Revised 02-02-2018

El Monte Union High School District

Course Outline

District:EMUHSD
High School:__ALL_______

Title: CALCULUS AB AP

Transitional*_______(Eng. Dept. Only)

Sheltered (SDAIE)*___Bilingual*___

AP**_X_____Honors**__________

Department: -
___MATHEMATICS_________ __

CTE/VOC ED :
Industry Sector:____________
Pathways:____________
Check One
Introductory:________
Concentrator:________
Capstone:________

Grade Level (s):_____9 - 12________

Semester___________Year___X____

Year of State Framework Adoption_2013_

This course meets graduation requirements:

( ) English
( ) Fine Arts
( ) Foreign Language
( ) Health & Safety
(X) Math
( ) Physical Education
( ) Science
( ) Social Science
( ) Elective

Department/Cluster Approval	Date
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*Instructional materials appropriate for English Language Learners are required.

**For AP/Honors course attach a page describing how this course is above and beyond a regular course. Also, explain why this course is the equivalent of a college level class.

1. Prerequisite(s): Precalculus Trigonometry or Precalculus Trigonometry Honors with a C or better.

2. Short description of course which may also be used in the registration manual:

AP Calculus AB is roughly equivalent to a first semester college calculus course devoted to topics in differential and integral calculus. The AP course covers topics in these areas, including concepts and skills of limits, derivatives, definite integrals, and the Fundamental Theorem of Calculus. Students will learn how to approach calculus concepts and problems when they are represented graphically, numerically, analytically, and verbally, and how to make connections amongst these representations. Students will learn how to use technology to help solve problems, experiment, interpret results, and support conclusions.

3. Describe how this course integrates the schools SLO (former ESLRs- Expected School-wide Learning Results):

This course utilizes technology through the use of calculators and graphing software. Critical thinking skills and problem-solving skills are applied to both symbolic and real-world situations. Due to the rigorous content and amount of work required to successfully pass the course, students must take responsibility for their time management in order to have assignments completed on time.

4. Describe the additional efforts/teaching techniques/methodology to be used to meet the needs of English Language Learners:

When needed, Bilingual or Spanish version materials will be created. The instructors of sheltered and bilingual courses have received training in sheltered and/or bilingual instruction. If possible, an LEP student will be seated near a student with the same native language but with better English skills.

5. Describe the interdepartmental articulation process for this course:

Students will be prepared to enter a calculus course at the college level either in the first or second semester of the course.

6. Describe how this course will integrate academic and vocational concepts, possibly through connecting activities. Describe how this course will address work-based learning/school to career concepts:

At the end of the units on differentiation and integration, real-world applications exercises are assigned to students. This course is a preparation for college calculus, which is a mathematical foundation for college courses such as physics, economics, and engineering courses.

7. Materials of Instruction (Note: Materials of instruction for English Language Learners are required and should be listed below.)

   A. Textbook(s) and Core Reading(s): Calculus with Analytic Geometry, 8th Edition. Ron Larson, Robert Hostetler, & Bruce Edwards. Houghton Mifflin Company, Boston, 2006

B. Supplemental Materials and Resources: Retired AP Exams (Multiple-Choice Questions Collection 1999 – 2017), Crash Course AP Calculus review workbook, AP College Board material online, Guide to a 5 workbook.

C. Tools, Equipment, Technology, Manipulatives, Audio-Visual: Graphing Calculators, Graphing Software, online video resources and online videos from Larsoncalculus.com, Cengage Learning, and YouTube, Tutorials by CalcChat.com, DESMOS, LCD Projector. Google Chromebooks, and graph paper.

OBJECTIVES IN COURSE:

1. Develop mathematical knowledge conceptually, guiding students to connect topics and representations throughout the course and to apply strategies and techniques to accurately solve diverse types of problems.
2. Apply definitions and theorems in the process of solving a problem.
3. Work with functions represented in a variety of ways: graphical, numerical, analytical, or verbal. Understand the connections among these representations.
4. Understand the meaning of the derivative in terms of a rate of change and local linear approximation and use derivatives to solve a variety of problems.
5. Understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of change and use integrals to solve a variety of problems.
6. Understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus.
7. Communicate mathematics both orally and in well-written sentences and explain solutions to problems.
8. Model a written description of a physical situation with a function, a differential equation, or an integral.
9. Use technology to help solve problems, experiment, interpret results, and verify conclusions.
10. Determine the reasonableness of solutions, including sign, size, relative accuracy, and units of measurement.

UNITS OF STUDY AND STANDARDS BEING MET:

1. Limits and Their Properties *(California Standards 1.0, 2.0, 3.0)*

- 1.1 A Preview of Calculus
- 1.2 Finding Limits Graphically and Numerically
- 1.3 Evaluating Limits Analytically
- 1.4 Continuity and One-Sided Limits
- 1.5 Infinite Limits

2. Differentiation *(California Standards 4.0, 5.0, 6.0, 7.0)*

- 2.1 The Derivative and the Tangent Line Problem
- 2.2 Basic Differentiation Rules and Rates of Change
- 2.3 Product and Quotient Rules and Higher-Order Derivatives
- 2.4 The Chain Rule
- 2.5 Implicit Differentiation
- 2.6 Related Rates

3. Applications of Differentiation *(California Standards 8.0, 9.0, 10.0, 11.0, 12.0)*

- 3.1 Extrema on an Interval
- 3.2 Rolle's Theorem and the Mean Value Theorem
- 3.3 Increasing and Decreasing Functions and the First Derivative Test
- 3.4 Concavity and the Second Derivative Test
- 3.5 Limits at Infinity
- 3.6 A Summary of Curve Sketching
- 3.7 Optimization Problems

3.8 Newton's Method
3.9 Differentials

4. Integration *(California Standards 13.0, 14.0, 15.0)*
4.1 Antiderivatives and Indefinite Integrals
4.2 Area
4.3 Riemann Sums and Definite Integrals
4.4 The Fundamental Theorem of Calculus
4.5 Integration by Substitution
4.6 Numerical Integration

5. Logarithmic, Exponential, and Other Transcendental Functions *(California Standards 17.0, 18.0, 20.0)*
5.1 The Natural Logarithmic Function: Differentiation
5.2 The Natural Logarithmic Function: Integration
5.3 Inverse Functions
5.4 Exponential Functions: Differentiation and Integration
5.5 Bases Other Than e and Applications
5.6 Inverse Trigonometric Functions: Differentiation
5.7 Inverse Trigonometric Functions: Integration
5.8 Hyperbolic Functions

6. Differential Functions *(California Standards 17.0, 18.0, 19.0, 20.0, 21.0, 27.0)*
6.1 Slope Fields and Euler's Method
6.2 Differential Equations: Growth and Decay
6.3 Separation of Variables and the Logistic Equation
6.4 First-Order Differential Equations

7. Applications of Integration *(California Standards 14.0, 16.0)*
7.1 Area of a Region Between Two Curves
7.2 Volume: The Disk Method
7.3 Volume: The Shell Method

8. Integration Techniques, L'Hopital's Rule, and Improper Integrals *(California Standards 8.0, 19.0, 22.0)*
8.1 Basic Integration Rules
8.2 Integration by Parts
8.3 Indeterminate Forms and L'Hopital's Rule

MATHEMATICAL PRACTICES FOR AP CALCULUS *(MPACs)*:

The MPACs for AP Calculus are not intended to be viewed as discrete items that can be check off a list; rather, they are highly interrelated tools that should be utilized frequently and in diverse contexts.

MPAC 1: Reasoning with definitions and theorems

Students can:

a. use definitions and theorems to build arguments, to justify conclusions or answers, and to prove results;

b. confirm that hypotheses have been satisfied in order to apply the conclusion of a theorem;

c. apply definitions and theorems in the process of solving a problem;

d. interpret quantifiers in definitions and theorems (e.g., "for all," "there exists");

e. develop conjectures based on exploration with technology; and

f. produce examples and counterexamples to clarify understanding of definitions, to investigate whether converses of theorems are true or false, or to test conjectures.

MPAC 2: Connecting concepts

Students can:

a. relate the concept of a limit to all aspects of calculus;

b. use the connection between concepts (e.g., rate of change and accumulation) or processes (e.g., differentiation and its inverse process, antidifferentiation) to solve problems;

c. connect concepts to their visual representations with and without technology; and

d. identify a common underlying structure involving different contextual situations.

MPAC 3: Implementing algebraic/computational processes

Students can:

a. select appropriate mathematical strategies;

b. sequence algebraic/computational procedures logically;

c. complete algebraic/computational processes correctly;

d. apply technology strategically to solve problems;

e. attend to precision graphically, numerically, analytically, and verbally and specify units of measure; and

f. connect the results of algebraic/computational processes to the question asked.

MPAC 4: Connecting multiple representations

Students can:

a. associate tables, graphs, and symbolic representations of functions;

b. develop concepts using graphical, symbolical, verbal, or numerical representations with and without technology;

c. identify how mathematical characteristics of functions are related in different representations;

d. extract and interpret mathematical content from any presentation of a function (e.g., utilize information from a table of values);

e. construct one representational form from another (e.g., a table from a graph or a graph from given information); and

f. consider multiple representations (graphical, numerical, analytical, and verbal) of a function to select or construct a useful representation for solving a problem.

MPAC 5: Building notational fluency

Students can:

a. know and use a variety of notations (e.g., $f'(x)$, y', $\frac{dy}{dx}$);

b. connect notation to definitions (e.g., relating the notation for the definite integral to that of the limit of a Riemann sum);

c. connect notation to different representations (graphical, numerical, analytical, and verbal); and

d. assign meaning to notation, accurately interpreting the notation in a given problem and across different contexts.

MPAC 6: Communicating

Students can:

a. clearly present methods, reasoning, justifications, and conclusions;

b. use accurate and precise language and notation;

c. explain the meaning of expressions, notation, and results in terms of a context (including units);

d. explain the connections among concepts;

e. critically interpret and accurately report information provided by technology; and

f. analyze, evaluate, and compare the reasoning of others.

THE CONCEPT OUTLINE

BIG IDEA 1: LIMITS

Students must have a solid, intuitive understanding of limits and be able to compute various limits, including one-sided limits, limits at infinity, the limit of a sequence, and infinite limits. They should be able to work with tables and graphs in order to estimate the limit of a function at a point. Students should know the algebraic properties of limits and techniques for finding limits of indeterminate forms, and they should be able to apply limits to understand the behavior of a function near a point. Students must also understand how limits are used to determine continuity, a fundamental property of functions.

Enduring Understandings (Students will understand that …)	Learning Objectives (Students will be able to …)	Essential Knowledge (Students will know that …)
EU 1.1: The concept of a limit can used to understand the behavior of functions.	**LO 1.1A(a):** Express limits symbolically using correct notation. **LO 1.1A(b):** Interpret limits expressed symbolically.	**EK 1.1A1:** Given a function f, the limit of $f(x)$ as be x approaches c is a real number R if $f(x)$ can be made arbitrarily close to R by taking x sufficiently close to c (but not equal to c). If the limit exists and is a real number, then the common notation is $\lim_{x \to c} f(x) = R$.

		<u>EXCLUSION STATEMENT (EK 1.1A1):</u> The epsilon-delta definition of a limit is not assessed on the AP Calculus AB Exam. However, teachers may include this topic in the course if time permits. **<u>EK 1.1A2:</u>** The concept of a limit can be extended to include one-sided limits, limits at infinity, and infinite limits. **<u>EK 1.1A3:</u>** A limit might not exist for some functions at particular values of x. Some ways that the limit might not exist are if the function is unbounded, if the function is oscillating near this value, or if the limit from the left does not equal the limit from the right. **<u>EXAMPLES OF LIMITS THAT DO NOT EXIST:</u>** $\lim_{x\to 0}\frac{1}{x^2}=\infty$ $\lim_{x\to 0}\sin\left(\frac{1}{x}\right)$ does not exist $\lim_{x\to 0}\frac{\lvert x\rvert}{x}$ does not exist $\lim_{x\to 0}\frac{1}{x}$ does not exist
	<u>LO 1.1B:</u> Estimate limits of functions.	**<u>EK 1.1B1:</u>** Numerical and graphical information can be used to estimate limits.
	<u>LO 1.1C:</u> Determine limits of functions.	**<u>EK 1.1C1:</u>** Limits of sums, differences, products, quotients, and composite functions can be found using the basic theorems of limits and algebraic rules. **<u>EK 1.1C2:</u>** The limit of a function may be found by using algebraic manipulation, alternate forms of trigonometric functions, or the squeeze theorem. **<u>EK 1.1C3:</u>** Limits of the indeterminate forms $\frac{0}{0}$ and $\frac{\infty}{\infty}$ may be evaluated using L'Hospital's Rule.
<u>EU 1.1:</u> The concept of a limit can be used to understand the behavior functions. (continued)	**<u>LO 1.1D:</u>** Deduce and interpret behavior of functions using limits.	**<u>EK 1.1D1:</u>** Asymptotic and unbounded behavior of functions can be explained and described using of limits. **<u>EK 1.1D2:</u>** Relative magnitudes of functions and their rates of change can be compared using limits.
<u>EU 1.2:</u> Continuity is a key property of functions that is defined using limits.	**<u>LO 1.2A:</u>** Analyze functions for intervals of continuity or points of discontinuity.	**<u>EK 1.2A1:</u>** A function f is continuous at $x=c$ provided that $f(c)$ exists, $\lim_{x\to c} f(x)$ exists, and $\lim_{x\to c} f(x)=f(c)$. **<u>EK 1.1A2:</u>** Polynomial, rational, power, exponential, logarithmic, and trigonometric functions are continuous at all points in their domains.

		EK 1.2A3: Types of discontinuities include removable discontinuities, jump discontinuities, and discontinuities due to vertical asymptotes.
	LO 1.2B: Determine the applicability of important calculus theorems using continuity.	**EK 1.2B1:** Continuity is an essential condition for theorems such as the IVT, the EVT, and the MVT.

BIG IDEA 2: DERIVATIVES

Students build the derivative using the concept of limits and use the derivative primarily to compute the instantaneous rate of change of a function. Applications of the derivative include finding the slope of a tangent line to a graph at a point, analyzing the graph of a function (for example, determining whether a function is increasing or decreasing and finding concavity and extreme values), and solving problems involving rectilinear motion. Students should be able use different definitions of the derivative, estimate derivatives from tables and graphs, and apply various derivative rules and properties. In addition, students should be able to solve separable differential equations, understand and be able to apply the Mean Value Theorem (MVT), and be familiar with a variety of real-world applications including related rates, optimization, and growth and decay models.

Enduring Understandings (Students will understand that …)	Learning Objectives (Students will be able to …)	Essential Knowledge (Students will know that …)
EU 2.1: The derivative of a function is defined as the limit of a difference quotient and can be determined using a variety of strategies.	**LO 2.1A:** Identify the derivative of a function as the limit of a difference quotient.	**EK 2.1A1:** The difference quotient $\frac{f(a+h)-f(a)}{h}$ and $\frac{f(x)-f(a)}{x-a}$ express the average rate of change of a function over an interval. **EK 2.1A2:** The instantaneous rate of change of a function at a point can be expressed by $\lim_{h\to 0}\frac{f(a+h)-f(a)}{h}$ or $\lim_{x\to a}\frac{f(x)-f(a)}{x-a}$, provided that the limit exists. There are common forms of the definition of the derivative and are denoted $f'(a)$. **EK 2.1A3:** The derivative of f is the function whose value at x is $\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ provided this limit exists. **EK 2.1A4:** For $y = f(x)$, notations for the derivative include $\frac{dy}{dx}$, $f'(x)$, and y'. **EK 2.1A5:** The derivative can be represented graphically, numerically, analytically, and verbally.
	LO 2.1B: Estimate derivatives.	**EK 2.1B1:** The derivative at a point can be estimated from information given in tables or graphs.
	LO 2.1C: Calculate derivatives.	**EK 2.1C1:** Direct application of the definition of the derivative can be used to find the derivative for selected functions, including polynomial, power, sine, cosine, exponential, and logarithmic functions.

EU 2.1: The derivative of a function is defined as the limit of a difference quotient and can be determined using a variety of strategies. *(continued)*	**LO 2.1C:** Calculate derivatives. *(continued)*	**EK 2.1C2:** Specific rules can be used to calculate derivatives for classes of functions, including polynomial, rational, power, exponential, logarithmic, trigonometric, and inverse trigonometric. **EK 2.1 C3:** Sums, differences, products, and quotients of functions can be differentiated using derivative rules. **EK 2.1C4:** The chain rule provides a way to differentiate composite functions. **EK 2.1C5:** The chain rule is the basis for implicit differentiation. **EK 2.1C6:** The chain rule can be used to find the derivative of an inverse function, provided the derivative of that function exists.
	LO 2.1D: Determine higher order derivatives.	**EK 2.1D1:** Differentiating f' produces the second derivative f'', provided the derivative of f' exists; repeating this process produces higher order derivatives of f. **EK 2.1D2:** Higher order derivatives are represented with a variety of notations. For $y = f(x)$, notations for the 2nd derivative include $\frac{d^2y}{dx^2}, f''(x)$, and y''. Higher order derivatives can be denoted $\frac{d^ny}{dx^n}$ or $f^{(n)}(x)$.
EU 2.2: A function's derivative, which is itself a function, can be used to understand the behavior of the function.	**LO 2.2A:** Use derivatives to analyze properties of a function.	**EK 2.2A1:** 1st and 2nd derivatives of a function can provide information about the function and its graph including intervals of increase or decrease, local (relative) and global (absolute) extrema, intervals of upward or downward concavity, and points of inflection. **EK 2.2A2:** Key features of functions and their derivatives can be identified and related to their graphical, numerical, and analytical representations. **EK 2.2A3:** Key features of the graphs of f, f', and f'' are related to one another.
	LO 2.2B: Recognize the connection between differentiability and continuity.	**EK 2.2B1:** A continuous function may fail to be differentiable at a point in its domain.
EU 2.3: The derivative has multiple interpretations and applications including those that involve instantaneous rates of change.	**LO 2.3A:** Interpret the meaning of a derivative within a problem.	**EK 2.3A1:** The unit for $f'(x)$ is the unit for f divided by the unit for x. **EK.2.3A2:** The derivative of a function can be

		interpreted as the instantaneous rate of change with respect to its independent variable.
	LO 2.3B: Solve problems involving the slope of a tangent line.	**EK 2.3B1:** The derivative at a point is the slope of the line tangent to a graph at that point on the graph. **EK 2.3B2:** The tangent line is the graph of a locally linear approximation of the function near the point of tangency.
EU 2.3: The derivative has multiple interpretations and applications including those that involve instantaneous rates of change. *(continued)*	**LO 2.3C:** Solve problems involving related rates, optimization, rectilinear motion.	**EK 2.3C1:** The derivative can be used to solve rectilinear motion problems involving position, speed, velocity, and acceleration. **EK 2.3C2:** The derivative can be used to solve related rates problems, that is, finding a rate at which one quantity is changing by relating it to other quantities whose rates of change are known. **EK 2.3C3:** The derivative can be used to solve optimization problems, that is, finding a maximum or minimum value of a function over a given interval.
	LO 2.3D: Solve problems involving rates of change in applied contexts. **LO 2.3E:** Verify solutions to differential equations. **LO 2.3F:** Estimate solutions to differential equations.	**EK 2.3D1:** The derivative can be used to express information about rates of change in applied contexts. **EK 2.3E1:** Solutions to differential equations are functions or families of functions. **EK 2.3F1:** Slope fields provide visual clues to the behavior of solutions to 1^{st} order differential equations.
EU 2.4: The Mean Value Theorem connects the behavior of a differentiable function over an interval to the behavior of the derivative of that function at a particular point in the interval.	**LO 2.4A:** Apply the MVT to describe the behavior of a function over an interval.	**EK 2.4A1:** If a function f is continuous over the interval $[a, b]$ and differentiable over the interval (a, b), the MVT guarantees a point within that open interval where the instantaneous rate of change equals the average rate of change over the interval.

BIG IDEA #3: INTEGRALS AND THE FUNDAMENTAL THEOREM OF CALCULUS

Students should understand the definition of a definite integral involving a Riemann sum, be able to approximate a definite integral using different methods, and be able to compute definite integrals using geometry. They should be familiar with basic techniques of integration and properties of integrals. The interpretation of a definite integral is an important skill, and students should be familiar with area, volume, and motion applications, as well as with the use of the definite integral as an accumulation function. It is critical that students grasp the relationship between integration and differentiation as expressed in the Fundamental Theorem of Calculus - a central idea in AP Calculus. Students should be able to work with and analyze functions defined by an integral.

Enduring Understandings (Students will understand that …)	Learning Objectives (Students will be able to …)	Essential Knowledge (Students will know that …)
EU 3.1: Antidifferentiation is the inverse process of differentiation.	**LO 3.1A:** Recognize antiderivatives of basic functions.	**EK 3.1A1:** An antiderivative of a function f is a function g whose derivative is f. **EK 3.1A2:** Differentiation rules provide the foundation for finding antiderivatives.
EU 3.2: The definite integral of a function over an interval is the limit of a Riemann sum over that interval and can be calculated using a variety of strategies.	**LO 3.2A(a):** Interpret the definite integral as the limit of a Riemann sum. **LO 3.2A(b):** Express the limit of a Riemann sum in integral notation.	**EK 3.2A1:** A Riemann sum, which requires a partition of an interval I, is the sum of products, each of which is the value of the function at a point in a subinterval multiplied by the length of that subinterval of the partition. **EK 3.2A2:** The definite integral of a continuous function f over the interval $[a,b]$, denoted by $\int_a^b f(x)dx$, is the limit of Riemann sums as the widths of the subintervals approach 0. That is, $\int_a^b f(x)dx = \lim_{\max \Delta x_i \to 0} \sum_{i=1}^n f(x_i)\Delta x_i$ where x_i is a value in the ith subinterval, Δx_i is the width of the ith subinterval, n is the number of subintervals, and $max\Delta x_i$ is the width of the largest subinterval. Another form of the definition is $\int_a^b f(x)dx = \lim_{n\to\infty} \sum_{i=1}^n f(x_i)\Delta x_i$, where $\Delta x_i = \frac{b-a}{n}$ and x_i is a value in the ith subinterval. **EK 3.2A3:** The information in a definite integral can be translated into the limit of a related Riemann sum, and the limit of a Riemann sum can be written as a definite integral.
	LO 3.2B: Approximate a definite integral.	**EK 3.2B1:** Definite integrals can be approximated for functions that are represented graphically, numerically, algebraically, and verbally.
EU 3.2: The definite integral of a function over an interval is the limit of a Riemann sum over that interval and can be calculated using a variety of strategies. *(continued)*	**LO 3.2B:** Approximate a definite integral. *(continued)*	**EK 3.2B2:** Definite integrals can be approximated using a left Riemann sum, a right Riemann sum, a midpoint Riemann sum, or a trapezoidal sum; approximations can be computed using either uniform or non-uniform partitions.
	LO.3.2C: Calculate a definite integral using areas and properties of definite	**EK 3.2C1:** In some cases, a definite integral can be evaluated by using geometry and the

	integrals.	connection between the definite integral and area. **EK 3.2C2:** Properties of definite integrals include the integral of a constant times a function, the integral of the sum of two functions, reversal of limits of integration, and the integral of a function over adjacent intervals. **EK 3.2C3:** The definition of the definite integral may be expanded to functions with removable or jump discontinuities.
EU 3.3: The Fundamental Theorem of Calculus, which has two distinct formulations, connects differentiation and integration.	**LO 3.3A:** Analyze functions defined by an integral.	**EK 3.3A1:** The definite integral can be used to define new functions; for example, $f(x) = \int_0^x e^{-t^2} dt$. **EK 3.3A2:** If f is a continuous function on the interval $[a, b]$, then $\frac{d}{dx}\left(\int_x^a f(t)dt\right) = f(x)$, where x is between a and b. **EK 3.3A3:** Graphical, numerical, analytical, and verbal representations of a function f provide information about the function g defined as $g(x) = \int_a^x f(t)dt$.
	LO 3.3B(a): Calculate antiderivatives.	**EK 3.3B1:** The function defined by $F(x) = \int_a^x f(t)dt$ is an antiderivative of f.
	LO 3.3B(b): Evaluate definite integrals.	**EK 3.3B2:** If f is continuous on $[a, b]$ and F is an antiderivative of f, then $\int_a^b f(x)dx = F(b) - F(a)$. **EK 3.3B3:** The notation $\int f(x) = F(x) + C$ means that $F'(x) = f(x)$, and $\int f(x)dx$ is called an indefinite integral of the function f. **EK 3.3B4:** Many functions do not have closed form antiderivatives.
EU 3.3: The Fundamental Theorem of which has two distinct connects differentiation integration. *(continued)*	**LO 3.3B(b):** Evaluate definite integrals. *(continued)*	**EK 3.3B5:** Techniques for finding Calculus, antiderivatives include algebraic formulations, manipulation such as long division and and completing the square, substitution of variables.
EU 3.4: The definite integral of a function over an interval is a mathematical tool with many interpretations and applications involving accumulations.	**LO 3.4A:** Interpret the meaning of a definite integral within a problem.	**EK 3.4A1:** A function defined as an integral represents an accumulation of a rate of of change.

		EK 3.4A2: The definite integral of the rate of change of a quantity over an interval gives the net change of that quantity over that interval. **EK 3.4A3:** The limit of an approximating Riemann sum can be interpreted as a definite integral.
	LO 3.4B: Apply definite integrals to problems involving the average value of a function.	**EK 3.4B1:** The average value of a function f over an interval $[a, b]$ is $\frac{1}{b-a}\int_a^b f(x)dx$.
	LO 3.4C: Apply definite integrals to problems involving motion.	**EK 3.4C1:** For a particle in rectilinear motion over an interval of time, the definite integral of velocity represents the particle’s displacement over the interval of time, and the definite integral of speed represents the particle’s total distance traveled over the interval of time.
	LO 3.4D: Apply definite integrals to problems involving area and volume.	**EK 3.4D1:** Areas of certain regions in the plane can be calculated with definite integrals.
	LO 3.4E: Use the definite integral to solve problems in various contexts.	**EK 3.4E1:** The definite integral can be used to express information about accumulation and net change in many applied contexts.
EU 3.5: Antidifferentiation is an underlying concept involved in solving separable differential equations. Solving separable differential equations involves determining a function or relation given its rate of change.	**LO 3.5A:** Analyze differential equations to obtain general and specific solutions.	**EK 3.5A1:** Antidifferentiation can be used to find specific solutions to differential equations with given initial conditions, including applications to motion along a line, exponential growth and decay. **EK 3.5A2:** Some differential equations can be solved by separation of variables. **EK 3.5A3:** Solutions to differential equations may be subject to domain restrictions.
EU 3.5: Antidifferentiation is an underlying concept involved in solving separable differential equations. Solving separable differential equations involves determining a function or relation given its rate of change. *(continued)*	**LO 3.5A:** Analyze differential equations to obtain general and specific solutions. *(continued)*	**EK 3.5A4:** The function F defined by $F(x) = c + \int_a^x f(t)dt$ is a general solution to the differential equation $\frac{dy}{dx} = f(x)$, and $F(x) = y_0 + \int_a^x f(t)dt$ is a particular solution to the differential equation $\frac{dy}{dx} = f(x)$ satisfying $F(a) = y_0$.
	LO 3.5B: Interpret, create, and solve differential equations from problems	**EK 3.5B1:** The model for exponential growth and decay that arises from the

in context.	statement "The rate of change of a quantity is proportional to the size of the quantity" is $\frac{dy}{dt} = ky$.

BIG IDEA #4: SERIES (BC TOPIC – NOT TAUGHT IN AB)

ACTIVITIES: Lecture, discussions, exploration with graphing calculator, and students will have daily assignments. Students will be assessed using daily quizzes, weekly tests and final exams.

TIMELINE:

Chapter 1 – Weeks 1 thru 5
Chapter 2 – Weeks 6 thru 10
Chapter 3 – Weeks 11 thru 15
Chapter 4 (part 1) – Weeks 16 thru 18 (4.1 – 4.3)
Fall Final Exam

Chapter 4 (part 2) – Weeks 19 thru 20 (4.4 – 4.6)
Chapter 5 – Weeks 21 thru 23
Chapter 6 – Weeks 24 thru 27
Chapter 7 – Weeks 28 thru 31
Prepare for AP Exam – Weeks 32 thru 35
Chapter 8 – Weeks 36 thru 38
Spring Final Exam

MINIMAL ATTAINMENT TO PASS: 10% Homework 20% Quizzes & Projects 70% Tests (Including finals)
Students must attain a minimum of 60% on all assignments and tests to pass the course.