**Curriculum**

**Advanced Placement Calculus BC**

**Course Overview**

This a full-year course for those students who have successfully completed the AP Calculus AB course. The course includes all the topics from the AP Calculus AB course and the following topics: derivatives and application of derivatives of vector functions and parametrically defined functions; integration by trigonometric substitution and by partial fractions; Simpson's Rule; improper integrals; area bounded by polar curves; length of a path; and work. The course also includesan in-depth study of convergence and divergence of sequences and series, including power series and Taylor series with Lagrange error approximation. The course prepares students for the Advanced Placement Calculus BC examination in May.

**Department Standards**

Students will be able to comprehend mathematical concepts.

Students will apply mathematical procedures accurately, efficiently, and appropriately.

Students will be able to formulate, represent, and solve mathematical problems.

Students will develop logical mathematical thought and precise mathematical communication.

**Benchmarks**:

1. prepare for and are expected to take the AP Calculus BC exam.

2. continually engage in self-assessment and reflection to develop achievable short-term and long-term goals.

3. master the skills and techniques of calculus.

4. seek to make connections between their current study of calculus and the mathematics that they have previously studied.

5. develop their ability to communicate mathematical concepts both orally and in writing.

**Performance Indicators**

First Quarter

Students will be able to:

identify limits that satisfy L'Hopital's Rule and evalute;

classify integrals and choose the appropriate integration technique to compute;

compute arc length and surface area of revolution for real functions of a single variable;

define and construct parametric equations for certain curves in the plane;

construct parametric equations that define the cycloid;

compute derivative values of cycloid; and

compute the arc length of cycloid;

Second Quarter

Students will be able to:

create position vectors from given or derived parametric equations;

determine velocity and acceleration vectors from a position vector;

create position vector from acceleration or velocity vectors and appropriate boundary conditions;

solve separable differential equations, first order linear differential equations by means of an integrating factor;

create models that involve studied differential equations;

use Euler's method to approximate solutions to given differential equations or slope fields; and

define moments and synthesize the moments of inertia of symmetric planes and solids.

Third Quarter

Students will be able to:

find the limit of a sequence using the definition, limit laws or other appropriate theorem;

determine the convergence or divergence of a sequence by means of appropriate theorem or convergence test;

define a series, as well as the special cases of arithmetic, geometric, telescoping and alternating series;

determine series convergence using appropriate test or theorem;

compute the sum of special series;

express analytic functions as a power series; and

use a function's power series representations to find approximate solutions to an arbitrary accuracy and precision using Taylor's theorem and alternating series estimation theorem.

Fourth Quarter

Students will be able to:

find the distances between two points in space;

define vectors given two points in space;

compute the cross product, dot product and apply concepts to relevant notions in physics; and

define space curves using vectors and compute arc length in space.

**Assessments**

First Quarter

weekly quizzes, Test1 New integration techniques, Test2 Parametric, Polar and vectors

Second Quarter

weekly quizzes, Test

Third Quarter

weekly quizzes, review exams Test Sequences and Series. Mock Exam

Fourth Quarter

weekly quizzes, AP Calculus BC exam, Test

**Core Topics**

New integration techniques

Parametric Equations

Polar coordinate system

VectorsDifferential equations

Euler's MethodSequences

Series

Intro to formal mathematical argumentation

Review for AP Calculus BC Exam.Introduction to multivariate calculus

**Specific Content**

First Quarter

L'Hopital's Rule.

Integration by Parts.

Integration by Partial Fractions.

Improper Interals.

Integration by Trigonometric Substitution.

Integration by Rationalizing Substitutions.

Arc Length of a real single variable function.

Surface Area of Revolution of a single variable.

Parametric equations.

Finding derivatives of a curve defined parametrically.

Arc Length of curve defined parametrically.

Surface Area of revolution for a curve defined parametrically.

Polar coordinates.

Finding derivatives of polar functions.

Area and Arc length in Polar coordinates.

Second Quarter

Vectors of single variable.

Position, velocity and acceleration vectors.

Similarities between vectors and parametric equations.

Separable differential equations and logistic differential equations.

Slope fields and Euler's Method.

Moments.

Work.

Third Quarter

Definition of a sequence.

Definition of the limit of a sequence.

Determining the convergence or divergence of an arbitrary sequence.

Definition of a series, and special consideration for arithmetic, geometric, telescoping and alternating series.

Determining the convergence or divergence of certain series and computing the sum when possible.

Convergence Tests.

nth term test for divergence.

Series estimation.

Power Series.

Taylor Polynomials and Taylor Series.

Taylor's Theorem.

Fourth Quarter

Three dimensional Cartesian space.

Cross product and dot product.

equations of lines and planes in space.

quadratic surfaces.

vector-valued functions and space curves.

the calculus of vector-valued functions with applications.

**Resources**

throughout the year:

www.wolframalpha.com.

graphing calculator.