Pequannock Township School District Curriculum Syllabus

AP Calculus

Course Description:

This Calculus course is the final step in the sequence of higher level courses in mathematics. Topics such as limits, differentiation, integrals, trigonometric and exponential functions as well as applications will be stressed. This course is designed for students having a strong mathematical background. It is expected that a student who successfully completes this course will have developed mastery and proficiency in the following areas: knowledge of calculus limits; solution of problems dealing with differentiation; application of differentiation; solution of definite integral problems; applications of integration; knowledge of formulas and methods of integration; and fundamental operations on trigonometric, exponential, and logarithmic functions. The above topics will also be examined through the use of TI-89 graphing calculators as well as through the use of written records. Having students communicate their mathematics by writing about topics helps to increase proficiency. This course is taken during the senior year and will culminate by taking the AP exam in early May.

Course Proficiencies:

* Content in this course surpasses the expectations of the NJSLS

Calculus AB and BC Mathematical Practices (From College Board)

1. Implementing Mathematical Processes
2. Connecting Representations
3. Justification
4. Communication and Notation

Calculus AB Big Ideas (From College Board)

1. Limits and continuity
2. Differentiation: Definition of fundamental properties
3. Differentiation: Composite, complicit, and inverse functions
4. Contextual applications of differentiation
5. Analytical applications of differentiation
6. Integration and accumulation of change
7. Differential equations
8. Applications of integration

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them. *SMP1*

2. Reason abstractly and quantitatively. *SMP2*
3. Construct viable arguments and critique the reasoning of others. *SMP3*
4. Model with mathematics. *SMP4*
5. Use appropriate tools strategically. *SMP5*
6. Attend to precision. *SMP6*
7. Look for and make use of structure. *SMP7*
8. Look for and express regularity in repeated reasoning. *SMP8*

Scope and Sequence

Unit 1: 5-Day Walkthrough (MP 1)

Students will develop an understanding for the five main topics to be included in the Calculus I AP course. Students will not be required to develop mastery in any of the topics. This is simply a quick overview of what is to come and a short review of the past topics covered.
The purpose of this unit is to give students an overview of what calculus is all about. Many of the students have not seen the big picture prior to entering this class. This Walk Thru" will give the students an exposure to what lies ahead.

Unit 2: Prerequisites of Calculus (MP 1)

Upon completion of this unit, students will have a thorough review of lines, slope, equations of lines, domain and range, symmetries, parametric equations and functions: piecewise defined functions, absolute value functions, composite functions, exponential and logarithmic functions, inverse functions. Students will also be given a thorough review of trigonometry: identities, periodicity, trigonometric functions, inverse trigonometric functions and all related graphical interpretations.

Unit 3: Limits and Continuity (MP 1)

The following topics will be explored in this unit:

1. Average and instantaneous speed
2. Definition and Properties of a limit
3. One-Sided and Two-Sided Limits
4. Squeeze Theorem
5. Continuous Functions and continuity at a point
6. Continuity of composite functions
7. Intermediate Value Theorem
8. Rates of Change

Unit 4: Derivatives (MP 1 and 2) Students will develop a thorough understanding of the topic in relation to finding the derivative of a multitude of functions. The students will also learn to apply this knowledge to various problems involving rates of motion, slopes and graphical interpretations.
Unit 5: Applications of Derivatives (MP 2) Students will develop a thorough understanding of the topic in relation to applying the idea of a derivative to various facets of mathematics. Students will use the derivative tests to sketch the graphs of various curves. Students will also use optimization and related rate problems in order to clarify the rationale behind the instruction of the derivative.
Unit 6: The Definite Integral (MP 2 and 3) Students will develop a thorough understanding of the topic in relation to finding the antiderivative of a multitude of functions. The students will also learn to apply this knowledge to various problems involving area under a curve.
Unit 7: Differential Equations and Mathematical Modeling (MP 3) Students will develop a thorough understanding of the topic in relation to solving initial value problems, developing and interpreting slope fields as well as a variety of integration techniques, including integration by parts. Students will also be able to solve problems involving exponential growth and exponential decay.
Unit 8: Applications of the Definite Integral (MP 3 and 4) Students will develop a thorough understanding of the topic in relation to finding the area under a curve and the area between intersecting curves. Once able to determine that area, students will be able to revolve the bounded region about an axis and determine the volume of the solid generated. Students will also be able to determine surface area of the above mentioned irregular solids.
Unit 9: AP Exam Preparation (MP 4) Students will be able to answer all questions on practice AP exams and have a sufficient knowledge of the past year's topics. The purpose of this unit is to make students familiar with the format of the exam as well as give closure to the material and how all the topics eventually blend together.

Assessments

Evaluation of student achievement in this course will be based on the following:

a. Tests & Quizzes
b. Classwork
c. Projects
d. Sample AP problems

Curriculum Resources

Instructional Resources:

Larson, Ron et al. eds *Calculus with Analytic Geometry*, 8th ed. Boston: Houghton Mifflin, 2006.

Technology Resources:

AP Calculus College Board website: https://apcentral.collegeboard.org/courses/ap-calculus-ab/exam

Home and School Connection

The following are suggestions and/or resources that will help parents support their children:

- Khan Academy: www.kahnacademy.com
- AP Calculus College Board website: https://apcentral.collegeboard.org/courses/ap-calculus-ab/exam
- Teacher Google Classroom