Greenwich Public Schools Curriculum Overview

ADVANCED PLACEMENT CALCULUS AB

Personalized learning is achieved through standards-based, rigorous and relevant curriculum that is aligned to digital tools and resources.

Note: Teachers retain professional discretion in how the learning is presented based on the needs and interests of their students.

Course Description

AP Calculus AB
Full Year
029100 6 Blocks 1 Credit

Prerequisite: Honors Precalculus with a B or better and teacher recommendation or Precalculus 1 and 2 with an A- or better and teacher recommendation.

This course is the equivalent to a one semester college course in Calculus. Topics include limits, differentiation, integration and applications of these topics. Students taking this course are expected to take the corresponding national Advanced Placement exam given in May.

Unit Guide

Chapter 2: Limits and Continuity
Chapter 3: Derivatives
Chapter 4: Applications of Derivatives
Midterm Review & Midterm Exam*
Chapter 5: Definite Integral
Chapter 6: Differential Equations and Mathematical Modeling
Chapter 7: Applications of Definite Integrals
Final Review & Final Exam*

***Note**: Semester exam review packets, answer keys and formula sheets can be found by joining our **Schoology** *Math Department Review Course*, using COURSE access code P9V9X-H6V37.

Common Core Mathematical Practices

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.

AP CALCULUS Mathematical Practices (page 14 of hyperlinked document):

- *Implementing Mathematical Processes:* Determine expressions and values using mathematical procedures and rules
- *Connecting Representations:* Translate mathematical information from a single representation or across multiple representations.
- *Justification:* Justify reasoning and solutions.
- *Communication and Notation:* Use correct notation, language, and mathematical conventions to communicate results or solutions.

Enduring Understandings

- *Chapter 2*:
  - Calculus allows us to generalize knowledge about motion to diverse problems involving change.
  - The concept of a limit can be used to understand the behavior of functions.
  - Continuity is a key property of functions that is defined using limits.
  - Reasoning with definitions, theorems, and properties can be used to justify claims about limits.
  - Derivatives allow us to determine rates of change at an instant by applying limits to knowledge about rates of change over intervals.
- *Chapter 3*:
  - The derivative of a function is defined as the limit of a difference quotient and can be determined using a variety of strategies.
  - Recognizing that a function's derivative may also be a function allows us to develop knowledge about the related behaviors of both.
  - Recognizing opportunities to apply derivative rules can simplify differentiation.
  - Derivatives allow us to determine rates of change at an instant by applying limits to knowledge about rates of change over intervals.
  - A function's derivative can be used to understand some behaviors of the function.
- *Chapter 4*:
  - Existence theorems allow us to draw conclusions about a function's behavior on an interval without precisely locating that behavior.
  - The Mean Value Theorem connects the behavior of a differentiable function over an interval to the behavior of the derivative of that function at a particular point in the interval.
  - L'Hospital's Rule allows us to determine the limits of some indeterminate forms.
  - A function's derivative, which is itself a function, can be used to understand the behavior of the function.
  - Derivatives allow us to solve real-world problems involving rates of change.
- *Chapter 5*:
  - Antidifferentiation is the inverse process of differentiation
  - The Fundamental Theorem of Calculus, which has two distinct formulations, connects differentiation and integration.
  - Definite integrals allow us to solve problems involving the accumulation of change over an interval.
  - Recognizing opportunities to apply knowledge of geometry and mathematical rules can simplify integration.
- *Chapter 6*:
  - Antidifferentiation is an underlying concept involved in solving separable differential equations.
  - Solving separable differential equations involves determining a function or relation

    - given its rate of change.
    - Solving differential equations allows us to determine functions and develop models.
- *Chapter 7*:
    - Definite integrals allow us to solve problems involving the accumulation of change in area or volume over an interval.
    - The definite integral of a function over an interval is a mathematical tool with many interpretations and applications involving accumulation.

<u>Essential Questions</u>

- *Chapter 2*:
    - Can change occur at an instant?
    - How does knowing the value of a limit, or that a limit does not exist, help you to make sense of interesting features of functions and their graphs?
    - How do we close loopholes so that a conclusion about a function is always true?
    - How can a state determine the rate of change in high school graduates at a particular level of public investment in education (in graduates per dollar) based on a model for the number of graduates as a function of the state's education budget?
    - If you knew that the rate of change in high school graduates at a particular level of public investment in education (in graduates per dollar) was a positive number, what might that tell you about the number of graduates at that level of investment?
- *Chapter 3*:
    - How does knowing the value of a limit, or that a limit does not exist, help you to make sense of interesting features of functions and their graphs?
    - Why do mathematical properties and rules for simplifying and evaluating limits apply to differentiation?
    - If pressure experienced by a diver is a function of depth and depth is a function of time, how might we find the rate of change in pressure with respect to time?
- *Chapter 4*:
    - How are problems about position, velocity, and acceleration of a particle in motion over time structurally similar to problems about the volume of a rising balloon over an interval of heights, the population of London over the 14th century, or the metabolism of a dose of medicine over time?
    - Since certain indeterminate forms seem to actually approach a limit, how can we determine that limit, provided it exists?
    - How might the Mean Value Theorem be used to justify a conclusion that you were speeding at some point on a certain stretch of highway, even without knowing the exact time you were speeding?
    - What additional information is included in a sound mathematical argument about optimization that a simple description of an equivalent answer lacks?
- *Chapter 5*:
    - How is integrating to find areas related to differentiating to find slopes?
    - If compounding more often increases the amount in an account with a given rate of return and term, why doesn't compounding continuously result in an infinite account balance, all other things being equal?
    - Given information about a rate of population growth over time, how can we determine how much the population changed over a given interval of time?
- *Chapter 6*:
    - How can we derive a model for the number of computers, C, infected by a virus, given a model for how fast the computers are being infected, $\frac{dC}{dt}$, at a particular time?

- *Chapter 7*:
    - How is finding the number of visitors to a museum over an interval of time based on information about the rate of entry similar to finding the area of a region between a curve and the x-axis?

Resources and Assured Experiences

Textbook Information:
Calculus: Graphical, Numerical, Algebraic
Finney, Demana, Waits, Kennedy
Pearson/Prentice Hall, 3rd edition, 2007
ISBN: 0132014084

AP Classroom

Quarterly Grading - Quarter Grades will be determined using the following components:

- Participation (includes Classwork) = 5%
- Preparation (includes Homework) = 5%
- Assessments (both Summative & Formative) = 90%

Connecticut Common Core State Standards

- *Chapter 3*: CCSS.MATH.CONTENT.HSF.IF.A.2, B.4; HSA.REI.B.3.

AP CALCULUS Mathematical Practices (page 14 of hyperlinked document)

- *Chapter 2:* 1.E, 2.B, 2.D, 3.B, 3C, 3.D, 3.E.
- *Chapter 3*: 1.C, 1.D, 1.E, 2.C, 2.D, 2.E, 3.C, 3.D, 3.E, 3.G, 4.C.
- *Chapter 4*: 1.D, 1.E, 2.A, 2.C, 2.D, 2.E, 3.D, 3.E, 3.F.
- *Chapter 5*: 1.D, 1.E, 1.F, 2.A, 2.B, 2.C, 2.D, 3.D, 4.B, 4.C.
- *Chapter 6*: 1.E, 2.C, 3.D, 3.F, 3.G, 4.D.
- *Chapter 7*: 1.D, 1.E, 2.B, 2.D, 3.D, 4.C, 4.E.