Leonia School District

AP Calculus BC

10-12

Course Description

AP Calculus BC is roughly equivalent to both first and second semester college calculus courses. It extends the content learned in AB to different types of equations (polar, parametric, vector-valued) and new topics (such as Euler's method, integration by parts, partial fraction decomposition, and improper integrals), and introduces the topic of sequences and series. The AP course covers topics in differential and integral calculus, including concepts and skills of limits, derivatives, definite integrals, the Fundamental Theorem of Calculus, and series. The course teaches students to approach calculus concepts and problems when they are represented graphically, numerically, analytically, and verbally, and to make connections amongst these representations. Students learn how to use technology to help solve problems, experiment, interpret results, and support conclusions.

Students will have opportunity to work collaboratively, think critically, and problem solve, in addition to other 21st century skills.

Pacing Guide

Time Frame	Unit Title
4 weeks	AB Calculus Review
4 weeks	Applications of Integration
4 weeks	Differential Equations
4 weeks	Integration Techniques, L'Hopital's , Improper
10 Weeks	Infinite Series
10 Weeks	Parametric Equations, Polar Graphs, Vectors

Born on:
Board Approved:
Readopted:

Unit 1 - AB Calculus Review

Goals/Objectives of Unit:

- How do you find and interpret the limit of a function for a certain value of x?
- How do you evaluate limits that cannot be solved through use of direct substitution?
- How do you find the limits of functions at infinity?
- How are the concepts of limits and continuity related?
- In what ways can a limit fail to exist?
- How do you find the slope of a graph at any single point?
- Are all functions differentiable at every point?
- What is differential calculus?
- How do numerous results depend on the Mean Value Theorem?
- How do you use the first derivative to determine whether a function is increasing or decreasing?
- How do you use the second derivative to determine whether the graph of a function is concave upward or concave downward?
- How do you find horizontal asymptotes of the graph of a function?
- How do you use calculus to sketch the graphs of functions?
- How do you solve optimization problems?
- How do you use approximation techniques to solve problems?
- How can derivatives be used to draw conclusions about extreme values of a function and the
- general shape of a function's graph.
- How does a tangent line capture the shape of a curve near a point of tangency?
- How can we deduce the rate of change of a function we cannot measure from rates of change
- we already know?
- How can we find a function when we know its derivative?

Core Instructional Resources/Materials:

Calculus A single variable

NJ-Student Learning Standards:

Unit 2 - Applications of Integration

Goals/Objectives of Unit:

1. Find the area of a region between two curves using integration.
2. Find the area of a region between intersecting curves using integration.
3. Describe integration as an accumulation process.
4. Find the volume of a solid of revolution using the disk method.
5. Find the volume of a solid of revolution using the washer method.
6. Find the volume of a solid with known cross section.
7. Find the arc length of a curve over an interval.

Core Instructional Resources/Materials:

Calculus A single variable

NJ-Student Learning Standards:

Unit 3 - Differential Equations

Goals/Objectives of Unit:

1. Find an antiderivative using integration by parts.
2. Understand the concept of partial fraction decomposition.
3. Use partial fraction decomposition with linear factors to integrate rational functions.
4. Recognize limits that produce indeterminate forms.
5. Apply L'Hopital's Rule to evaluate a limit.
6. Evaluate an improper integral that has an infinite limit of integration.
7. Evaluate an improper integral that has an infinite discontinuity

Core Instructional Resources/Materials:

Calculus A single variable

NJ-Student Learning Standards:

Unit 4 - Integration Techniques, L'Hopital's ,

Improper

Goals/Objectives of Unit:
1. Construct antiderivatives using the Fundamental Theorem of Calculus.
2. Solve initial value problems.
3. Construct slope fields and interpret slope fields as visualizations of different equations.
4. Use Euler's Method for graphing a solution to an initial value problem.
5. Solve problems involving exponential or logistic population growth.

Core Instructional Resources/Materials:
Calculus A single variable

NJ-Student Learning Standards:
HSA-SSE.B.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★
HSA-SSE.B.3a. Factor a quadratic expression to reveal the zeros of the function it defines.
HSA-SSE.B.3b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

HSF-IF.C.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
HSF-IF.C.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

Unit 5 - Infinite Series

Goals/Objectives of Unit:

- Determine whether a series diverges or converges
- Determine or estimate the sum of a series
- Construct and use Taylor polynomials
- Write a power series representing a given function
- Determine the radius and interval of convergence for a power series
- Use the Lagrange error bound to determine the accuracy of a Taylor approximation

Core Instructional Resources/Materials:
Calculus A single variable

NJ-Student Learning Standards:
HSA-SSE.B.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★
HSA-SSE.B.3a. Factor a quadratic expression to reveal the zeros of the function it defines.
HSA-SSE.B.3b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

HSF-IF.C.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
HSF-IF.C.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

Unit 6 - Parametric Equations, Polar Graphs, Vectors

Goals/Objectives of Unit:

- Sketch a curve represented by parametric equations
- Convert between rectangular and parametric equations
- Find the slope of a tangent line to a polar graph
- Find the area of a region bounded by a polar graph
- Convert polar coordinates to rectangular coordinates

Core Instructional Resources/Materials:
Calculus A single variable

NJ-Student Learning Standards:
HSA-SSE.B.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★
HSA-SSE.B.3a. Factor a quadratic expression to reveal the zeros of the function it defines.
HSA-SSE.B.3b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

HSF-IF.C.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
HSF-IF.C.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

General Assessments (may include but not limited to):

Possible Summative Assessment:

- Pre/Post Assessments
- Chapter tests
- AP Exam

Optional Daily Assessment:

- Exit ticket/survey (game/web-based: Kahoot!, Pear Deck, EdPuzzle, Plickers, Quizizz, FlipGrid, Google Suite)
- Reflection/self-assessment tool
- Graphic organizers
- Anecdotal notes/teacher observations