MIDLAND PARK PUBLIC SCHOOLS
Midland Park, New Jersey
CURRICULUM

Calculus (Honors/AP)

Prepared by:
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Approved by the Midland Park Board of Education on September 16, 2014

Calculus AP

Course Description:

AP calculus consists of a full high school academic year of work and is comparable to calculus courses in colleges and universities. It is expected that students who take AP calculus will seek college credit, college placement, or both.

AP calculus is intended to be challenging and demanding, and is primarily concerned with developing the students' understanding of the concepts of calculus and providing experience with its methods and applications. Emphasis is on a multi representational approach to calculus, with concepts, results, and problems being expressed graphically, numerically, analytically, and verbally. The connections among these representations also are important.

Through the use of the unifying themes of derivatives, integrals, limits, approximation, and applications and modeling, the course becomes a cohesive whole rather than a collection of unrelated topics. These themes are developed using prerequisite elementary functions including linear, polynomial, rational, exponential, logarithmic, trigonometric, inverse trigonometric and piecewise-defined functions.

Technology will be used regularly by students and teacher to reinforce the relationships among the multiple representations of functions, to confirm written work, to implement experimentation, and to assist in interpreting results.

***Suggested Course Sequence*:**

Unit 1: *Limits and Their Properties*: 3 weeks

Unit 2: *Differentiation*: 5 weeks

Unit 3: *Applications of Differentiation*: 5 weeks

Unit 4: *Integration*: 5 weeks (1 week for accumulation and net change included)

Unit 5: *Logarithmic, Exponential, and Other Transcendental Function*: 5 weeks (*1 week for practice included*)

Unit 6: *Differential Equations*: 2 weeks

Unit 7: *Applications of Integration*: 2 weeks

Unit 8: *Integration Techniques and Exam Review*: 3 weeks

Unit 9: *Selected Topics in Calculus: 4 weeks*

***Prerequisites*:** Before studying calculus, students should complete all four years of secondary mathematics designed for college-bound students: Algebra 1, algebra 2, geometry and pre-calculus. Students need to be familiar with elementary functions (constant, linear, polynomial, rational, exponential, logarithmic, trigonometric, inverse trigonometric and piecewise-defined) and their graphs. In particular, before studying calculus, students must be familiar with the properties of functions, the algebra of functions, and the graphs of functions. Students must also understand the language of functions (domain and range, odd and even, periodic, symmetry, zeros, intercepts, increasing and decreasing, extreme values and the like) and know the values of the trigonometric functions of the "special angles", $0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}$ and their multiples.

Unit Overview

Content Area:	Calculus
Unit Title:	Limits and Their Properties – Unit 1
Target Course/Grade Level:	12

Unit Summary: Find limits of functions analytically, graphically, and numerically.

21st century themes: Critical Thinking and Problem Solving, Collaboration, Teamwork and Leadership, Accountability, Productivity and Ethics, Creativity and Innovation

Learning Targets

Standards: NJ CCSS High School Mathematics

CPI#	Cumulative Progress Indicator (CPI)
F-IF-1,2	Understand the concept of a function and use function notation.
F-IF- 4,6	Interpret functions that arise in applications in terms of the context
F-IF -9	Analyze functions using different representations

Unit Essential Questions:

- What is a limit and why is it important to calculus?
- How does the idea of a limit solve the tangent line problem? The area problem?
- What is the meaning of infinity and why is it important for finding a limit?
- How is a limit found?

Unit Enduring Understandings:

- The limit process is a fundamental concept of calculus.
- The limit process transforms the more static pre-calculus mathematics into dynamic calculus mathematics.

Unit Learning Targets

Students will...

- Understand what calculus is and how it compares with pre-calculus.
- Understand that both the tangent line problem and the area problem are basic to calculus.
- Estimate a limit using a numerical or graphical approach.
- Learn different ways that a limit can fail to exist.
- Evaluate a limit using properties of limits.
- Develop and use a strategy for finding limits.
- Evaluate a limit using dividing out and rationalizing techniques.
- Evaluate a limit using the Squeeze Theorem.
- Determine continuity at a point and on an open interval.
- Determine one-sided limits and continuity on a closed interval.
- Use properties of continuity.
- Understand and use the Intermediate Value Theorem.
- Determine the infinite limits from the left and from the right.
- Find and sketch the vertical asymptotes of the graph of a function.
- Determine (finite) limits at infinity.
- Determine the horizontal asymptotes, if any, of the graph of a function.
- Determine infinite limits at infinity.

Evidence of Learning

Summative Assessment (1 day)
Unit test (multiple choice and free response questions)

Equipment Needed: Computer/web access, computer/ projector, document camera, TI 84 calculator
Teacher Resources: Text Book: *Calculus of a Single Variable* by Larson, Hostetler and Edwards, *Get-a-Five* website, Winplot, Geometers Sketchpad with *Calculus in* Motion and *Algebra in Motion,* power points, Collegeboard and college calculus websites, AP community forum

Formative Assessments

- Quizzes (written and oral)
- Journals
- AP problem sets
- Video quizzes
- Do Now's
- Exit questions
- Group work
- Homework
- On-Spot checking

Lesson Plans

Lesson #	Lesson Name	Time frame (hours/days)
1	A Preview of Calculus	1 day
2	Finding Limits Graphically and Numerically	3 days
3	Evaluating Limits Analytically	3 days
4	Continuity and One-Sided Limits	3 days
5	Infinite Limits	2 days
6	Limits at Infinity	2 days

Teacher Notes: *Limits at Infinity* can be found in Section 3.5 of the text book

Curriculum Development Resources
Click links below to access additional resources used to design this unit:

https://www.getafive.com/
https://apcommunity.collegeboard.org/web/guest/login?
http://www.linmcmullin.net/
http://www.calculus-help.com/funstuff
http://online.math.uh.edu/HoustonACT/videocalculus/
http://rowdy.msudenver.edu/~talmanl/APCalculus.html

Unit Overview

Content Area:	Calculus
Unit Title:	Differentiation – Unit 2
Target Course/Grade Level:	12

Unit Summary:
Use limits to find slopes of tangent lines to graphs.

21st century themes: Critical Thinking and Problem Solving, Creativity and Innovation, Collaboration, Teamwork, and Leadership, Accountability, Productivity, and Ethics.

Learning Targets

Standards: NJ CCSS High School Mathematics

CPI#	Cumulative Progress Indicator (CPI)
F-IF-1,2	Understand the concept of a function and use function notation.
F-IF- 4,5,6	Interpret functions that arise in applications in terms of the context.
F-IF -9	Analyze functions using different representations.
F-BF - 1	Build a function that models a relationship between two quantities.

Unit Essential Questions

- How does local linearity allow us to evaluate a limit?
- How does the concept of a limit lead to a derivative?
- How is a derivative calculated?
- How is the equation of a tangent line found?
- How are derivatives used to solve real world related rates problems?

Unit Enduring Understandings

- Analysis of the critical elements of functions is essential to calculus.
- Functions can be analyzed graphically by their limiting behavior and rates of change.

Unit Learning Targets

Students will...

- Use the idea of local linearization to evaluate a limit.
- Find the slope of a tangent line to a curve at a point.
- Use the limit definition to find the derivative of a function.
- Understand the relationship between differentiability and continuity.
- Find the derivative of a function using the Constant Rule, the Power Rule, the Constant Multiple Rule, and the Sum and Difference Rules.
- Find the derivative of the Sine function and the Cosine function.
- Use derivatives to find rates of change.
- Find the derivative of a function using the Product Rule and the Quotient Rule.
- Find the derivative of a trigonometric function.
- Find the higher-order derivative of a function.
- Find the derivative of a composite function using the Chain Rule.
- Find the derivative of a function using the General Power Rule.
- Simplify the derivative of a function using algebra.
- Find the derivative of a trigonometric function using the Chain Rule.
- Distinguish between functions written in implicit form and explicit form.
- Use implicit differentiation to find the derivative of a function.
- Find a related rate.
- Use related rates to solve real-life problems.

Evidence of Learning

Summative Assessment (1 day)
Unit test (multiple choice and free response questions)

Equipment Needed: Computer/web access, computer/ projector, document camera, TI 84 calculator
Teacher Resources: Text Book: *Calculus of a Single Variable* by Larson, Hostetler and Edwards, *Get-a-Five* website, Winplot, Geometers Sketchpad with *Calculus in* Motion and *Algebra in Motion,* power points, Collegeboard and college calculus websites, AP community forum

Formative Assessments

- Quizzes (written and oral)
- Journals
- AP problem sets
- Video quizzes
- Differentiation Gateway
- Do Now's
- Exit questions
- Group work
- Homework
- On-Spot checking

Lesson Plans

Lesson #	Lesson Name	Time frame (hours/days)
1	Local Linearization	1 day
2	The Derivative and the Tangent Line Problem	5 days
3	Basic Differentiation Rules and Rates of Change	4 days
4	Product and Quotient Rules and Higher-Order Derivatives	3 days
5	The Chain Rule	4 days
6	Implicit Differentiation	3 days
7	Related Rates	3 days

Teacher Notes: Local Linearization is not covered in the text book

Curriculum Development Resources
Click links below to access additional resources used to design this unit:

https://www.getafive.com/
http://apcentral.collegeboard.com/apc/public/courses/teachers_corner/2178.html
http://www.linmcmullin.net/
http://www.jamesrahn.com/homepages/calculus.htm
http://www.usna.edu/MathDept/website/courses/calc_labs/deriv/Deriv.html
http://online.math.uh.edu/HoustonACT/videocalculus/
http://rowdy.msudenver.edu/~talmanl/APCalculus.html

Unit Overview

Content Area:	Calculus
Unit Title:	Applications of Differentiation – Unit 3
Target Course/Grade Level:	**12**

Unit Summary:
Use calculus to analyze graphs of functions.

21st century themes: Critical Thinking and Problem Solving, Creativity and Innovation, Collaboration, Teamwork, and Leadership, Accountability, Productivity, and Ethics.

Learning Targets

Standards: NJ CCSS High School Mathematics

CPI#	Cumulative Progress Indicator (CPI)
F-IF - 2	Understand the concepts of a function and use function notation.
F-IF- 4,5	Interpret functions that arise in applications in terms of the context.
F-IF- 7,9	Analyze functions using different representations.
F-BF- 1	Build a function that models a relationship between two quantities.
F-BF- 3	Build new functions from existing functions.

Unit Essential Questions

- How is calculus used to solve real world optimization problems?
- How is calculus used to analyze the behavior of a function?

Unit Enduring Understandings

- Limits are the underlying concept supporting physical applications that are imbedded in many fields.
- Functions can be analyzed graphically by their limiting behavior and rates of change.

Unit Learning Targets

Students will...

- Understand the definition of extrema of a function on an interval.
- Understand the definition of relative extrema on an open interval.
- Find extrema on a closed interval.
- Understand and use Rolle's Theorem.
- Understand and use the Mean Value Theorem
- Determine intervals on which a function is concave upward or concave downward.
- Find any points of inflection of the graph of a function.
- Apply the Second Derivative Test to find relative extrema of a function.
- Analyze and sketch the graph of a function.
- Solve applied minimum and maximum problems.
- Understand the concept of a tangent line approximation.
- Compare the value of the differential, dy, with the actual change in y, Δy.
- Use differentials to approximate values of functions.
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Evidence of Learning

Summative Assessment (1 day)
Unit test (multiple choice and free response questions)
Differentiation Gateway

Equipment Needed: Computer/web access, computer/ projector, document camera, TI 84 calculator
Teacher Resources: Text Book: *Calculus of a Single Variable* by Larson, Hostetler and Edwards, *Get-a-Five* website, Winplot, Geometers Sketchpad with *Calculus in* Motion and *Algebra in Motion,* power points,

Collegeboard and college calculus websites, AP community forum.

Formative Assessments

- Quizzes (written and oral)
- Journals
- AP problem sets
- Video quizzes
- Do Now's
- Exit questions
- Group work
- Homework
- On-Spot checking

Lesson Plans

Lesson #	Lesson Name	Time frame (hours/days)
1	Extrema on an Interval	3 days
2	Rolle's Theorem and the Mean Value Theorem	3 days
3	Increasing and Decreasing Functions and the First Derivative Test	2 days
4	Concavity and the Second Derivative Test	2 days
5	Connecting f, f', f''	3 days
6	A Summary of Curve Sketching	2 days
7	Optimization Problems	5 days
8	Differentials and Tangent Line Approximation	3 days

Teacher Notes: Use supplemental materials for Connecting , f', f'' , it is not covered in the textbook.
Distribute integration differentiation gateway practice materials during unit to prepare for the differentiation gateway to be administered at the end of this unit.

Curriculum Development Resources

Click links below to access additional resources used to design this unit:

https://www.getafive.com/
http://apcentral.collegeboard.com/apc/public/courses/teachers_corner/2178.html
http://www.linmcmullin.net/
http://www.jamesrahn.com/homepages/calculus.htm
http://home.comcast.net/~ruhlep/AP%20Calculus/Handouts/4.3%20connecting%20f%20with%20derivative%20graphs.pdf
http://astro.temple.edu/~dhill001/maxmin/maxmin.html#Credits
http://online.math.uh.edu/HoustonACT/videocalculus/
http://rowdy.msudenver.edu/~talmanl/APCalculus.html

Unit Overview

Content Area:	Calculus
Unit Title:	Integration – Unit 4
Target Course/Grade Level:	12

Unit Summary: Use limits to calculate area of a region.

21st century themes: Critical Thinking and Problem Solving, Creativity and Innovation, Collaboration, Teamwork, and Leadership, Accountability, Productivity, and Ethics.

Learning Targets

Standards: NJ CCSS High School Mathematics

CPI#	Cumulative Progress Indicator (CPI)
F-IF - 2	Understand the concepts of a function and use function notation.
F- 4,5,6	Interpret functions that arise in applications in terms of the context.
F-IF- 7,9	Analyze functions using different representations.
F-BF- 1	Build a function that models a relationship between two quantities.
F-LE- 5	Interpret expressions for functions in terms of the situation they model.

Unit Essential Questions

- How is the limit process used to calculate the area of a region?
- How do differential equations describe rates of change?
- How are integrals used to measure changing quantities?
- How does the Fundamental Theorem of Calculus connect differential and integral calculus?

Unit Enduring Understandings

- Integration is the other half of calculus.
- Integration is closely related to differentiation.
- The limit process can be used to find areas of a wide variety of regions

Unit Learning Targets

Students will...

- Write the general solution of a differential equation.
- Use indefinite integral notation for antiderivatives.
- Use basic integration rules to find antiderivatives.
- Find a particular solution of a differential equation.
- Use sigma notation to write and evaluate a sum.
- Understand the concept of area.
- Approximate the area of a plane region.
  Find the area of a plane region using limits.
- Understand the definition of a Riemann sum.
- Evaluate a definite integral using limits.
- Evaluate a definite integral using properties of definite integrals.

- Evaluate a definite integral using the Fundamental Theorem of Calculus.
- Understand and use the Mean Value Theorem for Integrals.
- Find the average value of a function over a closed interval.
- Understand and use the Second Fundamental Theorem of Calculus.
- Use pattern recognition to find an indefinite integral.
- Use a change of variables to find an indefinite integral.
- Use the General Power Rule for Integration to find an indefinite integral.
- Use change of variables to find a definite integral.
- Evaluate a definite integral involving an even or odd function.
- Approximate a definite integral using the Trapezoidal Rule.

Evidence of Learning

Summative Assessment (1 day)
Unit test (multiple choice and free response questions)

Equipment Needed: Computer/web access, computer/ projector, document camera, TI 84 calculator
Teacher Resources: Text Book: *Calculus of a Single Variable* by Larson, Hostetler and Edwards, *Get-a-Five* website, Winplot, Geometers Sketchpad with *Calculus in* Motion and *Algebra in Motion,* power points, Collegeboard and college calculus websites, AP community forum

Formative Assessments

- Quizzes (written and oral)
- Journals
- AP problem sets
- Video quizzes
- Do Now's
- Exit questions
- Group work
- Homework
- On-Spot checking

Lesson Plans

Lesson #	Lesson Name	Time frame (hours/days)
1	Area exploration	3 days
2	Antiderivatives and Indefinite Integration	3 days
3	Area	3 days
4	Riemann Sums and Definite Integrals	3 days
5	The Fundamental Theorem of Calculus	3 days
6	Integration by Substitution	3 days
7	Numerical Integration	1 day
8	Accumulation as Net Change and FTC-2 with a twist	5 days

Teacher Notes: Use Winplot for area exploration. This is not covered in the text book.
Accumulation as Net Change and FTC-2 with a twist is not covered in the textbook. Do these after the unit test as a separate sub-unit. This will require an additional week of class time.

Curriculum Development Resources

Click links below to access additional resources used to design this unit:

https://www.getafive.com/
http://apcentral.collegeboard.com/apc/public/courses/teachers_corner/2178.html
http://www.linmcmullin.net/
http://math.exeter.edu/rparris/winplot.html
http://online.math.uh.edu/HoustonACT/videocalculus/
http://rowdy.msudenver.edu/~talmanl/APCalculus.html

Unit Overview

Content Area:	Calculus
Unit Title:	Logarithmic, Exponential, and Other Transcendental Functions – Unit 5
Target Course/Grade Level:	12

Unit Summary: Differentiate and integrate using transcendental functions.

21st century themes: Critical Thinking and Problem Solving, Creativity and Innovation, Collaboration, Teamwork, and Leadership, Accountability, Productivity, and Ethics.

Learning Targets

Standards: NJ CCSS High School Mathematics

CPI#	Cumulative Progress Indicator (CPI)
F-IF – 1,2	Understand the concepts of a function and use function notation.
F-IF- 4,5,6	Interpret functions that arise in applications in terms of the context.
F-IF- 7,9	Analyze functions using different representations.
F-BF- 1	Build a function that models a relationship between two quantities.
F-BF – 4,5	Build new functions from existing functions.
F-LE – 1,2,3,4	Construct and compare linear, quadratic, and exponential models and solve problems.
F-LE- 5	Interpret expressions for functions in terms of the situation they model.
F-TF– 3,4	Extend the domain of trigonometric functions using the unit circle
F-TF– 6,7	Model periodic phenomena with trigonometric functions

Unit Essential Questions

- In what ways are the transcendental functions supported by calculus?

Unit Enduring Understandings

- A definite integral can be used to define the natural logarithmic function
- Calculus spans beyond the six basic functions.

Unit Learning Targets

Students will…

- Develop and use properties of the natural logarithmic function.
- Understand the definition of the number *e*.
- Find derivative of functions involving the natural logarithm.
- Use the Log Rule for Integration to integrate a rational function.
- Integrate trigonometric functions.
  Verify that one function is the inverse function of another function.
- Determine whether a function has an inverse function.
- Find the derivative of an inverse function.

- Develop properties of the natural exponential function.
- Differentiate natural exponential functions.
- Integrate natural exponential functions.
- Define exponential functions that have bases other than *e*.
- Differentiate and integrate exponential functions that have bases other than *e*.
- Use exponential functions to model compound interest and exponential growth.
- Develop properties of six inverse trigonometric functions.
- Differentiate an inverse trigonometric function.
- Review the basic differentiation rules for elementary functions.
- Integrate functions whose antiderivatives involve inverse trigonometric functions.
- Review the basic integration rules involving elementary functions.

Evidence of Learning

Summative Assessment (1 day)
Unit test (multiple choice and free response questions)

Equipment Needed: Computer/web access, computer/ projector, document camera, TI 84 calculator
Teacher Resources: Text Book: *Calculus of a Single Variable* by Larson, Hostetler and Edwards, *Get-a-Five* website, Winplot, Geometers Sketchpad with *Calculus in* Motion and *Algebra in Motion,* power points, Collegeboard and college calculus websites, AP community forum

Formative Assessments

- Quizzes (written and oral)
- Journals
- AP problem sets
- Video quizzes
- Integration Gateway
- Do Now's
- Exit questions
- Group work
- Homework
- On-Spot checking

Lesson Plans

Lesson #	Lesson Name	Time frame (hours/days)
1	Review Transcendental Functions	1 day
2	The Natural Logarithmic Function: Differentiation	3 days
3	The Natural Logarithmic Function: Integration	2 days
4	Inverse Functions	3 days
5	Exponential Functions: Differentiation and Integration	3 days
6	Bases Other than *e* and Applications	2 days
7	Inverse Trigonometric Functions: Differentiation	2 days
8	Inverse Trigonometric Functions: Differentiation	1 day
9	Review and Assessment	3 days
10	Integration Practice	3 days

Teacher Notes: Distribute integration gateway practice materials during unit to prepare for the integration gateway to be administered at the end of this unit.

Curriculum Development Resources

Click links below to access additional resources used to design this unit:

ttps://www.getafive.com/
.ittp://apcentral.collegeboard.com/apc/public/courses/teachers_corner/2178.html
http://www.linmcmullin.net/
http://online.math.uh.edu/HoustonACT/videocalculus/
http://rowdy.msudenver.edu/~talmanl/APCalculus.html

Unit Overview

Content Area:	Calculus
Unit Title:	Differential Equations – Unit 6
Target Course/Grade Level:	12

Unit Summary: Sketch slope fields and solve differential equations.

21st century themes: Critical Thinking and Problem Solving, Creativity and Innovation, Collaboration, Teamwork, and Leadership, Accountability, Productivity, and Ethics.

Learning Targets

Standards: NJ CCSS High School Mathematics

PI#	Cumulative Progress Indicator (CPI)
F-IF – 1,2	Understand the concepts of a function and use function notation.
F-IF-5	Interpret functions that arise in applications in terms of the context.
F-IF- 9	Analyze functions using different representations.
F-LE –1,,4	Construct and compare linear, quadratic, and exponential models and solve problems.

Unit Essential Questions

- In what ways are differential equations used in real-world situations?
- How are slope fields used when solving differential equations?

Unit Enduring Understandings

- Differential equations play an important role in many disciplines including engineering, physics, economics, and biology.
- Slope field graphs can be used to solve differential equations.

Unit Learning Targets

Students will...

- Use initial conditions to find particular solutions to differential equations.
- Use slope fields to approximate solutions of differential equations.
- Use Separation of variables to solve a simple differential equation.
- Use exponential functions to model growth and decay in applied problems.
- Recognize and solve differential equations that can be solved by separation of variables.
- Use differential equations to model and solve applied problems.

Evidence of Learning

Summative Assessment (1 day)
Unit test (multiple choice and free response questions)

Equipment Needed: Computer/web access, computer/ projector, document camera, TI 84 calculator
Teacher Resources: Text Book: *Calculus of a Single Variable* by Larson, Hostetler and Edwards, *Get-a-Five* website, Winplot, Geometers Sketchpad with *Calculus in* Motion and *Algebra in Motion,* power points, Collegeboard and college calculus websites, AP community forum

Formative Assessments

- Quizzes (written and oral)
- Journals
- AP problem sets
- Video quizzes
- Do Now's
- Exit questions
- Group work
- Homework
- On-Spot checking

Lesson Plans

Lesson #	Lesson Name	Time frame (hours/days)
1	Slope Fields	3 days
2	Differential Equations: Growth and Decay	3 days
3	Separation of Variables	3 days

Teacher Notes: Omit homogeneous differential equations.
Use Winplot and/or TI-84 graphing calculator to create slope fields.

Curriculum Development Resources
Click links below to access additional resources used to design this unit:

https://www.getafive.com/
http://apcentral.collegeboard.com/apc/public/courses/teachers_corner/2178.html
http://www.linmcmullin.net/
http://online.math.uh.edu/HoustonACT/videocalculus/
http://rowdy.msudenver.edu/~talmanl/APCalculus.html

Unit Overview

Content Area:	Calculus
Unit Title:	Applications of Integration – Unit 7
Target Course/Grade Level:	12

Unit Summary: Use limits to write the exact volume of a solid as a definite integral.

21st century themes: Critical Thinking and Problem Solving, Creativity and Innovation, Collaboration, Teamwork, and Leadership, Accountability, Productivity, and Ethics.

Learning Targets

Standards: NJ CCSS High School Mathematics

CPI#	Cumulative Progress Indicator (CPI)
F-IF – 1,2	Understand the concepts of a function and use function notation.
F-IF- 9	Analyze functions using different representations.
F-LE- 5	Interpret expressions for functions in terms of the situation they model.

Unit Essential Questions	Unit Enduring Understandings
• How are limits used to find the exact volume of an irregular solid	• Limits are the underlying concept supporting physical applications that are imbedded in many fields.

Unit Learning Targets

Students will...

- Find the area of a region between two curves using integration.
- Find the area of a region between two intersecting curves using integration.
- Describe integration as an accumulation process.
- Find the volume of a solid of revolution using the disk method.
- Find the volume of a solid of revolution using the washer method.
- Find the volume of a solid with a known cross section.

Evidence of Learning

Summative Assessment (1 day)

Unit test (multiple choice and free response questions)

Equipment Needed: Computer/web access, computer/ projector, document camera, TI 84 calculator

Teacher Resources: Text Book: *Calculus of a Single Variable* by Larson, Hostetler and Edwards, *Get-a-Five* website, Winplot, Geometers Sketchpad with *Calculus in* Motion and *Algebra in Motion,* power points, Collegeboard and college calculus websites, AP community forum

ormative Assessments

- Quizzes (written and oral)
- Journals
- AP problem sets
- Video quizzes
- Volume project
- Do Now's
- Exit questions
- Group work
- Homework
- On-Spot checking

Lesson Plans

Lesson #	Lesson Name	Time frame (hours/days)
1	Area of a Region Between Two Curves	3 days
2	Volume: The Disk and Washer Methods	5 days

Teacher Notes: Volume project to be assigned after volume with known cross sections is covered. Cover volume with known cross sections before the disk methods in order to assign volume projects in a timely manner.
Use Geometers Sketchpad and Winplot for dynamic visuals of volumes of solids.

Curriculum Development Resources
Click links below to access additional resources used to design this unit:

https://www.getafive.com/
http://apcentral.collegeboard.com/apc/public/courses/teachers_corner/2178.html
http://www.linmcmullin.net/
http://online.math.uh.edu/HoustonACT/videocalculus/
http://rowdy.msudenver.edu/~talmanl/APCalculus.html

Unit Overview	
Content Area:	Calculus
Unit Title:	AP Exam Review – Unit 8
Target Course/Grade Level:	12
Unit Summary: Review for AP Calculus AB exam	
21st century themes: Critical Thinking and Problem Solving, Collaboration, Teamwork, and Leadership,	

Learning Targets

Standards: NJ CCSS High School Mathematics

CPI#	Cumulative Progress Indicator (CPI)
F-IF – 1,2	Understand the concepts of a function and use function notation.
F-IF- 9	Analyze functions using different representations.
F-LE- 5	Interpret expressions for functions in terms of the situation they model.

Unit Essential Questions	Unit Enduring Understandings
• How are calculus concepts presented on the AP Calculus AB exam? • What strategies can be used to perform at best on the exam?	• Math can be communicated verbally, graphically, and using technology.

Unit Learning Targets

Students will...

- Recognize limits that produce indeterminate forms.
- Apply L'Hôpitals Rule to evaluate a limit.
- Communicate mathematics in written form.

Evidence of Learning

Summative Assessment (1day)

AP Calculus AB exam

Equipment Needed: Computer/web access, computer/ projector, document camera, TI 84 calculator

Teacher Resources: College Board AP exam materials

Formative Assessments

- Quizzes
- Free response questions
- Multiple choice packets

Lesson Plans

Lesson #	Lesson Name	Time frame (hours/days)
1	Intermediate Form and L'Hôpitals Rule	1 day
2	Area/Volume	2 days
3	Particle Motion	3 days
4	Accumulation	2 days
5	More Rates	2 days
6	Multiple Choice	2 days
7	Theorems	2 days
8	Identify the top 13 Mistakes	1 day
9	Slope Fields/ Differential Equations	2 days

Teacher Notes: Schedule a practice exam (outside of school hours) if possible.

Curriculum Development Resources

Click links below to access additional resources used to design this unit:

https://www.getafive.com/
http://apcentral.collegeboard.com/apc/public/courses/teachers_corner/2178.html

Unit Overview

ɔntent Area:	Calculus
Unit Title:	Selected Topics in Calculus – Unit 9
Target Course/Grade Level:	12

Unit Summary: Study Calculus topics that are not included on the AP exam.

21st century themes: Critical Thinking and Problem Solving, Creativity and Innovation, Collaboration, Teamwork, and Leadership, Accountability, Productivity, and Ethics.

Learning Targets

Standards: NJ CCSS High School Mathematics

CPI#	Cumulative Progress Indicator (CPI)
F-IF – 1,2	Understand the concepts of a function and use function notation.
F-LE- 5	Interpret expressions for functions in terms of the situation they model.

Unit Essential Questions

- In what additional areas can we study calculus?

Unit Enduring Understandings

- Limits are the underlying concept supporting physical applications that are imbedded in many fields.

Unit Learning Targets

Students will...

- Find the Volume of a solid of revolution using the shell method.
  Find the arc length of a smooth curve.
  Find the work done by a constant and a variable force.
- Find an antiderivative using integration by parts.
- Use a tabular method to perform integration by parts.
- Understand the concept of partial fraction decomposition.
- Use partial fraction decomposition with linear factors to integrate rational functions.
- Use partial fraction decomposition with quadratic factors to integrate rational functions.
- Evaluate an improper integral that has an infinite limit of integration.
- Evaluate an improper integral that has an infinite discontinuity.
- Sketch the graph of a curve given by asset of parametric equations.
- Eliminate the parameter in a set of parametric equations.
- Find a set of parametric equations to represent a curve.
- Find the slope of a tangent line to a curve given by a set of parametric equations.

Evidence of Learning

Summative Assessment (1 day)

Open ended questions

Equipment Needed: Computer/web access, computer/ projector, document camera, TI 84 calculator

Teacher Resources: Text Book: *Calculus of a Single Variable* by Larson, Hostetler and Edwards

rmative Assessments

- Group work
- Homework

- On-Spot checking
- Final project presentations

Lesson Plans

Lesson #	Lesson Name	Time frame (hours/days)
1	Volume: The Shell Method	As time permits
2	Arc Length and Surfaces of Revolution	As time permits
3	Work	As time permits
4	Integration by Parts	As time permits
5	Partial Fractions	As time permits
6	Improper Integrals	As time permits
7	Parametric Equations	As time permits

Teacher Notes: Select a minimum of four topics determined by remaining time available. Students will be given two weeks to learn and create their lesson, and two class periods each to present their topics.

Curriculum Development Resources

'ick links below to access additional resources used to design this unit: N/A

Calculus AB

2007 - 2008

Brief Description of Course

My main objective in teaching AP Calculus AB is to get the students to understand the "why" behind the major idea as opposed to just memorizing the facts. When a student understands the reason for the ideas presented, then the application of these ideas can be quite satisfying therefore giving the motivation that drives the course. I accomplish this by presenting topics and investigating ideas using the rule of four; graphically, verbally, numerically and analytically. Students are expected to relate the various representations to each other.

Unit Information

Unit Name or Timeframe:
Chapter 1 : The Cartesian Plane and Functions (2-weeks)
A) Lines in a Plane
1. Slope as a rate of change
2. Parallel and pependicular lines
3. Equations of lines
B) Graphs of equations
1. Intercepts
2. Symmetry
C) Functions
1. Graphs of functions
2. Domain and Range
3. Even and odd functions
4. Composite functions
5. Piecewise functions

Content and/or Skills Taught:
The students are expected to have their graphing calculator in class each day and it is used daily throughout the course. During this review period, the students use their calculator to further explore the properties of functions found algebraically. The students practice graphing functions in a specified window.

Major Assignments and/or Assessments:

Unit Name or Timeframe:
Chapter 2 Limits and Continuity (3-weeks)
A) Finding limits
1. Graphs and tables
2. Evaluating limits algebraically
a) Substitution
b) Factor
c) Conjugate
3. Limits that fail to exist
4. One-sided limits

B) Continuity
1. Continuous functions
2. Continuity of a piecewise function
3. Classification of discontinuity
a) Point (removable)
b) Jump
c) Infinite
4. Intermediate Value Theorem
C) Infinite limits
1. Vertical asymptotes

Content and/or Skills Taught:
The students use the table feature on the graphing calculator to investigate the limit of a function numerically. The students can see the heights of a function getting closer and closer to a number that they come to realize is the limit.
The same technique is used while investigating a limit at a point discontinuity. The students find that the y-coordinate disappears when they reach the point of discontinuity on the table.
I often display a phrase across the top of the white board giving the students a thought for the day which I call my "banner for the day". After the class has investigated limits through graphs and tables, the "banner for the day" is "Graphs and tables are not sufficient to prove an idea. Verification always requires an analytic argument". This usually stirs a healthy discussion which leads into the next topic, evaluating limits algebraically.

Major Assignments and/or Assessments:
Beginning with this unit, I have the students submit journal writings in order to assess the debth of their understanding of the various topics in Calculus I. For this unit, they must write a journal entry for limits and another for continuity. Students are expected to write in complete sentences and present their explanations clearly.
Also beginning with this unit, the students are assigned a weekly "AP set" which is a multi-part problem similar to the free-response questions on the AP test. As the students gain knowledge, I mix in actual AP test questions. These are assigned on Mondays and due on Fridays, and continue through for the duration of the course. Partial credit is given when methods, reasoning and conclusions are presented clearly. Actual AP free-response questions are graded with the actual AP rubric. The students are given the grading rubric as we review their papers together. This method gives them an early preview into the grading process for the free-response questions on the AP test.

Unit Name or Timeframe:
Chapter 3 Differentiation (6 weeks)
A) Definition of a derivative
1)Limit of the average rate of change
2)Instantaneous rate of change
3)Limit of the difference quotient
4)Differentiability and continuity
B) The derivative
1) Derivative at a point
2) Local linearity
3) Derivative of a function
4) One-sided derivatives
5) Approximating derivatives using the calculator
6) Graphs of derivatives
7) Derivatives that fail to exist

AP Course Audit Form

Print This Page

Initial, Sign & Fax to:
1 800 332 9739
1 888 570 4329
(Canada)
or 1 215 825 8797
(Intl.)

CollegeBoard AP Course Audit Form

Teacher Name: Traitz, Gail — School Code: 310794
School Name: Midland Park High School
School Address: 250 Prospect Street
Midland Park, NJ 07432

AP Requirements

Form ID: 175779

Teacher's Initials	Principal's Initials	Curricular Requirements	Alternate Approach
GT	P.T.	The teacher has read the most recent *AP Calculus AB Course Description*, available as a free download at **apcentral.collegeboard.com/calculusab.**	
GT	P.T.	The course teaches all topics associated with Functions, Graphs, and Limits; Derivatives; and Integrals as delineated in the Calculus AB Topic Outline in the *AP Calculus Course Description*.	
GT	P.T.	The course provides students with the opportunity to work with functions represented in a variety of ways -- graphically, numerically, analytically, and verbally -- and emphasizes the connections among these representations.	
GT	P.T.	The course teaches students how to communicate mathematics and explain solutions to problems both verbally and in written sentences.	
GT	P.T.	The course teaches students how to use graphing calculators to help solve problems, experiment, interpret results, and support conclusions.	

Principal's Initials	Resource Requirements
P.T.	The school ensures that each student has a college-level calculus textbook (supplemented when necessary to meet the curricular requirements) for individual use inside and outside of the classroom.
P.T.	The school ensures that each student has a graphing calculator for individual use inside and outside of the classroom, with all the required capabilities listed in the *AP Calculus Course Description*. (A list of approved graphing calculators is available on AP Central at **apcentral.collegeboard.com/calculusab.**)

Signatures

Both teacher and principal must sign below to verify that your AP course meets the specified requirements. Note: If you indicated that your course does not include a particular element, but nonetheless accomplishes the goals of the corresponding course, you must explain your alternate approach on the syllabus you submit.

Teacher (print name): Gail Traitz Teacher (signature): Gail Traitz

Principal (print name): PATRICIA TERRACIANO Principal (signature): Patricia Terraciano

Form ID: 175779

Susan Schlosser

From: John Schembari
Sent: Wednesday, April 18, 2012 8:42 AM
To: Susan Schlosser
Subject: FW: AP Course List
Attachments: AP Course Ledger.pdf

FYI, put in AP folder and print for Math curriculum binder. Thanks.

From: Marie Pantina
Sent: Tuesday, April 17, 2012 3:29 PM
To: John Schembari
Cc: Nicholas Capuano
Subject: AP Course List

John:

Attached is the AP Course Ledger you requested printed from the College Board website.

You can view the syllabus for each course listed below on the College Board website, www.collegeboard.org Choose the AP tab, AP Course Audit tab, select the academic year 2011-2012. You will be able to view each AP class and syllabus.

Midland Park High School
250 Prospect Street
Midland Park, NJ 074321332

United States History
Matthew Arroyo
Authorization Renewed Download Letter
View Course Audit Form
Syllabus # 842946v1 Authorized
View Syllabus

English Literature and Composition
Sarah Berninger
Authorization Renewed Download Letter
View Course Audit Form
Syllabus # 842943v1 Authorized
View Syllabus

Biology
Raina Dawson
Authorization Renewed Download Letter
View Course Audit Form
Syllabus # 842941v1 Authorized
View Syllabus

Spanish Language
Susana Gonzalez
Authorization Renewed Download Letter
View Course Audit Form

Syllabus # 842944v1 Authorized
View Syllabus

Statistics
.ck Holmes
Authorized Download Letter
View Course Audit Form
Syllabus # 759950v1 Authorized
View Syllabus

Macroeconomics
Edward Mcdonough
Authorization Renewed Download Letter
View Course Audit Form
Syllabus # 842940v1 Authorized
View Syllabus

Chemistry
Lori Menken
Authorization Renewed Download Letter
View Course Audit Form
Syllabus # 842947v1 Authorized
View Syllabus

Spanish Language
Magdalene Ptak
Authorization Renewed Download Letter
ew Course Audit Form
llabus # 842949v1 Authorized
View Syllabus

French Language and Culture
Sheila Steinberg
Authorized Download Letter
View Course Audit Form
Syllabus # 855672v1 Authorized
View Syllabus

U.S. Government and Politics
Nancy Stewart
Authorization Renewed Download Letter
View Course Audit Form
Syllabus # 842945v1 Authorized
View Syllabus

Calculus AB
Gail Traitz
Authorization Renewed Download Letter
View Course Audit Form
Syllabus # 842942v1 Authorized
w Syllabus

Calculus AB
Leon Varjian
Authorization Renewed Download Letter
View Course Audit Form

Marie Pantina
Guidance Secretary
Midland Park High School

John Schembari

From: Nicholas Holmes
Sent: Saturday, August 27, 2011 11:09 AM
To: John Schembari
Cc: Nicholas Capuano
Subject: GOOD NEWS!

AP Course Audit - Your Course Has Been Authorized

AP Stat is ready to go. Thank you both for helping me to get all our ducks in a row. Good luck and stay safe throughout the storm. See ya Tuesday!

Nicholas Holmes

MPHS Math Teacher
Math Coach
Chess Advisor

-----Original Message-----
From: AP Course Audit [mailto:no-reply@epiconline.org]
Sent: Fri 8/26/2011 7:51 PM
To: Nicholas Holmes
Subject: AP Course Audit - Your Course Has Been Authorized

This is an automatic e-mail that does not accept e-mail replies. The below message is located in the Communication Center of your AP Course Audit account. For more information or to respond to this message, please log into your account at http://www.collegeboard.com/apcourseaudit and use the Communication Center link located on your Status page.

Dear Nick Holmes:

The College Board is pleased to announce that your Statistics course syllabus is authorized to use the AP® designation for the 2011 - 2012 academic year at Midland Park High School. The College Board applauds and recognizes your efforts to provide your students with the academic rigor and college-level experience that is the promise of AP. I thank you for the time and effort you put into participating in the AP Course Audit.

What Does Authorization Mean?
The authorization of your syllabus is an official recognition by the College Board that it meets or exceeds the expectations colleges and universities have for your AP subject. Your syllabus was reviewed by experienced college and university faculty, who have confirmed that it outlines how you provide a college-level learning experience for your students. This authorization grants you permission to use the "AP" designation on your students' transcripts in association with the authorized course.

Renewing Your Authorization
Once your course has been authorized, you do not need to resubmit the syllabus unless the College Board significantly revises the AP course. Prior to the 2012 - 2013 school year, you will be sent instructions for extending your authorization status for 2012 - 2013.

We understand that you may need to modify or adapt your syllabus or course plan to address the needs of your students, reflect new discoveries, and try out new approaches. You do not need to resubmit your syllabus when you modify it, as long as you are not changing your course so significantly as to eliminate from your curriculum one or more of the curricular requirements on the AP Course Audit form.

Thank you for all that you do to provide your students with a rigorous, college-level experience. The College Board appreciates your efforts to prepare students for college success.

Sincerely,

Trevor Packer
Vice President
Advanced Placement Program