shells
Lengths of plane curves
The area of a surface of revolution
The average value of a function
Moments and centers of mass
Work
Hydrostatic force

Unit Modifications/Enrichments:

- **Assistance to students having difficulty and/or special needs**

  Additional teacher help, cooperative groups, alternate text presentations.

- **Additional experiences for students capable of advanced work (cooperative learning, adaptive materials, re-teaching, second chance, etc.**

  Cooperative groups, challenge level questions

Materials/Resources:

- **Textbook (CORE and Supplemental) (Publisher, Edition, Year Adopted)**

  Elements of Calculus and Analytic Geometry, Addison-Wesley, 1989, adopted 1993

- **Media materials used**

  Calculus Connections A multimedia Adventure

- **Technology needs**

  Graphing calculator

- **Other resources (guest speakers, field trips)**

  Guest speaker: Local practicing engineers and professors from CSU-Pueblo
  Field trip: Physics Day at Elitches 6-Flags

Assessment Program

Publisher Developed (list test)
Teacher Developed

- **Tests and Quizzes, Homework**

  Teacher developed tests and quizzes

- **Type: Essay, constructed response, criterion referred, oral presentation**

  The majority of the tests are constructed response and criterion reference

  - **Notebook**

  - students are required to keep an organized notebook with daily notes, assignments and any assigned class projects

  - **Authentic production**

  Real world applications are used through out the course

- **Proficiency Test Requirement**

  Pre-Calculus is beyond the proficiency test requirements.

<u>Instructional time</u>:

List units or interdisciplinary themes and approximate length of time (actual or percent, etc.)

The rate of change of a function
Time on unit approximately 3 weeks

Derivatives
Time on unit approximately 3 weeks

Application of Derivatives
Time on unit approximately 3 weeks

Integration
Time on unit approximately 3 weeks

Applications of definite integrals
Time on unit approximately 4 weeks