

STRATFORD PUBLIC SCHOOLS

Stratford, Connecticut



“Tantum eruditi sunt liberi”
Only The Educated Are Free

Calculus Honors

Adopted by the Board of Education on June 25, 2012

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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)

CALCULUS HONORS UNIT PLANS #1 – 5

Stratford Public Schools Calculus Honors Unit #1

Unit Name: Introduction to Limits Est. # of Weeks: 5.5 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.	
<ul style="list-style-type: none"> ➤ Rates of Change and Limits ➤ Limits Involving Infinity ➤ Continuity 	
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.	<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.	----- Key Vocabulary <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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
- Unit Circle

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
Calculus Honors Unit #2**

Unit Name: Differentiation of Functions

Est. # of Weeks: 7.5 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.

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.

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.

- a. Represent and analyze linear and non-linear functions and relations symbolically and with tables and graphs.

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

- Solve problems using a variety of algebraic methods.

2.1 Understand that a variety of numerical

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?

representations can be used to describe quantitative relation-ships.

- a. Extend the understanding of number to include integers, rational numbers and real numbers.
- b. Interpret and represent large sets of numbers with the aid of technologies.

2.2 Use numbers and their properties to compute flexibly and fluently, and to reasonable estimate measures and quantities.

- a.. Develop strategies for computation and estimation using properties of number systems to solve problems.
- b.. Solve proportional reasoning problems.

Learning Objectives / Grade Level Expectations

- 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 function
- Differentiate inverse trigonometric functions
- Differentiate logarithmic functions

ASSESSMENT PLAN

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

- **PBA #1 What's the Pattern**
Critical Skills Rubric #2 & 5

Formative and Diagnostic Assessment(s)

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

LEARNING PLAN COMPONENTS

- 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
Calculus Honors 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.

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: Students should...

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

ASSESSMENT PLAN	
<p>Summative Assessment(s)/Performance Based Assessments including 21st Century Learning</p> <p>PBA #2 Food-Price Index Critical Skills Rubric #1 & 2</p>	<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
LEARNING PLAN COMPONENTS	
<ul style="list-style-type: none"> ○ <i>Calculus</i>, Stewart, Sections 4.1-4.5, 4.7 ○ <i>Calculus A Complete Course</i>, Finney, 4.1-4.4, 4.6 ○ TI-84 Graphing Calculator 	

Stratford Public Schools
Calculus Honors Unit #4

Unit Name: The Definite Integral

Est. # of Weeks: 7 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>➤ Approximate area by using Simpson's 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
Calculus Honors 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 involving rate of change.

STUDENT LEARNING GOALS

Content-Specific Powered Standards

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

- Integration, definite integral, vertical slicing, horizontal slicing, disc method, washer method

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 real-world situations.
- 3.2 Use spatial reasoning, location and geometric relationships to solve problems.
 - a. Use a variety of coordinate systems and transformations to solve geometric problems in two- and three-dimensions using appropriate tools and technologies

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?

Learning Objectives / Grade Level Expectations

- Determine the area between two curves using horizontal or vertical slicing.
- Determine the volume of a solid using horizontal or vertical slicing.

ASSESSMENT PLAN

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

PBA #4 Edible Volume
Critical Skills Rubric #2 & 4

Formative and Diagnostic Assessment(s)

- Common formative assessments as prescribed.
- Informal assessments of class work
- Weekly quiz
- Homework review
- Chapter assessment
- Quizzes
- Unit Assessment

LEARNING PLAN COMPONENTS

- Calculus, Stewart, Sections 6.1-6.3
- Calculus A Complete Course, Finney, 7.1-7.4
- TI-84 Graphing Calculator