Course Name: AP Calculus AB

Course Code: H2420 Grade: 12 Level: Accelerated Year: 5 Credits: 5

Course Description: This course is designed for students who intend to take the Advanced Placement Test in Calculus AB. This program is primarily concerned with providing an understanding of the concepts of calculus and experience with its methods and applications. Students who enroll in this program must have a thorough knowledge of college preparatory mathematics, including algebra, geometry, trigonometry, and analytic geometry. Topics included in the AP Calculus AB Level course are: 1) Functions – analysis of graphs, limits of functions, asymptotic and unbounded behavior and continuity as a property of functions; 2) Differential Calculus - concept of the derivative, derivative at a point and as a function, second derivative, applications of derivatives, and computation of derivatives; 3) Integral Calculus – Riemann sums, interpretations and properties of definite integrals, applications of integrals, the Fundamental Theorem of Calculus, techniques of antidifferentiation, applications of antidifferentiation, and numerical approximations to definite integrals.

Prerequisite: Math Analysis Accelerated

Course Proficiencies: The following is a list of the proficiencies students are expected to know and be able to do as a result of successfully completing this course. The proficiencies are the basis of the assessment of student achievement. Because this course is planned to prepare students for the Calculus AB Advanced Placement Examination, these proficiencies will be achieved by the date of the administration of the examination, typically in early to mid-May. The remainder of the school year is devoted to elaborating these proficiencies and to developing complementary knowledge and skills. The learner will demonstrate the ability to:

1. Graph functions and apply properties of graphs including intercepts, symmetry, and asymptotic behavior.
2. Employ operations on functions and relate these to transformations of function graphs.
3. Determine relative magnitudes of functions and their rates of change; for example, contrasting exponential growth, polynomial growth and logarithmic growth.
4. Apply the concepts and properties of limits to specific functions; apply the limit concept to functions involving sums, products and quotients.
5. Interpret the limit concept in special circumstances such as one-sided limits, limits at infinity, non-existent limits, indeterminate form, and infinite limits.
6. Apply and interpret the concept of continuity in terms of limits for specific functions and relate continuity to the behavior of function graphs; utilize the Intermediate Value Theorem and the Extreme Value Theorem to demonstrate a geometric understanding of graphs of continuous functions.
7. Apply the definition of a derivative as the limit of the difference quotient.

AP Calculus AB Proficiencies – *cont'd.*

8. Apply differentiation rules and formulas and implicit differentiation to basic functions such as polynomials, trigonometric, rational, inverses of functions (including inverses of trigonometric functions) and logarithmic.
9. Determine and apply higher order derivatives to determine the relationship between the concavity of the function and the sign of the second derivative.
10. Apply the definition and the principal theorems concerning derivatives including the relation between differentiability and continuity and the Mean Value Theorem.
11. Utilize derivatives to find and describe function graphs to include: the slope of a curve using tangent and normal lines, points at which there are vertical tangents or no tangents, whether a function is increasing or decreasing, the identification of critical numbers, the concavity of a function graph, and the identification of inflection points.
12. Employ differentials to make local linear approximations.
13. Apply derivatives to solve optimizations problems, which include both absolute (global) and relative (local) extrema.
14. Apply derivatives to solve problems that involve rates of change in varied applied contexts, including velocity, speed and acceleration and to model rates of change, including related rates problems.
15. Apply the concept of a Riemann sum over equal and not equal subdivisions; compute Riemann sums using left, right, and midpoint evaluation points.
16. Determine the definite integral as a limit of Riemann sums and as a rate of change of a quantity over an interval interpreted as the change of the quantity over the interval.
17. Apply the basic properties of definite integrals such as additivity and linearity.
18. Apply the definite integral to specific applications, which include finding the area of a region, the volume of a solid with known cross sections, the average value of a function, and the distance traveled by a particle along a line.
19. Utilize the Fundamental Theorem of Calculus to evaluate definite integrals and to represent a particular antiderivative, and the analytical and graphical analysis of functions so defined.
20. Determine antiderivatives following directly from derivatives of basic functions.
21. Determine antiderivatives by substitution of variables including change of limits for definite integrals.
22. Determine specific antiderivatives using initial conditions, including applications to motion along a line.
23. Apply antidifferentiation to solve separable differential equations and use them in modeling; in particular, in studying the equation y'=ky and exponential growth and decay.
24. Utilize Riemann sums and the Trapezoidal Rule to approximate definite integrals of functions represented algebraically, geometrically, and by tables of values.
25. Apply mathematics in practical situations and in other disciplines.
26. Use critical thinking skills to make sense of problems, solve them, and communicate processes. ***CRP 2, 4 & 8.***
27. Use technology to gather, analyze, and communicate mathematical information. ***8.1.12.A.3, 8.1.12.C.1***

AP Calculus AB Proficiencies – *cont'd.*

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

A. Tests are usually given at the end of a unit. These generally require a full period to complete.
B. Classwork, evidenced by completed and carefully presented daily work and by the meeting of daily responsibilities, is an essential part of learning. The day-to-day work included as classwork may involve quizzes, the written results of learning activities, graded homework, and assessments of learning observed during class. The more a student is involved, the more learning that takes place.
C. Folders/Notebooks must be maintained by students. These typically include notes and assignments kept in an organized fashion.

Board Adopted Materials:

Teaching Resources and Related Student Materials:

Textbook: Calculus, 4th Edition
Author: Finney, et al
Publisher: Prentice Hall
Copyright: 2012

Board Approved – 12/12/2018