AP CALCULUS AB 2015-2016

MAT 221 – Fall Semester 2015 *Dual Enrollment Chandler Gilbert Community College*

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Prerequisites: Grade of "C" or better in Honors Pre-Calculus or equivalent.

TEXT: Calculus

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COURSE DESCRIPTION – CALCULUS 1

1 - Real numbers, limits, continuity, differential and integral calculus of functions of one variable

COURSE OBJECTIVES/COMPETENCIES MAT 221

On completion of this course, the student will be able to:

1. Analyze the behavior and continuity of functions using limits.
2. State the definition and explain the significance of the derivative.
3. Compute the derivative using the definition and associated formulas for differentiation.
4. Solve application problems using differentiation.
5. State and explain the significance of the Fundamental Theorem of Calculus.
6. Compute anti-derivatives, indefinite and definite integrals of elementary functions.
7. Read and interpret quantitative information when presented numerically, analytically or graphically.
8. Compare alternate solution strategies, including technology.
9. Justify and interpret solutions to application problems.
10. Communicate process and results in written and verbal formats.

Course Overview:

This course is designed for the student who has shown superior achievement in an accelerated high school college preparatory curriculum. The course includes all topics recommended by the College Board Committee for the Advanced Placement Calculus AB program.

AP Calculus AB is the study of the topics covered in college-level Calculus I. AP Calculus AB is primarily concerned with developing the students' understanding of the concepts of Calculus and providing experience with its methods and applications. This course includes instruction and student assignments on all of the topics as listed in the AP Course Description: "Topic Outline for Calculus AB." The course emphasizes integral and differential calculus through a variety of methods. The course will provide students with a strong conceptual foundation including the concepts of a limit, a derivative and an integral. Students will be provided with various opportunities to explore calculus in real world contexts. Additional class time will be spent preparing students for the AP exam through practice tests and in class discussions.

Due to the complex nature of the course, an emphasis is placed on allowing students to articulate their learning with each other. The course places less emphasis on the direct-lesson approach. The course will provide students will opportunities to discuss the content of the course. This is accomplished by seating students in pods (or groups of 3-4). Seating students in pods allow students to articulate their learning and take ownership of the content. Students are expected to take an active role in the discussion and with their peers. Every class will begin with a discussion of the previous night's homework in their pods and in whole class discussion. In addition classroom activities will be structured to allow students to communicate results with each other.

Supplies: Coming to class prepared is essential. These are the things you will need EVERY DAY:

- ☑ A one inch 3 ring binder or section of a larger binder. **DO NOT THROW AWAY ANY MATH PAPERS!!!**
- ☑ 5 Dividers (tabs) labels
    - o Suggested labels: *Course Info, AP Practice, Notes, Homework, Test Prep and Reviews*
- ☑ Loose leaf notebook paper, loose leaf graph paper (optional)
- ☑ Pencil and Pen and highlighter
- ☑ Graph Paper
- ☑ **Calculator: A graphing calculator is required and mandatory!**

Quarter Grades:
- 75% - Assessments (Tests and Quizzes)
- 25% - Assignments (Graded Homework, Classwork, AP Practice, Projects, etc.)

Semester grade calculation:
- 80% - Quarter 1 and Quarter 2 Cumulative Grade (2nd semester: Quarters 3 and 4 Cumulative)
- 20% - Semester exam score

The following grade scale will be used: A = 90-100%; B = 80-89%; C = 70-79%; D =60-69%; F = 0-59%

Notes
- Effective note-taking techniques are an important skill to master and a valuable study method. Students are encouraged to take notes for the class. With each lesson, problems and exercises are assigned from the textbook. Students are required to maintain a notebook consisting of notes, assignments, and the AP practice questions.

Quizzes
- Quizzes will be given every week and cover smaller amount of material than tests.

Tests
- Tests come in two varieties, in-class and take-home. In-class tests will be divided into calculator/non-calculator sections to familiarize students with the free-response section of the AP Exam. Tests will be given at the end of each chapter (approximately every 4 weeks) Students solve both calculator active and non-calculator problems. Although calculators will be used to solve problems students are instructed on how to provide written justification of calculator and how to provide clear and logical link leading from the mathematics to the technology to support their results. Emphasis is placed not only on finding the correct answer but explaining the "why" as well. In addition students will be given various opportunities to summarize their learning both written and verbally.

Assignments
- Assignments come in two forms, homework and AP Practice.
  - Homework is assigned daily and should take about 45 minutes to complete. All homework will be due the day of the test. Two to three questions will be randomly selected and graded. Students will have an opportunity to discuss and correct homework prior to the due date.
  - AP Practice sets are generated from past AP Exams and other AP Exam review resources. The primary goal of problem-sets is to allow students to effectively build their free-response writing skills in preparation of the AP Exam. Students are highly encouraged to work with their peers on problem-sets but are required to submit their own work for each problem. These are assigned every Monday and due the following Monday. AP PRACTICE IS DUE MONDAY: NO EXPECTIONS. LATE ASSIGNMENTS WILL NOT BE ACCEPTED.

Attendance:
- It is essential that you come to class each day and that you are on time. When you are absent, it is ***your responsibility*** to find out what you missed, including copying notes or class work, and completing homework. You can ask a reliable classmate for this, check the folder on the class bulletin board, or check on my webpage. Make-up work is given one class period for each day a student is gone from class. If you miss the day of a test or quiz, you will take it upon your return. If you are leaving early for sports or a field trip, you must pick up your work prior to your absence.

Tardies:
- **Students must be in their seats** when the tardy bell rings or they will be considered tardy. Students will be assigned lunch detention after 3 tardies.

Cheating
- Cheating means, but is not limited to: copying homework, tests and quizzes or using electronic devices during tests or quizzes. These behaviors are unacceptable. Please DO NOT do it. Students will receive a 0 for the assignment/test/quiz, have to call their parents/guardians, and be written a conduct referral.

Advanced Placement:
AP Calculus is equivalent to a college level Calculus course. Most universities will give 4 credit hours for a successful AP exam (given in early May). Tax credit money can be used to pay the cost of the exam. The AP Calculus exam is a difficult, challenging exam. Students who wish to score a 3 or better on this exam need to study, memorize and work hard throughout the year, and practice as many sample questions as possible prior to taking the exam.

Dual Credit/Enrollment:
In conjunction with Chandler-Gilbert Community College the student has the opportunity to enroll in a dual credit situation. Dual enrollment students must meet the prerequisite criteria for the course or have a qualifying placement score by taking a free assessment test. Dual enrollment classes meet at the high school during the regular high school day and are taught by college certified high school instructors using a college curriculum and text. Dual enrollment credits transfer to all Arizona public colleges and universities. Articulation agreements are in place with a variety of colleges outside Arizona. Dual enrollment and advanced placement courses are both good options for students. The difference is dual enrollment students receive a grade and credit for the work performed throughout the year. These credits usually transfer to the student's college of choice as direct course equivalents.

Chandler Gilbert Community College required information.

STATEMENT REGARDING OUTCOMES AND ASSESSMENT

The faculty and programs at CGCC are dedicated to effective teaching and successful learning with emphasis in the following areas: communication, critical thinking, literacy, and personal development.
Periodically, students will participate in formal and informal assessment activities that will help faculty improve programs and teaching strategies. These activities are designed to facilitate student growth in whatever combination of the above outcomes applies to a course.

STATEMENT REGARDING STUDENTS WITH DISABILITIES

Students with disabilities are required to register for services in the Disability Resources and Services (DRS) office in the Student Center at the beginning of the semester. Do not wait to visit the DRS office if you want support with any CGCC classes. The DRS office will meet with you to determine accommodations based on appropriate documentation. Therefore, faculty members are not authorized to provide or approve any accommodations for students in this class without written instructions from the DRS office. This must be on file before any accommodation will be provided. You can contact the DRS office at (480) 857-5188.

INFORMATION ON LEARNING CENTER

The CGCC Learning Center's mission is to support students' academic learning by providing free tutoring and resources to reinforce and supplement classroom instruction and to assist CGCC students to achieve academic success. All Learning Center services are free to students currently enrolled at Chandler-Gilbert Community College. At the Pecos Campus, the Learning Center is located on the second floor of the Library, rooms LIB227, LIB228, LIB229 and LIB237. At the Williams Campus, the Learning Center is located in Bridget Hall, rooms BRID114 and BRID115. The Learning Center also provides instructional support resources in the form of videotapes, software, and print materials. For a schedule of tutoring hours, additional information, or assistance, students should contact the Learning Center at (480) 732-7231, or visit our website at http://www.cgc.edu/lc .

STATEMENT CONCERNING PLAGIARISM

Plagiarism is defined as presenting the work of another as one's own. More than four consecutive words from a source other than the writer constitute plagiarism when the source is not clearly identified in appropriate documentation format.

From the *CGCC Student Handbook*:
"Plagiarism includes, but is not limited to, the use of paraphrase or direct quotation, of the published or unpublished work of another person without full and clear acknowledgement. It also includes the unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials."

Rule of Four

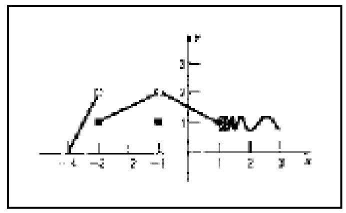
The course uses the “Rule of Four” to develop and enrich concepts. Students will represent problems expressed graphically, numerically, analytically, and verbally. Each of the four methods is given equal emphasis. Whenever possible, concepts are developed and applied using all of these representations. Technology is used regularly by students to reinforce the relationships and make connections. Students will use technology to confirm written work, to experiment and make conjectures, and to help interpret results. Using the “Rule of Four” helps students unify concepts of derivatives, integrals, limits, approximations and applications and modeling.

Numerically: Complete the table and use the results to estimate the limit. $\lim_{x\to 0}\frac{\cos x - 1}{x}$.

x	-0.1	-0.01	-0.001	0	0.001	0.01	.1
f(x)				---			

Graphically: Use the given graph to find the specified limit if it exist.

a. $\lim_{x\to -3} f(x)$ b. $\lim_{x\to -^-} f(x)$ c. $\lim_{x\to 1} f(x)$



Symbolically: Find the indicated limit or state that it does not exist.

a. $\lim_{x\to 6}(x-5)^{97}$ b. $\lim_{x\to 2}\frac{x^2-2x}{x^2-5x+6}$ c. $\lim_{x\to 0}\frac{(x+h)^2-x^2}{h}$

Verbally: Identify any vertical asymptotes or “holes” in the graph of the given function. Describe the behavior on each side of the asymptote or “hole”. In your own words and symbols, write a definition for a vertical asymptote. In your own words and appropriate symbols, write a definition for a “hole” in a graph. $f(x)=\frac{x^2+x-12}{x^2-9}$.

Technology

Instruction will be given using primarily the TI-83/84. This graphing calculator will be used daily in the class. The most basic skills on the calculator: graphing a function with an appropriate window, finding roots and points of intersection, finding numerical derivatives and approximating definite integrals, are mastered by all students. Students have their own calculator and programs, such as Riemann sums, slope fields, and Newton’s method, to name a few. Unit assessments consist of two parts: one without the use of any calculator and the other part requiring the use of a graphing calculator. The graphing calculator provides students with an opportunity to interpret problems in a variety of ways, to support their work graphically, and to make conjectures regarding the behavior of functions, limits, and other topics.

A variety of graphing calculator activities will be incorporated into the course. Activities will include:

- performing numerical differentiation with a graphing calculator
- performing numerical integration with a graphing calculator
- comparing the relative magnitudes of two functions with a graphing calculator.
- using a graphing calculator to investigate a numerical approach to evaluate the limit of a function, to estimate limits, and to determine the asymptotic behavior of a function, and to explore the continuity of a function.
- using a graphing calculator to numerically investigate the derivative of a function at a point, and to numerically calculate the value of a definite integral.
- using a graphing calculator to investigate a population growth model
- using a graphing calculator to investigate the slope of the line tangent to a function at a point.
- using a graphing calculator to analyze mathematical ideas, such as interpreting the effect of varying a parameter on a family of curves.
- using a calculator to approximate the value of an answer found analytically in order to verify whether it seems reasonable.
- using a calculator to view the graph of a function proposed as the answer to the problem; and again to check whether the answer has the desired traits.

Keep this in your notebook for future reference. Feel free to contact me with any questions you might have!
You and I have the same goal – That you are successful in this class!

Arizona College Preparatory- Erie
Strive for the impossible and be extraordinary!

AP Calculus AB Objectives Semester 1

*************DISCLAIMER******************

Course content may vary from the outline to meet the needs of this group.

Chapter 0 Quick Review of Pre-Calculus and Graphing Calculator Basics

Chapter 1 Limits:

1.1 <u>The concept of a limit can be used to understand the behavior of functions.</u>

1.1A(a) Express limits symbolically using correct notation.

- 1.1A1: Given a function *f*, the limit of *f(x)* as *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 $\lim_{x \to c} f(x) = R$.
- 1.1A2: The concept of a limit can be extended to include one-sided limits, limits at infinity, and infinite limits.
- 1.1A3: A limit might not exist for some function 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.

1.1A(b) Interpret limits expressed symbolically.

1.1B Estimate limits of functions.

- 1.1B1: Numerical and graphical information can be used to estimate limits.

1.1C Determine limits of Functions

- 1.1C1: Limits of sums, differences, products, quotients, and composite functions can be found using the basic theorems of limits and algebraic rules.
- 1.1C2: The limit of a function may be found by using algebraic manipulation, alternate forms of trigonometric functions or the squeeze theorem.
- 1.1C3: Limits of the indeterminate forms $\frac{0}{0}$ and $\frac{\infty}{0}$ may be evaluated using L'Hospital's Rule.

1.1D Deduce and interpret behavior of functions

- 1.1D1: Asymptotic and unbounded behavior of functions can be explained and described using limits.
- 1.1 D2: Relative magnitudes of functions and their rates of change can be compared using limits.

<u>1.2 Continuity is a key property of functions that is defined using limits.</u>

1.2A Analyze function for intervals of continuity or points of discontinuity

- 1.2 A1: A function *f* is continuous at *x = c* provided that f(x) exists, $\lim_{x \to c} f(x)$ exists, and $\lim_{x \to c} f(x) = f(c)$.
- 1.2 A2: Polynomial, rational, power, exponential, logarithmic, and trigonometric functions are continuous at all points in their domains.
- 1.2 A3: Types of discontinuities include removable discontinuities, jump discontinuities, and discontinuities due to vertical asymptotes.

1.2B Determine the applicability of important theorems using continuity.

- 1.2 B1: Continuity is an essential condition for theorems such as the Intermediate Value Theorem, the Extreme Value Theorem, and the Mean Value Theorem.

Graphing Calculator Activities include: *investigating a numerical approach to evaluate the limit of a function, investigating the asymptotic behavior of a function, and exploring the continuity of a function.*

Chapter 2: Rules for Derivatives

2.1 <u>The derivative of a function is defined as the limit of a difference quotient and can be determined using a variety of strategies.</u>

2.1A Identify the derivative of a function as the limit of a difference quotient.

- 2.1A1: The difference quotients $\frac{f(a+h)-f(a)}{h}$ and $\frac{f(x)-f(a)}{x-a}$ express the average rate of change of a function over an interval.
- 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 the limit exists. These are common forms of the definition of the derivative and are denoted f'(a).
- 2.1A3: The derivative of *f* is the function whose value at *x* is $\lim_{h\to 0}\frac{f(a+h)-f(a)}{h}$ provided this limit exists.
- 2.1A4: For *y = f(x)*, notations for the derivative include $\frac{dy}{dx}$, *f'(x)*, and *y'*.
- 2.1A5: The derivative can be represented graphically, numerically, analytically, and verbally.

2.1B Estimate derivatives.

- 2.1B1: The derivative at a point can be estimated from information given in tables or graphs.

2.1C Calculate Derivatives

- 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.
- 2.1C2: Specific rules can be used to calculate derivatives for classes of functions including polynomial, rational, power, exponential, logarithmic, trigonometric, and inverse trigonometric.
- 2.1C3: Sums, differences, products, quotients of functions can be differentiated using derivative rules.
- 2.1C4: The chain rule provides a way to differentiate composite functions.
- 2.1.C5: The chain rule is the basis for implicit differentiation.
- 2.1C6: The chain rule can be used to find the derivative of an inverse function, provided the derivative of that function exists.

2.1D Determine higher order derivatives.

- 2.1D1: Differentiating *f'* produces the second derivative *f''*, provided the derivative of *f'* exists; repeating this process provides higher order derivatives of *f*.
- 2.1 D2: Higher order derivatives are represented with a variety of notations. For *y = f(x),* notations for the second derivative include $\frac{d^2y}{dx^2}$, *f''(x)* and *y''*. Higher order derivatives can be denoted $\frac{d^ny}{dx^n}$ or $f^{(n)}(x)$.

2.2 <u>A function's derivative, which is itself a function, can be used to understand the behavior of a function.</u>

2.2A Use derivatives to analyze properties of a function.

- 2.2A2: Key features of functions and their derivatives can be identified and related to their graphical, numerical, and analytical representations.
- 2.2A3: Key features of the graphs or *f*, *f'*, and *f''* are related to one another.

2.2B Recognize the connection between differentiability and continuity.

- 2.2B1: A continuous function may fail to be differentiable at a point in its domain.
- 2.2B2: If a function is differentiable at a point, then it is continuous at that point.

Graphing Calculator Activities include: *investigating the slope of the line tangent to a function at a point, investigating the derivative of a function at a point, and to numerically calculate the value of a definite integral.*

Chapter 3: Applications of Derivatives

2.2 A function's derivative, which is itself a function, can be used to understand the behavior of a function.

2.2AUse derivatives to analyze properties of a function.

- 2.2A1: First and second 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.

2.3 The derivative has multiple interpretations and applications including those that involve instantaneous rate of change.

2.3A Interpret the meaning of a derivative with a problem.

- 2.3A1: The unit for $f'(x)$ is the unit for f divided by the unit for x.
- 2.3A2: The derivative of a function can be interpreted as the instantaneous rate of change with respect to tis independent variable.

2.3B Solve problems involving the slope of the tangent line.

- 2.3B1: The derivative at a point is the slope of the line tangent to a graph at that point on the graph.
- 2.3B2: The tangent line is the graph of a locally linear approximation of the function near the point of tangency.

2.3C Solve problems involving related rates, optimization, rectilinear motion [planar motion BC].

- 2.3C1: The derivative can be used to solve rectilinear motion problems involving position, speed, velocity, and acceleration.
- 2.3C2: The derivative can be used to solve related rate problems, that is, finding a rate at which one quantity is changing by relating it to other quantities whose rates of change are known.
- 2.3C3: The derivative can be used to solve optimization problems that is, find a maximum or minimum value of a function over a given interval.

2.3D Solve problems involving rates of change in applied contexts.

- 2.3D1: The derivative can be used to express information about rates of change in applied contexts.

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.

2.4A Apply the mean value theorem to describe the behavior of a function over an interval.

- 2.4A1: If a function f is continuous over the interval $[a, b]$ and differentiable over the interval (a, b), the Mean Value Theorem guarantees a point within that open interval where the instantaneous rate of change equal the average rate of change over the interval.

Graphing Calculator Activities include: Investigating concavity, extrema, intervals of decrease and increase. Optimization and modeling rates of change, exploring Newton's method

******Chapter 4: Integrals and the Fundamental Theorem of Calculus*****
This chapter will be introduced and tested on second semester.

AP Calculus AB Objectives Semester 2

Chapter 4: Integrals and the Fundamental Theorem of Calculus

3.1 Antidifferentiation is the inverse process of differentiation.

3.1A Recognize antiderivatives of basic functions.

- 3.1A1: An antiderivative of a function *f* is a function *g* whose derivative is *f*.
- 3.1A2: Differentiation rules provide the foundation for finding antideriviatives.

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.

3.2A(a) Interpret the definite integral as the limit of a Riemann sum.
3.2A(b) Express the limit of a Riemann sum in integral notation.

- 3.2A1: A Riemann sum, which requires a partition of an interval *I*, is the sum of the products, each of which is the value of the function at a point in a subinterval multiplied by the length of that subinterval.
- 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 i^{th} subinterval, Δx_i is the width of the i^{th} subinterval, *n* is the number of subintervals, and max Δx_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 $\Delta x_i = \dfrac{b-a}{n}$ and x_i^* is a value in the i^{th} subinterval.
- 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.

3.2B Approximate a definite integral.

- 3.2B1: Definite integrals can be approximated for functions that are represented graphically, numerically, algebraically, and verbally.
- 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.

3.2C Calculate a definite integral using areas and properties of definite integrals.

- 3.2C1: In some cases, a definite integral can be evaluated by using geometry and the connection between the definite integral and area.
- 3.2C2: Properties of definite integrals include the integral of 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.

3.2D Approximate a definite integral.

- 3.2D1: An improper integral is an integral that has one or both limits at infinite or has an integrand that is unbounded in the interval of integration.
- 3.2D2: Improper integrals can be determined using limits of definite integrals.

3.3 The Fundamental Theorem of Calculus, which has two distinct formulations, connect differentiation and integration.

3.3A Analyze functions defined by a definite integral.

- 3.3A1: The definite integral can be used to define new functions; for example $f(x)=\int_0^x e^{-t^2}dt$.
- 3.3A2: If *f* is a continuous function on the interval *[a, b]*, then $\frac{d}{dx}\left(\int_a^x f(t)dt\right)=f(x)$, where *x* is between *a* and *b*.
- 3.3A3: Graphical, numerical, analytical, and verbal representations of a function *f* provide information about the function *g* defined as $g(x)=\int_a^x f(t)dt$.

3.3B(a) Calculate antiderivatives.

3.3B(b) Evaluate definite integrals.

- 3.3B1: The function defined by $F(x)=\int_a^x f(t)dt$ is an antiderivative of *f.*
- 3.3B2: If *f* is continuous on the interval *[a, b]* and *F* is an antiderivative of *f* then $\int_a^b f(x)dx=F(a)-F(b)$.
- 3.3B3: The notation $\int f(x)dx=F(x)+C$ means that *F′(x) = f(x)* and $\int f(x)dx$ is called an indefinite integral of the function *f*.
- 3.3B4: Many functions do not have closed form antiderivatives.
- 3.3B5: Techniques for finding antiderivatives include algebraic manipulation such as long division and completing the square, substitution of variables.

3.4 The definite integral of a function over an interval is a mathematical tool with many interpretations and applications involving accumulation.

3.4A Interpret the meaning of a definite integral within a problem.

- 3.4A1: A function defined as an integral represents an accumulation of a rate of change.
- 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.
- 3.4A3: The limit of an approximating Riemann sum can be interpreted as a definite integral.

3.4B Apply definite integrals to problems involving the average value of a function.

- 3.4B1: The average value of a function *f* over an interval *[a, b]* is $\frac{1}{b-a}\int_a^b f(x)dx$.

3.4C Apply definite integrals to problems involving motion.

- 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.

Graphing Calculator Activities include: *Investigating investigate how to calculate the value of a definite integral.*

Chapter 5: Applications of Integrals

3.4D Apply definite integrals to problems involving area and volume.

- 3.4D1: Areas of certain regions in the plane can be calculated with definite integrals.
- 3.4D2: Volumes of solids with known cross sections, including discs and washers, can be calculated with definite integrals.

3.4A Use the definite integral to solve problems in various contexts.

- 3.4E1: The definite integral can be used to express information about accumulation and net change in many applied contexts.

Chapter 7: Differential Equations

<u>2.3 The derivative has multiple interpretations and applications including those that involve instantaneous rate of change.</u>

2.3E Verify solutions to differential equations.

- 2.3E1: Solutions to differential equations are functions or families of functions.

2.3F Estimate slopes to differential equations.

- 2.3F1: Slope fields provide visual clues to the behavior of solutions to first order differential equations.
- 2.3F2: For differential equations, Euler's method provides a procedure for approximating a solution or a point on a solution curve.

<u>3.5 Anti-differentiation 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.</u>

3.5A Analyze differential equations to obtain general and specific solutions.

- 3.5A1: Anti-differentiation 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.
- 3.5A2: Some differential equations can be solved by separation of variables.
- 3.5A3: Solutions to differential equations may be subject to domain restrictions.
- 3.5A4: The function *F* defined by $F(x) = c + \int_a^x f(t)dt$ is a general solution to the differential equation $\frac{dy}{dt} = f(x)$, and $F(x) = y_0 + \int_a^x f(t)dt$ is a particular solution to the differential equation satisfying $F(a) = y_0$.

3.5B Interpret, create, and solve differential equations from problems in context.

- 3.5B1: The model for exponential growth and decay that arises from the statement "The rate of change of a quantity is proportional to the size of the quantity" is $\frac{dy}{dt} = ky$.

Graphing Calculator Activities include: *investigating the population growth model, investigation slope fields and developing Euler's Method*

AP Review: Students continue to work in teams using previous AP®exams and sample tests.

After the AP exam

1. Introduction to BC topics (if time)
2. End of the Year Project.