FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT

AP Calculus AB

Board Approval Date: May 20, 2021	**Course Length: 2 Semesters**
Grading: A-F	**Credits: 5 Credits per Semester**
Proposed Grade Level(s): 11, 12	**Subject Area: Mathematics** **Elective Area (if applicable):** **N/A**
Prerequisite(s): **"B" or better in Precalculus**	**Corequisite(s):** **N/A**
CTE Sector/Pathway: N/A	
Intent to Pursue 'A-G' College Prep Status: Yes	
A-G Course Identifier: (c) Mathematics	
Graduation Requirement: Yes	
Course Intent: District Course **Program (if applicable): N/A**	
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COURSE DESCRIPTION: (Online Course)

In AP Calculus AB, students learn to understand change geometrically and visually (by studying graphs of curves), analytically (by studying and working with mathematical formulas), numerically (by seeing patterns in sets of numbers), and verbally. Instead of simply getting the right answer, students learn to evaluate the soundness of proposed solutions and to apply mathematical reasoning to real-world models. Calculus helps scientists, engineers, and financial analysts understand the complex relationships behind real-world phenomena. The equivalent of an introductory college-level calculus course, AP Calculus AB prepares students for the AP exam and further studies in science, engineering, and mathematics. This course has been authorized by the College Board to use the AP designation.

DETAILED UNITS OF INSTRUCTION:

Unit Number/Title	**Unit Essential Questions**	**Examples of Formative Assessments**	**Examples of Summative Assessment**
1. Precalculus Review	Is your precalculus foundation in algebra and trigonometry ready for the rigor of calculus?	*Precalculus Review Sheet	
2. Bridge to Calculus	What is calculus?	*Practice: Graphing Functions and Finding Roots *Practice: Writing Symmetrical Functions	*Shifting and Distorting Graphs *Unit Test
3. Limits and Continuity	How do you determine the value of a function for a value that is restricted in the domain? What are one-sided limits and infinite limits? What are the methods used to determine limits?	*Practice: Limits of Functions *Practice: Determining Limits Analytically *Practice: Asymptotes as Limits *Practice: Limits That Do Not Exist *Practice: The Intermediate Value Theorem and the Extreme Value Theorem	*Determining Graphs When Given Limits *Unit Test
4. Derivatives	What is the relationship between the graph of a function and its derivative? How does the formal definition of derivative apply to what we know about tangent lines? What is the relationship between differentiability and continuity? How do the derivatives of trigonometric functions differ from the derivatives of their inverses?	*Practice: Rates of Change as Slopes and Limits *Practice: The Derivative at a Point *Practice: Derivatives of Sums, Products, and Quotients of Functions *Practice: Relating the Graph of a Function and Its Derivative *Practice: Theorems: Rolle and Mean Value *Practice: Implicit Differentiation	*Computing Derivatives *Identifying Functions and Their Derivatives *Unit Test
5. Rates of Change	What are extrema and critical points and what do they tell us about a function? How are the function and its first and second derivatives connected?	*Practice: Extrema and Number Line Tests *Practice: Tangent and Normal Lines *Practice: Rates of Change as Derivatives *Practice: Rectilinear Motion	*Salsa Jars *Finding Rates of Changes *Unit Test

	How can we determine the rate at which a function is changing based on the rate of change of other related functions? When can a continuous function have a maximum?		
6. The Integral and Fundamental Theorem of Calculus	What do integrals tell us about a function? Which method for determining definite integrals is most accurate? How does the Fundamental Theorems of Calculus tie together?	*Practice: Analyzing Velocity and Distance in a Car Ride *Practice: Area Under a Curve: Riemann Sums *Practice: Properties of the Definite Integral *Practice: The Antiderivative *Practice: The Fundamental Theorems of Calculus	*Finding a Better Approximation of Area Under a Curve *Finding Antiderivatives of Composite Functions *Unit Test
7. Applications of the Integral	How can we use a slope field to gain information about a function? Which method for determining the volume of revolution around a line is most appropriate?	*Practice: Area Between Curves *Practice: Volumes of Revolution *Practice: Rectilinear Motion *Practice Using Definite Integrals	*Finding Domains for Given Areas *Unit Test
8. Inverse and Transcendental Functions	In what ways are the transcendental functions supported by calculus?	*Practice: Inverse Functions and Their Derivatives *Practice: Inverse Trigonometric Functions *Practice: Derivatives of Exponential and Logarithmic Functions *Practice: L'Hospital's Rule	*Determine and Use Derivatives of Inverse Trig Functions *Determine Derivatives of Logarithmic and Exponential Functions *Unit Test
9. Separable and Differential Functions	How do you graph a differential equation by visualizing a whole family of functions at once, using a slope field? How do you recognize a differential equation and how do you solve some really simple differential equations used in modeling “real life” situations?	*Practice: Differential Equations and Slope Fields *Practice: Exponential Growth and Decay	*Unit Test

ESSENTIAL STANDARDS:

1.0 Students demonstrate knowledge of both the formal definition and the graphical interpretation of the limit of values of functions. This knowledge includes one-sided limits, infinite limits, and limits at infinity. Students know the definition of convergence and divergence of a function as the domain variable approaches either a number or infinity:

1.1 Students prove and use theorems evaluating the limits of sums, products, quotients, and composition of functions.

1.2 Students use graphical calculators to verify and estimate limits.

1.3 Students prove and use special limits, such as the limits of (sin(x))/x and (1-cos(x))/x as x tends to 0.

2.0 Students demonstrate knowledge of both the formal definition and the graphical interpretation of continuity of a function.

3.0 Students demonstrate an understanding and the application of the intermediate value theorem and the extreme value theorem.

4.0 Students demonstrate an understanding of the formal definition of the derivative of a function at a point and the notion of differentiability:

4.1 Students demonstrate an understanding of the derivative of a function as the slope of the tangent line to the graph of the function.

4.2 Students demonstrate an understanding of the interpretation of the derivative as an instantaneous rate of change. Students can use derivatives to solve a variety of problems from physics, chemistry, economics, and so forth that involve the rate of change of a function.

4.3 Students understand the relation between differentiability and continuity.

4.4 Students derive derivative formulas and use them to find the derivatives of algebraic, trigonometric, inverse trigonometric, exponential, and logarithmic functions.

5.0 Students know the chain rule and its proof and applications to the calculation of the derivative of a variety of composite functions.

6.0 Students find the derivatives of parametrically defined functions and use implicit differentiation in a wide variety of problems in physics, chemistry, economics, and so forth.

7.0 Students compute derivatives of higher orders.

8.0 Students know and can apply Rolle's theorem, the mean value theorem, and L'Hôpital's rule.

9.0 Students use differentiation to sketch, by hand, graphs of functions. They can identify maxima, minima, inflection points, and intervals in which the function is increasing and decreasing.

10.0 Students know Newton's method for approximating the zeros of a function.

11.0 Students use differentiation to solve optimization (maximum-minimum problems) in a variety of pure and applied contexts.

12.0 Students use differentiation to solve related rate problems in a variety of pure and applied contexts.

13.0 Students know the definition of the definite integral by using Riemann sums. They use this definition to approximate integrals.

14.0 Students apply the definition of the integral to model problems in physics, economics, and so forth, obtaining results in terms of integrals.

15.0 Students demonstrate knowledge and proof of the fundamental theorem of calculus and use it to interpret integrals as antiderivatives.

16.0 Students use definite integrals in problems involving area, velocity, acceleration, volume of a solid, area of a surface of revolution, length of a curve, and work.

17.0 Students compute, by hand, the integrals of a wide variety of functions by using techniques of integration, such as substitution, integration by parts, and trigonometric substitution. They can also combine these techniques when appropriate.

18.0 Students know the definitions and properties of inverse trigonometric functions and the expression of these functions as indefinite integrals.

19.0 Students compute, by hand, the integrals of rational functions by combining the techniques in standard. 17.0 with the algebraic techniques of partial fractions and completing the square.

20.0 Students compute the integrals of trigonometric functions by using the techniques noted above.

21.0 Students understand the algorithms involved in Simpson's rule and Newton's method. They use calculators or computers or both to approximate integrals numerically.

22.0 Students understand improper integrals as limits of definite integrals.

23.0 Students demonstrate an understanding of the definitions of convergence and divergence of sequences and series of real numbers. By using such tests as the comparison test, ratio test, and alternate series test, they can determine whether a series converges.

24.0 Students understand and can compute the radius (interval) of the convergence of power series.

25.0 Students differentiate and integrate the terms of a power series in order to form new series from known ones.

26.0 Students calculate Taylor polynomials and Taylor series of basic functions, including the remainder term.

27.0 Students know the techniques of solution of selected elementary differential equations and their applications to a wide variety of situations, including growth-and-decay problems.

RELEVANT STANDARDS AND FRAMEWORKS, CONTENT/PROGRAM SPECIFIC STANDARDS:

Link to Common Core Standards (if applicable):
Educational standards describe what students should know and be able to do in each subject in each grade. In California, the State Board of Education decides on the standards for all students, from kindergarten through high school.
https://www.cde.ca.gov/be/st/ss/documents/ccssmathstandardaug2013.pdf

Link to Framework (if applicable):
Curriculum frameworks provide guidance for implementing the content standards adopted by the State Board of Education (SBE). Frameworks are developed by the Instructional Quality Commission, formerly known as the Curriculum Development and Supplemental Materials Commission, which also reviews and recommends textbooks and other instructional materials to be adopted by the SBE.
https://www.cde.ca.gov/ci/ma/cf/documents/mathfwcalculus.pdf

Link to Subject Area Content Standards (if applicable):
Content standards were designed to encourage the highest achievement of every student, by defining the knowledge, concepts, and skills that students should acquire at each grade level.
https://apcentral.collegeboard.org/pdf/ap-calculus-ab-bc-course-and-exam-description-0.pdf

Link to Program Content Area Standards (if applicable):
Program Content Area Standards applies to programs such as International Baccalaureate, Advanced Placement, Career and Technical Education, etc.

TEXTBOOKS AND RESOURCE MATERIALS:

Textbooks

Board Approved	Pilot Completion Date (If applicable)	Textbook Title	Author(s)	Publisher	Edition	Date
Yes		*APEX: AP Calculus AB*		APEX Online Courses		*2019*

Other Resource Materials
N/A

Supplemental Materials

Board approved supplemental materials (Including but not limited to: Film Clips, Digital Resources, Supplemental texts, DVDs, Programs (Pebble Creek, DBQ, etc.):
N/A