TRUMBULL PUBLIC SCHOOLS

Trumbull, Connecticut

Advanced Placement / Early College Experience
Calculus BC

Mathematics Department
Trumbull High School

2016

Curriculum Writing Team

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AP/ECE Calculus BC
Table of Contents

CORE VALUES AND BELIEFS

The Trumbull School Community engages in an environment conducive to learning which believes that all students will **read** and **write effectively**, therefore communicating in an articulate and coherent manner. All students will participate in activities **that present problem-solving through critical thinking**. Students will use technology as a tool applying it to decision making. We believe that by fostering self-confidence, self-directed and student-centered activities, we will promote **independent thinkers and learners**. We believe **ethical conduct** to be paramount in sustaining the welcoming school climate that we presently enjoy.

Approved 8/26/2011

INTRODUCTION

Advanced Placement / Early College Experience Calculus BC is designed for the student who has successfully completed Honors PreCalculus. In AP/ECE Calculus BC, students will become proficient with derivatives and their applications, integrals and their applications, and Taylor and Maclaurin series. The use of a graphing calculator is integral to the course. Students will be prepared to succeed on the Advanced Placement Examination in May as well as the Early College Experience Examinations by the University of Connecticut in January and June.

PHILOSOPHY

Success in mathematics depends upon active involvement in a variety of interrelated experiences. When students participate in stimulating learning opportunities, they can reach their full potential.

The Trumbull Mathematics Program embraces these goals for all students.
The successful mathematician will:

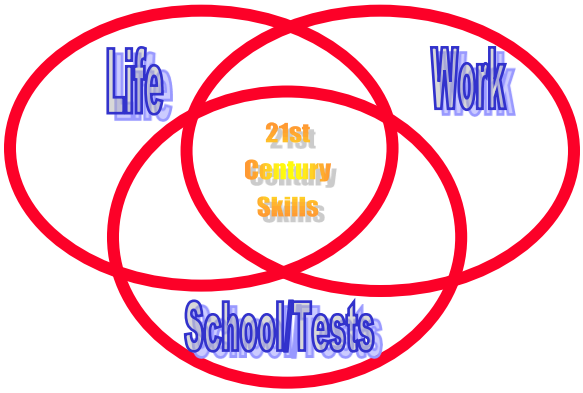
- Acquire the factual knowledge necessary to solve problems
- Gain procedural proficiency in problem solving
- Demonstrate a perceptual understanding of problems posed
- Make meaningful mathematical connections to his or her world
- Solve problems utilizing a variety of strategies
- Utilize technology to improve the quality of the problem-solving process
- Communicate effectively using mathematical terminology, both independently and collaboratively
- Use sound mathematical reasoning by utilizing the power of conjecture and proof in his or her thinking
- Become a reflective thinker through continuous self-evaluation
- Become an independent, self-motivated, lifelong learner

The Trumbull Mathematics Program promotes the empowerment of students and encourages students to embrace the skills needed to become successful in the 21st century. Students expand their mathematical abilities by investigating real-world phenomena. Through such experiences, students can access the beauty and power of mathematics and truly appreciate the impact mathematics has on the world in which they live.

Developed by Trumbull K-12 Math Committee, June 2004; revised and approved April 2011

Mathematics instruction must:

- Blend the concrete with the abstract, the practical with the theoretical, and the routine with the non-routine.
- Teach students to search for, find, and represent patterns.
- Instill in students an appreciation for the intrinsic beauty of mathematics.
- Encourge students to reason, analyze, make connections, and self-assess.
- Immerse students in the learning process through questioning, technology, manipulatives, cooperative, and individual activities.



Information, Media And Technology Skills

1. Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks.

Learning and Innovation Skills

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.

Life and Career Skills

6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

COURSE DESCRIPTION

Advanced Placement / Early College Experience Calculus BC follows the Advanced Placement Calculus BC curriculum prescribed by the College Board as well as the University of Connecticut's Math 1131Q and Math 1132Q. The course emphasizes a thorough study of functions, limits, continuity, derivatives, the integral, and series. Students become proficient at both explicit and implicit derivatives of polynomial, rational, trigonometric, exponential, and logarithmic functions. Derivative applications are studied through motion, curve fitting, extrema, and related rates. Applications of the integral are stressed through the investigation of volumes, lengths of curves, and volumes of solids. Taylor and Maclaurin series are studied in depth, as are polar coordinates and parametric equations. The goal is to learn, understand, and be able to work with the main ideas of Calculus. Students should not only be able to work through problems similar to ones seen in the homework, but should also have the ability to go beyond, presenting

their knowledge in a clear and coherent manner as well. A graphing calculator is required for this course.

COURSE GOALS

The Standards for Mathematical Practice describe varieties of expertise that all teachers of mathematics will develop in their students.

These practices rest on important "processes and proficiencies" that have long been valued in mathematics education.

1. Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary.

2. Reason abstractly and quantitatively.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved.

Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

3. Construct viable arguments and critique the reasoning of others.

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is.

4. Model with mathematics.

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace.

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They

routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

5. Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and the tools' limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data.

They are able to use technological tools to explore and deepen their understanding of concepts.

6. Attend to precision.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning.

They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, expressing numerical answers with a degree of precision appropriate for the problem context. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

7. Look for and make use of structure.

Mathematically proficient students look closely to discern a pattern or structure.

They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects.

8. Look for and express regularity in repeated reasoning.

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

COURSE ENDURING UNDERSTANDINGS

Students will understand that . . .

- calculus is the study of change.
- calculus can be used to extend our mathematical boundaries.
- formal definitions, applications, and properties of derivatives and integrals are essential to the study of calculus.

COURSE ESSENTIAL QUESTIONS

- What is a limit, and how can it be interpreted?
- What is a derivative, and how can it be applied?
- What is an integral, and how can it be applied?
- How can functions be interpreted through sequences and series?

COURSE KNOWLEDGE & SKILLS

Students will understand . . .

- formal definitions and graphical interpretations of limits and continuity.
- formal definitions, applications, and properties of a derivative.
- formal definitions, applications, and properties of an integral.
- interpretations and creations of series representations and polynomial approximations.

Students will be able to . . .

- sketch functions using Calculus.
- solve real-life problems such as related rates and optimization problems.
- use integration to calculate the area between curves and volumes of solids.
- use parametric functions and polar coordinates to find the arc length of curves.
- use Taylor and Maclaurin polynomials and series to approximate functions.

COURSE SYLLABUS

Course Name

Advanced Placement / Early College Experience Calculus BC

Level

Advanced Placement

Prerequisites

Completion of Honors PreCalculus with a B or better and teacher recommendation.

Materials Required

TI-84 graphing calculator

General Description of the Course

Advanced Placement / Early College Experience Calculus BC follows the Advanced Placement Calculus BC curriculum prescribed by the College Board as well as the University of Connecticut's Math 1131Q and Math 1132Q. The course emphasizes a thorough study of functions, limits, continuity, derivatives, the integral, and series. Students become proficient at both explicit and implicit derivatives of polynomial, rational, trigonometric, exponential, and logarithmic functions. Derivative applications are studied through motion, curve fitting, extrema, and related rates. Applications of the integral are stressed through the investigation of volumes, lengths of curves, and volumes of solids. Taylor and Maclaurin series are studied in depth, as are polar coordinates and parametric equations. The goal is to learn, understand, and be able to work with the main ideas of Calculus. Students should not only be able to work through problems similar to ones seen in the homework, but should also have the ability to go beyond, presenting their knowledge in a clear and coherent manner as well. A graphing calculator is required for this course.

Assured Assessments

Students will be evaluated by their performance on tests, quizzes, homework, problem sets, journals, other formative and summative assessments, and midterm and final examinations including questions required by the University of Connecticut.

Core Text

Larson, Ron, and Bruce H. Edwards. *Calculus: AP Edition*. 9th ed. Boston: Brooks/Cole, 2010. Print.

Recommended Supplemental Material

College Board website including past Advanced Placement Calculus BC tests

Unit 1: The Derivative

Performance Standards

The following Performance Standards are TPS-created, and influenced by the Fairfield Public Schools AP Calculus BC Curriculum Guide.

- Demonstrate an understanding of the formal definition of the derivative of a function at a point and the notion of differentiability.
    - Demonstrate an understanding of the derivative of a function as the slope of the tangent line to the graph of the function.
    - Demonstrate an understanding of the interpretation of the derivative as an instantaneous rate of change, using derivatives to solve a variety of problems from physics, chemistry, economics, and so forth that involve the rate of change of a function.
    - Understand the relation between differentiability and continuity.
    - Derive derivative formulas and use them to find the derivatives of algebraic, trigonometric, inverse trigonometric, exponential, and logarithmic functions.
- Know the chain rule and its proof and applications to the calculation of the derivative of a variety of composite functions.
- Compute derivatives of higher orders.

Essential Questions

- How does the concept of a limit lead to a derivative?
- How does one differentiate a polynomial function using the power rule?
- How does one differentiate a rational function using the quotient rule?
- How does one differentiate a product of functions using trigonometric functions using the product rule?
- How does one differentiate a composition of functions using the chain rule?

Content (Scope and Sequence)

- The tangent line problem
- Finding limits graphically, numerically, analytically, and algebraically
- Continuity and one-sided limits
- Infinite limits
- Average and instantaneous rates of change
- Definition of the derivative
- Finding equations of tangent lines to a curve at a given point
- Graphical representations of the derivative
- Finding derivatives explicitly using sum, constant, product, quotient, power rules, chain rule, trigonometric functions, exponential functions, logarithmic functions, and inverse functions
- Finding derivatives using implicit differentiation
- Finding second derivatives and applying them

- Derivatives of parametric, vector, and polar functions (may be covered at the end of the course if time in Unit 1 does not permit)

Instructional/Teaching Strategies

Brainstorming, comprehension questions based on instruction, cuing expected behavior, direct instruction, discussion groups, encouraging students to clarify and expand ideas, peer modeling, question-and-answer sessions, refocusing students, research using technology, restating and rephrasing key concepts, wait time

Technology Competency Standards

1. Creativity and Innovation – Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.
2. Communication and Collaboration – Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
3. Research and Information Fluency – Students apply digital tools to gather, evaluate, and use information.
4. Critical Thinking, Problem Solving, and Decision Making – Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
5. Digital Citizenship – Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.

Assured Experiences

Problem Sets
Homework
Mid-Unit Quizzes
Tests

Time Allocation

Approximately 30 days

Unit 2: Applications of the Derivative

Performance Standards

The following Performance Standards are TPS-created, and influenced by the Fairfield Public Schools AP Calculus BC Curriculum Guide.

- Find the derivatives of parametrically defined functions and use implicit differentiation in a wide variety of problems in physics, chemistry, economics, and so forth.
- Know and apply Rolle's Theorem, the Mean Value Theorem, and L'Hôpital's Rule.
- Use differentiation to sketch, by hand, graphs of functions, identifying maxima, minima, inflection points, and intervals in which the function is increasing and decreasing.
- Know Newton's method for approximating the zeros of a function, and calculate zeros traditionally (using the quadratic formula, graphing and zooming in to get more accuracy, or using a numerical root-finder on a calculator).
- Use differentiation to solve optimization (maximum-minimum problems) in a variety of pure and applied contexts.
- Use differentiation to solve related rates problems in a variety of pure and applied contexts.

Essential Questions

- What is a limit?
- What role does calculus play as a tool in science, business, and other areas of study?
- How is the derivative used to solve problems involving area, velocity, and acceleration?
- What information can be determined from the derivative to help sketch the graph of a function?

Content (Scope and Sequence)

- Solving related rates problems
- Extrema
- Mean Value Theorem (and Rolle's Theorem)
- Increasing and decreasing functions
- First Derivative Test
- Concavity
- Second Derivative Test
- Optimization problems
- Position, velocity, and acceleration
- Newton's method

Instructional/Teaching Strategies

Brainstorming, comprehension questions based on instruction, cuing expected behavior, direct instruction, discussion groups, encouraging students to clarify and expand ideas, peer modeling, question-and-answer sessions, refocusing students, research using technology, restating and rephrasing key concepts, wait time

Technology Competency Standards

1. Creativity and Innovation – Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.
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5. Digital Citizenship – Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.

Assured Experiences (Projects)

Problem Sets
Homework
Mid-Unit Quizzes
Tests

Time Allocation

Approximately 25 days

Unit 3: The Definite Integral

Performance Standards

The following Performance Standards are TPS-created, and influenced by the Fairfield Public Schools AP Calculus BC Curriculum Guide.

- Know the definition of the definite integral by using Riemann sums to approximate integrals.
- Apply the definition of the integral to model problems in physics, chemistry, economics, and so forth, obtaining results in terms of integrals.
- Demonstrate knowledge and proof of the Fundamental Theorem of Calculus, using it to interpret integrals as anti-derivatives.

Essential Questions

- How does one determine the area under a curve?
- What is an integral, both definite and indefinite?
- How does one find the integral?
- What does the integral represent?
- How is integration related to differentiation through the Fundamental Theorem of Calculus?

Content (Scope and Sequence)

- Average rate of change
- Riemann sums
- Trapezoidal rule
- Definite integral to find area under a curve
- Mean Value Theorem
- Average value of a function
- The Fundamental Theorem of Calculus
- The Second Fundamental Theorem of Calculus

Instructional/Teaching Strategies

Brainstorming, comprehension questions based on instruction, cuing expected behavior, direct instruction, discussion groups, encouraging students to clarify and expand ideas, peer modeling, question-and-answer sessions, refocusing students, research using technology, restating and rephrasing key concepts, wait time

Technology Competency Standards

1. Creativity and Innovation – Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.
2. Communication and Collaboration – Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.

3. Research and Information Fluency – Students apply digital tools to gather, evaluate, and use information.
4. Critical Thinking, Problem Solving, and Decision Making – Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
5. Digital Citizenship – Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.

Assured Experiences (Projects)

Problem Sets
Homework
Mid-Unit Quizzes
Tests

Time Allocation

Approximately 25 days

Unit 4: Differential Equations

Performance Standard

The following Performance Standard is TPS-created, and influenced by the Fairfield Public Schools AP Calculus BC Curriculum Guide.

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

Essential Questions

- How does one use initial conditions to find particular solutions of differential equations?
- Why does Euler's method approximate the solution to a differential equation?
- How does one use slope fields to obtain the solutions to a first-order differential equation?

Content (Scope and Sequence)

- Differential equations including separation of variables
- Euler's method
- Slope fields
- Logistic equations

Instructional/Teaching Strategies

Brainstorming, comprehension questions based on instruction, cuing expected behavior, direct instruction, discussion groups, encouraging students to clarify and expand ideas, peer modeling, question-and-answer sessions, refocusing students, research using technology, restating and rephrasing key concepts, wait time

Technology Competency Standards

1. Creativity and Innovation – Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.
2. Communication and Collaboration – Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
3. Research and Information Fluency – Students apply digital tools to gather, evaluate, and use information.
4. Critical Thinking, Problem Solving, and Decision Making – Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
5. Digital Citizenship – Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.

Assured Experiences (Projects)

Problem Sets
Homework
Mid-Unit Quizzes
Tests

Time Allocation

Approximately 15 days

Unit 5: Applications of Integration and Integration Techniques

Performance Standards

The following Performance Standards are TPS-created, and influenced by the Fairfield Public Schools AP Calculus BC Curriculum Guide.

- Use definite integrals in problems involving area, velocity, acceleration, volume of a solid, and length of a curve.
- Compute, by hand, the integrals of a wide variety of functions by using techniques of integration, such as substitution, integration by parts, and trigonometric substitution, combining techniques when appropriate.
- Know the definitions and properties of inverse trigonometric functions and the expression of these functions as indefinite integrals.
- Compute, by hand, the integrals of rational functions by combining the techniques such as substitution, integration by parts, and trigonometric substitution with the algebraic techniques of partial fractions and completing the square.
- Compute the integrals of trigonometric functions by using the techniques such as substitution, integration by parts, and trigonometric substitution.
- Understand improper integrals as limits of definite integrals.
- Know the techniques of solution of selected elementary differential equations and their applications to a wide variety of situations, including growth-and-decay problems.

Essential Questions

- How is integration used to solve problems involving area, velocity, and acceleration?
- What approaches can be used to determine the integrals for different functions?
- How is integration used to illustrate the various geometric formulas for volume and area?

Content (Scope and Sequence)

- Area of a region between two curves
- Volume of solids using known cross-sectional area and solids of revolution
- Arc length
- Integration by parts
- Partial fractions
- Improper integrals

Instructional/Teaching Strategies

Brainstorming, comprehension questions based on instruction, cuing expected behavior, direct instruction, discussion groups, encouraging students to clarify and expand ideas, peer modeling, question-and-answer sessions, refocusing students, research using technology, restating and rephrasing key concepts, wait time

Technology Competency Standards

1. Creativity and Innovation – Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.

2. Communication and Collaboration – Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
3. Research and Information Fluency – Students apply digital tools to gather, evaluate, and use information.
4. Critical Thinking, Problem Solving, and Decision Making – Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
5. Digital Citizenship – Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.

Assured Experiences (Projects)

Problem Sets
Homework
Mid-Unit Quizzes
Tests

Time Allocation

Approximately 30 days

Unit 6: Polynomial Approximations and Series

Performance Standards

The following Performance Standards are TPS-created, and influenced by the Fairfield Public Schools AP Calculus BC Curriculum Guide.

- Demonstrate an understanding of the definitions of convergence and divergence of sequences and series of real numbers, using such tests as the comparison test, ratio test, and alternate series test to determine whether a series converges.
- Understand and compute the radius (interval) of the convergence of power series.
- Differentiate and integrate the terms of a power series in order to form new series from known ones.
- Calculate Taylor polynomials and Taylor series of basic functions, including the remainder term.

Essential Questions

- What is series convergence?
- Which convergence test should or could be used to show convergence/divergence?
- How can an elementary function be represented by a Taylor or Maclaurin polynomial?
- How can the interval and radius of convergence be determined?
- How can one represent functions by power series, Taylor series, and Maclaurin series?

Content (Scope and Sequence)

- Sequences
- Convergence of series including radius of convergence and interval of convergence
- Tests for convergence: n^{th} term, geometric series, telescoping series, *p*-series, alternating series, integral, root, ratio, direct comparison, and limit comparison
- Taylor and Maclaurin polynomials and approximations
- Power series
- Taylor and Maclaurin series

Instructional/Teaching Strategies

Brainstorming, comprehension questions based on instruction, cuing expected behavior, direct instruction, discussion groups, encouraging students to clarify and expand ideas, peer modeling, question-and-answer sessions, refocusing students, research using technology, restating and rephrasing key concepts, wait time

Technology Competency Standards

1. Creativity and Innovation – Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.
2. Communication and Collaboration – Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.

3. Research and Information Fluency – Students apply digital tools to gather, evaluate, and use information.
4. Critical Thinking, Problem Solving, and Decision Making – Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
5. Digital Citizenship – Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.

Assured Experiences (Projects)

Problem Sets
Homework
Mid-Unit Quizzes
Tests

Time Allocation

Approximately 35 days

Culminating Activity

Final Exam

The final exam is worth 10% of the student's Trumbull High School course grade and 90% of the student's UCONN Calculus 1132Q grade.

It is comprised of ¾ questions created by the UCONN Mathematics Department and ¼ questions created by the Trumbull High School Mathematics Department.

TEACHER GUIDE

Unit 1: The Derivative

Sections:

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

Unit 2: Applications of the Derivative

3.1 Extrema on an Interval
3.2 Rolle's Theorem and the Mean Value Theorem
3.3 Increasing and Decreasing Functions and the First Derivative Test
3.4 Concavity and the Second Derivative
3.6 A Summary of Curve Sketching
3.7 Optimization
3.8 Newton's Method
3.9 Differentials

Unit 3: The Definite Integral

4.1 Antiderivatives and Indefinite Integrations
4.2 Area
4.3 Riemann Sums and Definite Integrals
4.4 The Fundamental Theorem of Calculus
4.5 Integration by Substitution
4.6 Numerical Substitution
5.1 The Natural Logarithmic Function: Differentiation
5.2 The Natural Logarithmic Function: Integration
5.3 Inverse Functions
5.4 Exponential Functions: Differentiation and Integration
5.5 Bases other than *e* and Applications

Unit 4: Differential Equations

6.1 Slope Fields and Euler's Method
6.2 Differential Equations: Growth and Decay
6.3 Separation of Variables

Unit 5: Applications of Integrations and Integration Techniques

7.1 Area of a Region between Two Curves
7.2 Volume: The Disk Method
7.4 Arc Length
7.5 Work
8.1 Basic Integration Rules

8.2 Integration by Parts
8.3 Trigonometric Intervals
8.5 Partial Fractions
8.7 Indeterminate Forms and L'Hôpital's Rule
8.8 Improper Integrals

Unit 6: Polynomial Applications and Series

9.1 Sequences
9.2 Series and Convergence
9.3 The Integral Test and *p*-series
9.4 Comparison of Series
9.5 Alternating Series
9.6 The Ratio and Root Tests
9.7 Taylor Polynomials and Approximations
9.8 Power Series
9.9 Representation of Functions by Power Series
9.10 Taylor and Maclaurin Series

COURSE CREDIT

One THS credit in Mathematics

.8 University of Connecticut credits possible

One class period daily for a full year

PREREQUISITES

Completion of Honors PreCalculus with a B or better and teacher recommendation.

TEXT

Larson, Ron, and Bruce H. Edwards. *Calculus: AP Edition*. 9th ed. Boston: Brooks/Cole, 2010. Print.

SUPPLEMENTARY MATERIALS/RESOURCES/TECHNOLOGY

TI-84 Plus graphing calculators

College Board website including past Advanced Placement Calculus BC tests

CURRENT REFERENCES

College Board: Advanced Placement Calculus BC Examination

http://apcentral.collegeboard.com/apc/members/exam/exam_information/8031.html

Fairfield Public Schools AP Calculus BC Curriculum

http://cdn.fairfieldschools.org/curriculum/math-2014/AP%20Calculus%20BC.pdf

ASSURED STUDENT PERFORMANCE RUBRICS

- Trumbull High School School-Wide Writing Rubric
- Trumbull High School School-Wide Problem-Solving Rubric
- Trumbull High School School-Wide Independent Learning and Thinking Rubric

Rubric 2: Write Effectively

Category/ Weight	Exemplary 4 Student work:	Goal 3 Student work:	Working Toward Goal 2 Student work:	Needs Support 1-0 Student work:
Purpose X_____	• Establishes and maintains a clear purpose • Demonstrates an insightful understanding of audience and task	• Establishes and maintains a purpose • Demonstrates an accurate awareness of audience and task	• Establishes a purpose • Demonstrates an awareness of audience and task	• Does not establish a clear purpose • Demonstrates limited/no awareness of audience and task
Organization X_____	• Reflects sophisticated organization throughout • Demonstrates logical progression of ideas • Maintains a clear focus • Utilizes effective transitions	• Reflects organization throughout • Demonstrates logical progression of ideas • Maintains a focus • Utilizes transitions	• Reflects some organization throughout • Demonstrates logical progression of ideas at times • Maintains a vague focus • May utilize some ineffective transitions	• Reflects little/no organization • Lacks logical progression of ideas • Maintains little/no focus • Utilizes ineffective or no transitions
Content X_____	• Is accurate, explicit, and vivid • Exhibits ideas that are highly developed and enhanced by specific details and examples	• Is accurate and relevant • Exhibits ideas that are developed and supported by details and examples	• May contain some inaccuracies • Exhibits ideas that are partially supported by details and examples	• Is inaccurate and unclear • Exhibits limited/no ideas supported by specific details and examples
Use of Language X_____	• Demonstrates excellent use of language • Demonstrates a highly effective use of standard writing that enhances communication • Contains few or no errors. Errors do not detract from meaning	• Demonstrates competent use of language • Demonstrates effective use of standard writing conventions • Contains few errors. Most errors do not detract from meaning	• Demonstrates use of language • Demonstrates use of standard writing conventions • Contains errors that detract from meaning	• Demonstrates limited competency in use of language • Demonstrates limited use of standard writing conventions • Contains errors that make it difficult to determine meaning

Rubric 3: Problem Solving through Critical Thinking

Category/Weight	Exemplary 4	Goal 3	Working Toward Goal 2	Needs Support 1-0
Understanding X_____	Student demonstrates clear understanding of the problem and the complexities of the task	Student demonstrates sufficient understanding of the problem and most of the complexities of the task	Student demonstrates some understanding of the problem but requires assistance to complete the task	Student demonstrates limited or no understanding of the fundamental problem after assistance with the task
Research X_____	Student gathers compelling information from multiple sources including digital, print, and interpersonal	Student gathers sufficient information from multiple sources including digital, print, and interpersonal	Student gathers some information from few sources including digital, print, and interpersonal	Student gathers limited or no information
Reasoning and Strategies X_____	Student demonstrates strong critical thinking skills to develop a comprehensive plan integrating multiple strategies	Student demonstrates sufficient critical thinking skills to develop a cohesive plan integrating strategies	Student demonstrates some critical thinking skills to develop a plan integrating some strategies	Student demonstrates limited or no critical thinking skills and no plan
Final Product and/or Presentation X_____	Solution shows deep understanding of the problem and its components. Solution shows extensive use of 21st Century Technology Skills.	Solution shows sufficient understanding of the problem and its components. Solution shows sufficient use of 21st Century Technology Skills.	Solution shows some understanding of the problem and its components. Solution shows some use of 21st Century Technology Skills.	Solution shows limited or no understanding of the problem and its components. Solution shows limited or no use of 21st Century Technology Skills.

Rubric 5: Independent Learners And Thinkers

Category/Weight	Exemplary 4	Goal 3	Working Toward Goal 2	Needs Support 1-0
Proposal X_____	Student demonstrates a strong sense of initiative by generating compelling questions, creating uniquely original projects/work.	Student demonstrates initiative by generating appropriate questions, creating original projects/work.	Student demonstrates some initiative by generating questions, creating appropriate projects/work.	Student demonstrates limited or no initiative by generating few questions and creating projects/work.
Independent Research & Development X_____	Student is analytical, insightful, and works independently to reach a solution.	Student is analytical, and works productively to reach a solution.	Student reaches a solution with direction.	Student is unable to reach a solution without consistent assistance.
Presentation of Finished Product X_____	Presentation shows compelling evidence of an independent learner and thinker. Solution shows deep understanding of the problem and its components. Solution shows extensive and appropriate application of 21st Century Skills.	Presentation shows clear evidence of an independent learner and thinker. Solution shows adequate understanding of the problem and its components. Solution shows adequate application of 21st Century Skills.	Presentation shows some evidence of an independent learner and thinker. Solution shows some understanding of the problem and its components. Solution shows some application of 21st Century Skills.	Presentation shows limited or no evidence of an independent learner and thinker. Solution shows limited or no understanding of the problem. Solution shows limited or no application of 21st Century Skills.