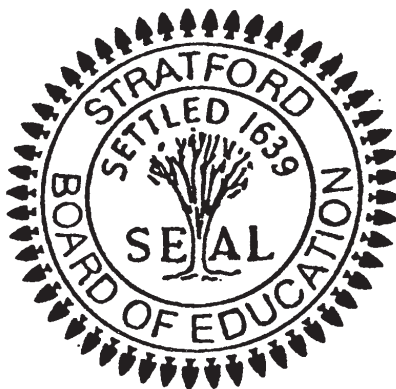


STRATFORD PUBLIC SCHOOLS

Stratford, Connecticut



“Tantum eruditi sunt liberi”
Only The Educated Are Free

AP Calculus AB

Adopted by the Board of Education on June 25, 2012

Irene Cornish
Superintendent

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DISTRICT MISSION

The mission of the Stratford Public Schools is to develop a community of learners in which students acquire the knowledge, skills and confidence to meet the challenges of a changing and increasingly diverse 21st century society.

DISTRICT CORE VALUES

Students will acquire content knowledge, strengthen higher-order thinking, and develop character in order to address 21st century challenges.

BUNNELL HIGH SCHOOL BELIEFS

We believe teachers must work collaboratively in support of student learning and to model collaboration as a social skill with students. We believe that a rigorous curriculum for all students, an acceptance of diversity, and a culture that actively welcomes all learners will contribute to a more knowledgeable community and society. We believe in the value of a strong education as a means of preparing students for work and life in the remainder of the 21st century.

STRATFORD HIGH SCHOOL BELIEFS

- a safe, positive school climate that embraces diversity is essential to ensure respect and opportunity for each individual
- students should understand the world beyond their community in order to contribute to a global society
- parents and students must share responsibility and work in partnership with the school in order to improve academic performance and to develop lifelong learners
- students should use technology effectively to acquire, process, and deliver information

BUNNELL HIGH SCHOOL and STRATFORD HIGH SCHOOL

LEARNING EXPECTATIONS

All students will...

- use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks. (Academic)
- work independently and collaboratively to solve problems and accomplish goals. (Civic-Social)
- communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes. (Academic)
- demonstrate innovation, flexibility and adaptability in thinking patterns, work habits and working/learning conditions. (Academic)
- effectively apply the analysis, synthesis and evaluation processes that enable productive problem solving. (Academic)
- value and demonstrate personal responsibility, character, cultural understanding and ethical behavior. (Civic-Social)
- show competence in all core academic subjects and other fields of interest, including the ability to clearly and effectively communicate content information in multiple formats. (Academic)

AP CALCULUS AB COURSE SYLLABUS

Expectations

The course is intended for students who have completed the equivalent of four years of secondary mathematics including the study of algebra, geometry, trigonometry, analytic geometry and elementary functions. The goal is that students are able to understand and communicate mathematical concepts verbally, analytically, graphically, and in tabular form. The course of study will include properties of functions, limits, differential calculus, and integral calculus. Students are expected to own and be proficient using a graphing calculator (preferably using the TI-83, TI-83+, or the TI-89). Calculators will be used on a regular basis to discover or reinforce the concepts that they are learning. Students should be able to graph a function, find a window appropriate for viewing a function, and be able to find the zeros of a function.

Teaching Strategies

Students will be taught how to communicate mathematical concepts verbally and in written form. Much time is devoted to interpretations of graphs of functions and graphs of the derivatives of functions. Students will be instructed in the use of graphing calculators and use them regularly, working individually and in groups. Lessons are occasionally presented using a TI-84 or a TI-89 graphic calculator.

Student Evaluation

Students will be graded each quarter, at the midyear and at the end of the year. Quarter grades will be based on homework, quizzes, tests, activities, and participation. Graphing calculators are allowed on most assessments. The midterm is worth 20% of the first semester grade and the final is worth 20% of the second semester grade. The two semester grades are averaged to determine the final grade.

Textbooks

Stewart, James; Single Variable Calculus Sixth Edition Thomson Brooks/Cole, Belmont, California, 2008

Finney, Ross L.; Demana, Franklin D.; Waits, Bert K.; Kennedy, Daniel Calculus A Complete Course Second Edition Addison-Wesley Inc, New York, 2000

Larson, Roland E.; Hostetler, Robert P.; Edwards, Bruce H. Brief Calculus with Applications D.C. Heath and Company, Lexington, MA, 1995.

AP CALCULUS AB SYLLABUS

The following list is a set of specific course objectives for *Calculus*. This list is organized with respect to its six major course topics which include the development of *limits*, *differentiation*, *integration*, *transcendental functions*, *special techniques/methods*, and the applications of these.

Major Course Topic	Application of Topic
<p><u>Unit 1</u></p> <p><u>A. Limits and Their Properties</u></p> <ol style="list-style-type: none"> 1. An Introduction to Limits 2. Techniques for Evaluating Limits <ol style="list-style-type: none"> a) By tabular method b) By graphic methods c) By analytic methods d). Sandwich Theorem e). One-sided Limits 3. Limits Involving Infinity <ol style="list-style-type: none"> a) Horizontal Asymptotes b) Vertical Asymptotes c) End Behavior Models 4. Properties of Limits 5. Continuity <ol style="list-style-type: none"> a) Types of Discontinuities <ol style="list-style-type: none"> i. Removable ii. Infinite iii. Vertical Tangent iv. Oscillating b) Intermediate Value Theorem 	<p><u>Students Activities</u></p> <ul style="list-style-type: none"> • Students begin the unit using tables and graphs to evaluate the limit of a function as $x \rightarrow a$. Emphasis is then placed on students being able to evaluate a limit analytically and confirm their results graphically and by use of a table. • Given a function such as $f(x) = e^x + 2x$, students must be able to find the right and left end behavior model. • Working in groups, students, given the equations of functions, must find the domain of the function, determine if the function is continuous, and state the theorems they used to determine continuity. • Writing assignment: Students must know the definition of continuity of a function at a point. Given graphs or equations of non-continuous functions, students must write an explanation of why the function is not continuous.
<p><u>Unit 2</u></p> <p><u>B. Differentiation</u></p> <ol style="list-style-type: none"> 1. The Definition of Derivative <ol style="list-style-type: none"> a) Slope of secant, tangent lines, and normal lines b) One-sided Derivatives 2. Differentiability <ol style="list-style-type: none"> a) How $f'(x)$ may fail to exist b) Intermediate Value Theorem for Derivatives 3. Basic Differentiation Rules <ol style="list-style-type: none"> a) Derivative of a Constant b) The Constant Multiple Rule c) The Sum and Difference Rule d) The Power Rule e) Derivatives of Polynomial Functions f) Numerical Derivatives 4. The Product/Quotient Rules 	<p><u>Student Activities</u></p> <ul style="list-style-type: none"> • Student will create a table to evaluate the slope of the secant line of a given function, $f(x) = x^2 + 1$, from $x = 1$ to $x = 3, 2, 1.5, 1.1, 1.01, 1.001$. They will evaluate the limit of the sequence of those slopes. Students will apply the limit definition of derivative to discover that $\frac{f(1+h) - f(1)}{h}$ generates the same sequence and that the limit as h approaches zero is the slope of the tangent line. • Students will use the definition of derivative to find slopes of various functions. • Students will find derivatives by using differentiation rules. • Students will find the derivative of a function at a point by using their calculators. • Given the graph of a function, students will sketch graphs of the derivative function.

<ul style="list-style-type: none"> a) Derivatives of Rational Functions b) Higher Order Derivatives 5. Rates of Change 6. The Chain Rule a) Derivatives of Trigonometric Functions b) Derivatives of Exponential Functions c) Bases Other than e 7. Implicit Differentiation a) Derivatives of Logarithmic Functions b) Derivatives of $\log_b x$ 	<ul style="list-style-type: none"> • Given a table of values of a function, students will sketch a graph of the derivative function. • Working in groups, given graphs position graphs or velocity graphs, students will draw conclusion such as: when the object changes direction, moves left or right, is moving the fastest and is at rest. They will be able to sketch the acceleration graph from the velocity graph.
<p style="text-align: center;"><u>Unit 3</u></p> <p><u>C. Differentiation and application</u></p> <ul style="list-style-type: none"> 1. Extrema on an Interval <ul style="list-style-type: none"> a) Extreme Value Theorem b) Local and Absolute Value Extrema c) Critical Points 2. The Mean Value Theorem <ul style="list-style-type: none"> a) Rolle's Theorem b) Increasing and Decreasing Functions 3. Relating the First and Second Derivatives to the Graph of a Function <ul style="list-style-type: none"> a) The First Derivative Test b) Concavity and the Second Derivative Test c) Points of Inflection 4. Particle Motion Problems 5. Optimization Problems 6. Linearization and Differentials 7. Related Rates 8. L'Hôpital's Rule 	<p><u>Student Activities</u></p> <ul style="list-style-type: none"> • Students will examine the graph of the derivative of a function and state characteristics of the function (on what intervals the function is increasing or decreasing, on what intervals the function is concave up or down, for what x values the function has a maximum or minimum value). • Working in groups, using a sheet of paper (11" by 8½"), students will construct open boxes of various dimensions. They will compare the volumes. They will find the dimensions that yield the maximum volume. • Students will observe a sliding ladder simulation program on a TI-84 graphing calculator. They will calculate the rate at which the top of the ladder is sliding down the wall. • Students will estimate a zero of a function by using a tangent line to approximate the function. They will apply Newton's Method for finding the zero of a function. • Writing assignment: Given the function $\begin{cases} x + 1, & -1 \leq x < 0 \\ 1 - x, & 0 \leq x \leq 1 \end{cases}$, students must show that there is no tangent parallel to the chord between (-1, 0) and (1,0). They must explain why this does not contradict the Mean Value Theorem. • Writing assignment: Given the function $f(x) = 3 + 4\cos x + \cos 2x$, students must determine if the function is ever negative and explain why they need to only consider values in the interval $[0, 2\pi]$.

<p style="text-align: center;"><u>Unit 4</u></p> <p><u>D. The Definite and Indefinite Integral</u></p> <ol style="list-style-type: none"> 1. Antiderivatives <ol style="list-style-type: none"> a) Initial Value Problems b) Properties of Indefinite Integrals 2. Area by Rectangular Approximation Method 3. Riemann Sums 4. Definite Integrals and Antiderivatives <ol style="list-style-type: none"> a) Properties of Integration b) Average (Mean) Value Theorem 5. The Fundamental Theorem of Calculus <ol style="list-style-type: none"> a) Part 1 b) Part 2 6. Area <ol style="list-style-type: none"> a) By Trapezoid Rule b) By Simpson's Rule 7. Applications <ol style="list-style-type: none"> a) Finding Distance Traveled b) Approximating Area 8. Integration by Substitution 	<p><u>Student Activities</u></p> <ul style="list-style-type: none"> • Given the graph and equation of a function, students will estimate the area between the graph of the function and the x-axis by drawing a stated number of rectangles (rectangle approximation method). Students will use a calculator program that generates the left, right and midpoint area approximations for any given number of rectangles. They will compare left, right and midpoint approximations. They will increase the number of rectangles to arrive at better estimations. • Writing assignment: Students must explain how they can determine when a rectangular approximation will be an overestimate or an underestimate. • Students will use their calculators to find the definite integral of a function. • Given the graph of a function, students will use the definite integral to evaluate the total area between the graph and the x-axis. • Working in groups, given a function, $f(t) = 2t$, students will construct a table of values of the function $F(x) = \int_a^x f(t)dt$. They will find the equation of the function for $F(x)$. They will find the derivative of the function $F(x)$ to discover that $\frac{d}{dx} \int_a^x f(t)dt = f(x)$. • Given the equation of a function, students will estimate the area between the graph of the function and the x axis by drawing a stated number of trapezoids.
<p style="text-align: center;"><u>Unit 5</u></p> <p><u>E. Applications of the Definite Integral</u></p> <ol style="list-style-type: none"> 1. Integral as Net Change 2. Area of a Region between Two Curves <ol style="list-style-type: none"> a) Vertical Slicing b) Horizontal Slicing 3. Volume: The Disc Method <ol style="list-style-type: none"> a) Vertical Slicing b) Horizontal Slicing 	<p><u>Student Activities</u></p> <ul style="list-style-type: none"> • Working in groups, given the graph of the velocity of a particle in motion, students will determine how much the particle has moved over a given period, the particle's position at a given time and what the acceleration of the particle was at a given time. • Students will be given tables of rates (i.e. oil consumption) over uniform intervals and determine the total amount. • Writing assignment: Students will determine if the area of the region between the graphs of the continuous functions $y = f(x)$ and $y = g(x)$ and the vertical lines $x = a$ and $x = b$ is $\int_a^b [f(x) - g(x)]dx$ and explain their reasons. • Students will find the volume of a region revolved around either axis by using the disc method.

AP CALCULUS AB PACING GUIDE

Staff can appropriately adjust length of time given to teaching skills and content to meet the needs of students without compromising the pace of the curriculum.

Unit Name and Synopsis	Projected # of Days	Actual # of Days	Factors that Affected the Pace of Learning	Implications for Curriculum and Unit Design
<p>Introduction to Limits This unit is a general review of factoring and trigonometry, the definition and behavior of a limit and continuity, and rates of change.</p>	27			
<p>Differentiation of Functions Students will need to know how to differentiate different types of functions. Students will need to know how to apply differentiation formulas to rates of change problems.</p>	37			
<p>Differentiation and its applications This unit serves as an extension of Unit #2. Students will apply the rules of differentiation to real-world scenarios in order to solve problems involving rate of change.</p>	42			
<p>The Definite Integral Students will discover the relationship between the derivative and the anti-derivative of a function.</p>	32			
<p>Applications of the Definite Integral This unit serves as an extension of Unit #4. Students will apply the rules of integration to real-world scenarios in order to solve problems involving rate of change.</p>	36			

AP CALCULUS AB UNIT PLANS #0 – 5

Stratford Public Schools AP Calculus AB Unit # 0 Review

Unit Name: General Review Est. # of Weeks: 2 weeks	
Synopsis: This unit is a general review of algebra and precalculus topics <ul style="list-style-type: none"> ➤ Functions ➤ Trigonometry ➤ Transformations ➤ Composite Functions ➤ Inverse Functions 	
STUDENT LEARNING GOALS	
Algebraic Reasoning: Patterns and Functions <ul style="list-style-type: none"> ➤ Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies. 	<u>Interdisciplinary Standards (Technology Integration)</u> Standard 1: Information Strategies Students determine their need for information and apply strategies to select, locate, and access information resources. Standard 2: Information Use Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests. Standard 3: Information and Technology Application Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information. Standard 4: Literacy and Literary Appreciation Students extract meaning from fiction and non-fiction resources in a variety of formats. They demonstrate an enjoyment of reading, including an appreciation of literature and other creative expressions. Standard 5: Personal Management Students display evidence of ethical, legal, and social responsibility in regard to information resources and project and self-management.
<u>21st Century Skills and Expectations</u> <u>Rubric: Critical Skills</u> 1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks. 2. Work independently and collaboratively to solve problems and accomplish goals. 3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes. 4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions. 5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving. 6. Value and demonstrate personal responsibility, character, cultural understanding and ethical behavior.	<hr style="border-top: 1px dashed black;"/> Key Vocabulary <ul style="list-style-type: none"> ➤ Function notation, inverse functions, unit circle, translations, stretches and shrinks, reflections, composite functions, one-to-one functions, HLT
Enduring Understandings 1.1 Understand and describe patterns and functional relationships. <ul style="list-style-type: none"> a. Describe relationships and make generalizations about patterns and functions. 1.3 Use operations, properties and algebraic symbols to determine equivalence and solve problems. <ul style="list-style-type: none"> a. Solve problems using a variety of algebraic methods. 	Essential Questions <ul style="list-style-type: none"> ➤ How do patterns and functions help us describe data and physical phenomena to solve a variety of problems? ➤ How are quantitative relationships represented by numbers? ➤ How do geometric relationships and measurements help us to solve problems and make sense of our world?

Learning Objectives / Grade Level Expectations

- Techniques for Evaluation Limits
- Limits Involving Infinity
- Properties of Limits
- Types of Discontinuity
- Intermediate Value Theorem
- Rates of Change
- Unit Circle

ASSESSMENT PLAN**Summative Assessment(s)/Performance Based**

- Quizzes
- Unit Assessments

Formative and Diagnostic Assessment(s)

- Common Formative Assessments
- Verbal Assessments
- Diagnostic Test

LEARNING PLAN COMPONENTS

- Single Variable Calculus , James Stewart, Sections 1.1 – 1.6
- TI-83 Graphing Calculator

Stratford Public Schools
AP Calculus AB Unit #1

Unit Name: Introduction to Limits

Est. # of Weeks: 5 weeks

Synopsis: This unit is a general review of factoring and trigonometry, the definition and behavior of a limit and continuity, and rates of change.

- Rates of Change and Limits
- Limits Involving Infinity
- Continuity
- Limit Definition of the Derivative

STUDENT LEARNING GOALS

Content-Specific Powered Standards
Algebraic Reasoning: Patterns and Functions

- Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

21st Century Skills and Expectations

Rubric: Critical Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding and ethical behavior.

Interdisciplinary Standards (Technology Integration)

Standard 1: Information Strategies

Students determine their need for information and apply strategies to select, locate, and access information resources.

Standard 2: Information Use

Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3: Information and Technology Application

Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Standard 4: Literacy and Literary Appreciation

Students extract meaning from fiction and non-fiction resources in a variety of formats. They demonstrate an enjoyment of reading, including an appreciation of literature and other creative expressions.

Standard 5: Personal Management

Students display evidence of ethical, legal, and social responsibility in regard to information resources and project and self-management.

Key Vocabulary

- Slope, functions, limit, asymptote, end behavior, continuity, Instantaneous rate of change, average rate of change, velocity, speed

Enduring Understandings

1.1 Understand and describe patterns and functional relationships.

a. Describe relationships and make generalizations about patterns and functions.

1.3 Use operations, properties and algebraic symbols to determine equivalence and solve problems.

a. Solve problems using a variety of algebraic methods.

Essential Questions

- What is the definition of a limit?
- What is the definition of continuity?
- What method is used to find a limit involving infinity?
- What is the difference between instantaneous and average velocity?
- What methods of factoring are applied to limits?

Learning Objectives / Grade Level Expectations

- Techniques for Evaluation Limits
- Limits Involving Infinity
- Properties of Limits
- Types of Discontinuity
- Intermediate Value Theorem
- Rates of Change

ASSESSMENT PLAN**Summative Assessment(s)/Performance Based Assessments including 21st Century Learning****Formative and Diagnostic Assessment(s)**

- CFA
- Diagnostic Test
- Verbal assessments
- Informal assessments of class work
- Weekly quiz
- Homework review
- Chapter assessment
- Quizzes

LEARNING PLAN COMPONENTS

- Single Variable Calculus , James Stewart, Sections 2.2, 2.3, 2.4, 2.5, 2., 2.6, 2.7, and 2.8
 - Calculus a Complete Course, Finney, Demana, Waits, Kennedy, Sections 2.1, 2.2, 2.3, and 2.4
 - TI-83 Graphing Calculator
- Precalculus a Graphing Approach, Demana, Waits, Clemens, Foley, Sections 0.5, 1.3, 6.1, 6.4, 6.6, 6.7

Stratford Public Schools
AP Calculus AB Unit #2

Unit Name: Differentiation of Functions

Est. # of Weeks: 7 weeks

Synopsis: Students will need to know how to differentiate different types of functions. Students will need to know how to apply differentiation formulas to rates of change problems.

- Differentiation Rules
- Implicit Differentiation
- Exponential Growth and Decay
- Related Rates
- Linearization
- Particle Motion (Horizontal and Vertical motion)

STUDENT LEARNING GOALS

Content-Specific Powered Standards

Algebraic Reasoning: Patterns and Functions

- Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

Numerical and Proportional Reasoning

- Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools, and technologies.

21st Century Skills and Expectations

Rubric: Critical Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding and ethical behavior

Interdisciplinary Standards (Technology Integration)

Standard 1: Information Strategies

Students determine their need for information and apply strategies to select, locate, and access information resources.

Standard 2: Information Use

Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3: Information and Technology Application

Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Standard 4: Literacy and Literary Appreciation

Students extract meaning from fiction and non-fiction resources in a variety of formats. They demonstrate an enjoyment of reading, including an appreciation of literature and other creative expressions.

Standard 5: Personal Management

Students display evidence of ethical, legal, and social responsibility in regard to information resources and project and self-management.

Key Vocabulary

- Constant function, power function, constant multiple function, sum function, difference function, number e, derivative of exponential function, product function, quotient function, trigonometric function, chain rule, implicit functions, inverse trigonometric functions, logarithmic functions.

Enduring Understandings

1.1 Understand and describe patterns and functional relationships.

- a. Describe relationships and make generalizations about patterns and functions

1.2 Represent and analyze quantitative relationships in a variety of ways.

Essential Questions

- How can functions be classified?
- How can algebraic operations be used in differential formulas?
- How can the chain rule be involved with different functions?
- How can implicit functions be differentiated?

<p>a. Represent and analyze linear and non-linear functions and relations symbolically and with tables and graphs.</p> <p>1.3 Use operations, properties and algebraic symbols to determine equivalence and solve problems.</p> <p>Solve problems using a variety of algebraic methods.</p> <p>2.1 Understand that a variety of numerical representations can be used to describe quantitative relationships.</p> <p>a. Extend the understanding of number to include integers, rational numbers and real numbers.</p> <p>b. Interpret and represent large sets of numbers with the aid of technologies.</p> <p>2.2 Use numbers and their properties to compute flexibly and fluently, and to reasonable estimate measures and quantities.</p> <p>a.. Develop strategies for computation and estimation using properties of number systems to solve problems.</p> <p>b.. Solve proportional reasoning problems.</p>	
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<p>Learning Objectives / Grade Level Expectations</p> <ul style="list-style-type: none"> ➤ Differentiate a constant function ➤ Differentiate a power function ➤ Differentiate a constant multiple function ➤ Differentiate a sum function ➤ Differentiate a difference function ➤ Work with the number e ➤ Differentiate exponential functions ➤ Differentiate product function ➤ Differentiate quotient function ➤ Differentiate trigonometric functions ➤ Apply the chain rule to any function ➤ Differentiate implicit functions ➤ Differentiate inverse trigonometric functions ➤ Differentiate logarithmic functions 	
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ASSESSMENT PLAN	
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<p>Summative Assessment(s)/Performance Based Assessments including 21st Century Learning</p> <ul style="list-style-type: none"> ● PBA #1 What's the Pattern Critical Skills Rubric #2 & 5 	<ul style="list-style-type: none"> ● Formative and Diagnostic Assessment(s) ● CFA ● Verbal assessments ● Informal assessments of class work ● Weekly quiz ● Homework review ● Chapter assessment ● Quizzes
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LEARNING PLAN COMPONENTS	
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<ul style="list-style-type: none"> ➤ Single Variable Calculus, Stewart, Section 3.1, 3.2, 3.3, 3.4, and 3.5 ➤ Calculus a complete Course, Finney, Demana, Waits, Kennedy, Sections 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9 ➤ TI-83 Graphing Calculator

Stratford Public Schools
AP Calculus AB Unit #3

Unit Name: Differentiation and its applications

Est. # of Weeks: 8 weeks

Synopsis: This unit serves as an extension of Unit #2. Students will apply the rules of differentiation to real-world scenarios in order to solve problems involving rate of change.

- Extrema on an interval
- Mean Value Theorem
- Relating 1st and 2nd derivatives to the graph of a function
- Optimization

STUDENT LEARNING GOALS

Content-Specific Powered Standards

Algebraic Reasoning: Patterns and Functions

- Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

21st Century Skills and Expectations

Rubric: Critical Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding and ethical behavior

Interdisciplinary Standards (Technology Integration)

Standard 1: Information Strategies

Students determine their need for information and apply strategies to select, locate, and access information resources.

Standard 2: Information Use

Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3: Information and Technology Application

Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Standard 4: Literacy and Literary Appreciation

Students extract meaning from fiction and non-fiction resources in a variety of formats. They demonstrate an enjoyment of reading, including an appreciation of literature and other creative expressions.

Standard 5: Personal Management

Students display evidence of ethical, legal, and social responsibility in regard to information resources and project and self-management.

Key Vocabulary

- Extrema, critical point, maxima, minima, inflection, concavity, optimization, L'Hopital's rule, Rolle's theorem, mean value theorem, related rates.

Enduring Understandings

1.1 Understand and describe patterns and functional relationships.

a. Model real-world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

1.2 Represent and analyze quantitative relationships in a variety of ways.

- a. Relate the behavior of functions and relations to specific parameters and determine functions to model real-world situations.

Essential Questions

- What is the meaning of a critical point?
- How can determining the extrema of a function be useful?
- What is the use of the mean value theorem?
- How can the first and second derivatives of a function be used to model the shape of that function?
- How can optimization be used to improve real-world situations?
- How can related rates be applied to real-world situations?
- When is L'Hopital's rule useful?

Learning Objectives / Grade Level Expectations

- Locate the extrema of a function using the first derivative
- Solve real-world problems using critical points
- Apply mean value theorem and Rolle's theorem

- Use the first and second derivatives of a function to determine maxima, minima, concavity, and points of inflection.
- Apply differentiation to determine the location or motion of a particle
- Apply differentiation to optimize real-world situations
- Apply differentiation to solve real-world problems involving related rates of change.
- Apply L'Hopital's rule when necessary (not an AP exam topic)
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ASSESSMENT PLAN

Summative Assessment(s)/Performance Based Assessments including 21st Century Learning

PBA #2 Food-Price Index
Critical Skills Rubric #1 & 2

- **Formative and Diagnostic Assessment(s)**
- CFA
- Verbal assessments
- Informal assessments of class work
- Weekly quiz
- Homework review
- Chapter assessment
- Quizzes

LEARNING PLAN COMPONENTS

- Calculus, Stewart, Sections 4.1-4.5, 4.7
- Calculus A Complete Course, Finney, 4.1-4.4, 4.6
- TI-84 Graphing Calculator

Stratford Public Schools
AP Calculus AB Unit #4

Unit Name: The Definite Integral

Est. # of Weeks: 6 weeks

Synopsis:

- Students will discover the relationship between the derivative and the anti-derivative of a function.
- Students will discover the relationship between the definite integral of a function and the area between the x-axis and the function.

STUDENT LEARNING GOALS

Content-Specific Powered Standards
Algebraic Reasoning: Patterns And Functions

- Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies

Geometry and Measurement

- Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies.

21st Century Skills and Expectations

Rubric: Critical Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding and ethical behavior

Interdisciplinary Standards (Technology Integration)

Standard 1: Information Strategies

Students determine their need for information and apply strategies to select, locate, and access information resources.

Standard 2: Information Use

Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3: Information and Technology Application

Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Standard 4: Literacy and Literary Appreciation

Students extract meaning from fiction and non-fiction resources in a variety of formats. They demonstrate an enjoyment of reading, including an appreciation of literature and other creative expressions.

Standard 5: Personal Management

Students display evidence of ethical, legal, and social responsibility in regard to information resources and project and self-management.

Key Vocabulary

- Anti-derivative
- Indefinite Integral
- Rectangular Approximation Method
- Riemann Sums
- Definite Integral
- Fundamental Theorem of Calculus

Enduring Understandings

- **1.1 Understand and describe patterns and functional relationships**
 - a. Model real-world situations and make generalizations about mathematical relationships using a variety of patterns and functions.
- **1.2 Represent and analyze quantitative relationships in a variety of ways.**
 - a. Represent the behavior of functions and relations to specific parameters and determine functions to model real-world situations.
- **1.3 Use operations, properties and algebraic symbols to determine equivalence and solve problems.**

Essential Questions

- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?
- How are quantitative relationships represented by numbers?
- How do geometric relationships and measurements help us to solve problems and make sense of our world?
- What is the relationship between area and the definite integral?

<p>a. Use and extend algebraic concepts to include real and complex numbers, vectors and matrices.</p> <p>➤ 3.1 Use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.</p> <p>a. Use methods of deductive and inductive reasoning to make, test and validate geometric conjectures.</p> <p>➤ 3.2 Use spatial reasoning, location and geometric relationships to solve problems.</p> <p>➤ a. Use a variety of coordinate systems and transformations to solve geometric problems in two- and three- dimensions using appropriate tools and technologies</p> <p>➤ 3.3 Develop and apply units, systems, formulas and appropriate tools to estimate and measure.</p> <p>Approximate measurements that cannot be directly determined with some degree of precision using appropriate tools, techniques and strategies.</p>	
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<p>Learning Objectives / Grade Level Expectations</p> <p>➤ Find area by Rectangular Approximation Method</p> <p>➤ Calculate Riemann sums</p> <p>➤ Approximating area between the x-axis and the function</p> <p>➤ Find definite integrals and anti-derivatives</p> <p>➤ Apply the properties of integration</p> <p>➤ Apply the Mean Value Theorem</p> <p>➤ Apply the Fundamental Theorem of Calculus</p> <p>➤ Approximate area by using the trapezoid rule</p> <p>➤ Find the net and total distance traveled</p>	
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ASSESSMENT PLAN

<p>Summative Assessment(s)/Performance Based Assessments including 21st Century Learning</p> <p style="text-align: center;">PBA #3 Dealing with Small Leaks Critical Skills Rubric #2 & 3</p>	<p>Formative and Diagnostic Assessment(s)</p> <ul style="list-style-type: none"> • CFA • Verbal assessments • Informal assessments of class work • Weekly quiz • Homework review • Chapter assessment • Quizzes
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LEARNING PLAN COMPONENTS

<p>➤ <i>Calculus</i> (Stewart) Sections 4.9, 5.1, 5.2, 5.3, 5.4, 5.5</p> <p>➤ <i>Calculus a Complete Course</i> (Finney)</p> <p>➤ Graphing calculator</p>

Stratford Public Schools
AP Calculus AB Unit #5

Unit Name: Applications of the Definite Integral

Est. # of Weeks: 7 weeks

Synopsis: This unit serves as an extension of Unit #4.

- Students will apply the rules of integration to real-world scenarios in order to solve problems including areas between curves
- Students will apply rules of integration to find volumes of solids
- Students will solve problems involving rate of change
- Students will construct slope fields to solve differentiable equations
- Students will solve separable first-order differential equations

STUDENT LEARNING GOALS

Content-Specific Powered Standards

- Algebraic Reasoning: Patterns and Functions
 - Patterns and functional relationship can be represented and analyzed using a variety of strategies, tools and technologies.
 - Geometry and Measurement
- Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies.

21st Century Skills and Expectations

Rubric: Critical Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding and ethical behavior

Interdisciplinary Standards (Technology Integration)

Standard 1: Information Strategies

Students determine their need for information and apply strategies to select, locate, and access information resources.

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Students extract meaning from fiction and non-fiction resources in a variety of formats. They demonstrate an enjoyment of reading, including an appreciation of literature and other creative expressions.

Standard 5: Personal Management

Students display evidence of ethical, legal, and social responsibility in regard to information resources and project and self-management.

Key Vocabulary

- Integration, definite integral, vertical slicing, horizontal slicing, disk method, washer method, solid with known cross-section, slope-fields, separable differential equations

Enduring Understandings: Students should...

- 1.3 Understand and describe patterns and functional relationships.
 - a. Model real-world situations and make generalizations about mathematical relationships using a variety of patterns and functions.
- 1.4 Represent and analyze quantitative relationships in a variety of ways.
 - a. Relate the behavior of functions and relations to specific parameters and determine functions to model

Essential Questions

- What is the meaning of the value of a definite integral?
- How can the area of a curved region be determined?
- How can the volume of a curved shape be determined?

<p>real-world situations.</p> <p>3.2 Use spatial reasoning, location and geometric relationships to solve problems.</p> <p>a. Use a variety of coordinate systems and transformations to solve geometric problems in two- and three-dimensions using appropriate tools and technologies</p>	
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<p>Learning Objectives / Grade Level Expectations</p> <ul style="list-style-type: none"> ➤ Determine the area between two curves using horizontal or vertical slicing. ➤ Determine the volume of a solid using horizontal or vertical slicing. ➤ Determine the volume of a solid with a known cross-section

ASSESSMENT PLAN

<p>Summative Assessment(s)/Performance Based Assessments including 21st Century Learning</p> <p>PBA #4 Edible Volume Critical Skills Rubric #2 & 4</p>	<p>Formative and Diagnostic Assessment(s)</p> <ul style="list-style-type: none"> ➤ Common formative assessments as prescribed. ➤ Informal assessments of class work ➤ Weekly quiz ➤ Homework review ➤ Chapter assessment ➤ Quizzes ➤ Unit Assessment
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LEARNING PLAN COMPONENTS

<ul style="list-style-type: none"> ○ <i>Calculus</i>, Stewart, Sections 6.1-6.3, 9.2 – 9.3 ○ <i>Calculus A Complete Course</i>, Finney, 7.1-7.4 ○ TI-84 Graphing Calculator
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