

OCEAN COUNTY MATHEMATICS CURRICULUM  
SOUTHERN REGIONAL SCHOOL DISTRICT

**Content Area: Mathematics**

**Course Title: Calculus I**

**Grade Level: 11, 12**

**Unit Plan 1  
Pre-Requisite Skills**

**Pacing Guide  
8-11 days**

**Unit Plan 2  
Limits and Their Properties**

**Pacing Guide  
11-14 days**

**Unit Plan 3  
Differentiation**

**Pacing Guide  
28-33 days**

**Unit Plan 4  
Applications of Differentiation**

**Pacing Guide  
28-33 days**

**Unit Plan 5  
Integration**

**Pacing Guide  
23-28 days**

**Unit Plan 6  
Transcendental Functions**

**Pacing Guide  
23-28 days**

**Unit Plan 7  
Particle Motion**

**Pacing Guide  
4-6 days**

**Unit Plan 8  
Additional Integration Techniques**

**Pacing Guide  
9-13 days**

**Unit Plan 9  
Applications of Integration**

**Pacing Guide  
13-18 days**

**Date Created: February 2012**

**Board Approved on: March 14, 2012**

**OCEAN COUNTY MATHEMATICS CURRICULUM  
SOUTHERN REGIONAL SCHOOL DISTRICT  
Unit Overview**

**Content Area: Mathematics**

**Unit Title: Pre-Requisite Skills**

**Target Course/Grade Level: Calculus I / 11, 12**

**Unit Summary**

This unit will review pre-requisite skills necessary for success in calculus. The skills include simplifying, graphing, adding, subtracting and multiplying rational expressions; understanding and using function notation; evaluating and simplifying trigonometric expressions; solving and graphing trig equations.

**Primary interdisciplinary connections:**

Infused within the unit is connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

**21<sup>st</sup> century themes:**

The unit will integrate the 21<sup>st</sup> Century Life and Career strand 9.1 strands A-D. These strands include: Critical thinking and problem solving, creativity and innovation, collaboration, teamwork and leadership, and cross cultural understanding and interpersonal communication.

**Technology connections:**

For further clarification refer to Common Core State Standards at:

<http://www.corestandards.org/the-standards/mathematics>

**Learning Targets**

**Content Standards**

**Interpret the structure of expressions.**

A-SSE.1. Interpret expressions that represent a quantity in terms of its context.

A-SSE.2. Use the structure of an expression to identify ways to rewrite it.

**Write expressions in equivalent forms to solve problems.**

A-SSE.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

**Perform arithmetic operations on polynomials.**

A-APR.1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

**Rewrite rational expressions.**

A-APR.7. Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

**Create equations that describe numbers or relationships.**

A-CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

**Understand solving equations as a process of reasoning and explain the reasoning.**

A-REI.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise

**Represent and solve equations and inequalities graphically.**

A-REI.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

**Understand the concept of a function and use function notation.**

F-IF.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

**Interpret functions that arise in applications in terms of the context.**

F-IF.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

F-IF.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

**Analyze functions using different representations.**

F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-IF.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

**Build a function that models a relationship between two quantities.**

F-BF.1. Write a function that describes a relationship between two quantities.

Build new functions from existing functions.

F-BF.3. Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

**Model periodic phenomena with trigonometric functions.**

F-TF.7. (+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.

**CONTENT STANDARDS LINK:** <http://www.corestandards.org/the-standards/mathematics/>

<p><b>Unit Essential Questions</b></p> <ul style="list-style-type: none"> <li>• Are the necessary pre-requisite skills in place for success in calculus?</li> </ul>	<p><b>Unit Enduring Understandings</b> <i>Students will understand that...</i></p> <ul style="list-style-type: none"> <li>• There are certain skills from previous math courses that are essential to success in Calculus.</li> </ul>
<p><b>Unit Objectives</b> <i>Students will know...</i></p> <ul style="list-style-type: none"> <li>• How to simplify, graph, add, subtract, multiply, and divide rational expressions.</li> <li>• How to understand and use function notation.</li> <li>• How to simplify and evaluate trigonometric expressions.</li> <li>• How to solve and graph trigonometric equations.</li> </ul>	<p><b>Unit Objectives</b> <i>Students will be able to...</i></p> <ul style="list-style-type: none"> <li>• Simplify, graph, add, subtract, multiply, and divide rational expressions.</li> <li>• Understand and use function notation.</li> <li>• Simplify and evaluate trigonometric expressions.</li> <li>• Solve and graph trigonometric equations.</li> </ul>

**OCEAN COUNTY MATHEMATICS CURRICULUM  
SOUTHERN REGIONAL SCHOOL DISTRICT  
Evidence of Learning**

**Formative Assessments**

- Homework
- Teacher observation
- Class participation
- DO-NOW
- Notebook
- Open-ended writing assignments

**Summative Assessments**

For additional ideas please refer to Resources page for the Common Core State Standards:

<http://www.corestandards.org/resources>

- Chapter/Unit Test
- Open-Ended Writing Assignments
- Quizzes
- Unit Projects and Demonstrations
- Quarterly Tests

**Modifications (ELLs, Special Education, Gifted and Talented)**

- Teacher tutoring
- Peer tutoring
- Cooperative learning groups
- Modified assignments
- Differentiated instruction
- Native language texts and native language to English dictionary
- Follow all IEP modifications/504 plan

**Curriculum Development Resources/Instructional Materials/Equipment Needed Teacher Resources:**

- Textbook and Textbook Resources
- Graphing Calculator and/or Scientific Calculator
- Teacher-made tests, worksheets, warm-ups, and quizzes

**Teacher Notes:**

Start introducing limits during the review of graphing rational expressions.

**OCEAN COUNTY MATHEMATICS CURRICULUM  
SOUTHERN REGIONAL SCHOOL DISTRICT  
Unit Overview**

**Content Area: Mathematics**

**Unit Title: Limits and Their Properties**

**Target Course/Grade Level: Calculus I / 11, 12**

**Unit Summary**

This unit focuses on calculating a limit graphically, numerically, and analytically; identifying where a function is continuous and not continuous; identifying the different types of discontinuity that a function may have; identify the vertical asymptotes of a graph and solving limit problems associated with those asymptotes.

**Primary interdisciplinary connections:**

Infused within the unit is connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

**21<sup>st</sup> century themes:**

The unit will integrate the 21<sup>st</sup> Century Life and Career strand 9.1 strands A-D. These strands include: Critical thinking and problem solving, creativity and innovation, collaboration, teamwork and leadership, and cross cultural understanding and interpersonal communication.

**Technology connections:**

For further clarification refer to Common Core State Standards at:

<http://www.corestandards.org/the-standards/mathematics>

**Learning Targets**

**Content Standards**

**Represent and solve equations and inequalities graphically.**

A-REI.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

**Understand the concept of a function and use function notation.**

F-IF.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

**Analyze functions using different representations.**

F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-IF.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

F-BF.1. Write a function that describes a relationship between two quantities.

**CONTENT STANDARDS LINK:** <http://www.corestandards.org/the-standards/mathematics/>

<p><b>Unit Essential Questions</b></p> <ul style="list-style-type: none"> <li>• What is a limit?</li> <li>• How is a limit calculated?</li> <li>• What does continuity mean and what are the different types of discontinuities?</li> <li>• What are vertical asymptotes and how are they related to limits?</li> </ul>	<p><b>Unit Enduring Understandings</b></p> <p><i>Students will understand that...</i></p> <ul style="list-style-type: none"> <li>• There are different ways of calculating limits.</li> <li>• There are different types of discontinuities.</li> <li>• Limits, asymptotes, and continuity are interconnected calculus topics.</li> </ul>
<p><b>Unit Objectives</b></p> <p><i>Students will know...</i></p> <ul style="list-style-type: none"> <li>• How to calculate a limit graphically, numerically, and analytically</li> <li>• How to identify where a function is continuous and not continuous</li> <li>• How to identify the different types of discontinuities that a function may have.</li> <li>• How to identify the vertical asymptotes of a graph and solve limit problems associated with those asymptotes</li> </ul>	<p><b>Unit Objectives</b></p> <p><i>Students will be able to...</i></p> <ul style="list-style-type: none"> <li>• How to calculate a limit graphically, numerically, and analytically.</li> <li>• Identify where a function is continuous and not continuous.</li> <li>• Identify the different types of discontinuity that a function may have.</li> <li>• Identify the vertical asymptotes of a graph and solve limit problems associated with those asymptotes.</li> </ul>

**OCEAN COUNTY MATHEMATICS CURRICULUM**  
**SOUTHERN REGIONAL SCHOOL DISTRICT**  
Evidence of Learning

**Formative Assessments**

- Homework
- Teacher observation
- Class participation
- DO-NOW
- Notebook
- Open-ended writing assignments

**Summative Assessments**

For additional ideas please refer to Resources page for the Common Core State Standards:  
<http://www.corestandards.org/resources>

- Chapter/Unit Test
- Open-Ended Writing Assignments
- Quizzes
- Unit Projects and Demonstrations
- Quarterly Tests

**Modifications (ELLs, Special Education, Gifted and Talented)**

- Teacher tutoring
- Peer tutoring
- Cooperative learning groups
- Modified assignments
- Differentiated instruction
- Native language texts and native language to English dictionary
- Follow all IEP modifications/504 plan

**Curriculum Development Resources/Instructional Materials/Equipment Needed Teacher Resources:**

- Textbook and Textbook Resources
- Graphing Calculator and/or Scientific Calculator
- Teacher-made tests, worksheets, warm-ups, and quizzes

**Teacher Notes:**

Graphing piecewise functions may be a pre-requisite skill that requires a significant review.

**OCEAN COUNTY MATHEMATICS CURRICULUM  
SOUTHERN REGIONAL SCHOOL DISTRICT  
Unit Overview**

**Content Area: Mathematics**

**Unit Title: Differentiation**

**Target Course/Grade Level: Calculus I / 11, 12**

**Unit Summary**

This unit focuses on the following: the tangent line problem; using the formal definition of a derivative; finding derivatives using the power rule, product rule, quotient rule, chain rule, and implicit differentiation.

**Primary interdisciplinary connections:**

Infused within the unit is connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

**21<sup>st</sup> century themes:**

The unit will integrate the 21<sup>st</sup> Century Life and Career strand 9.1 strands A-D. These strands include: Critical thinking and problem solving, creativity and innovation, collaboration, teamwork and leadership, and cross cultural understanding and interpersonal communication.

**Technology connections:**

For further clarification refer to Common Core State Standards at:

<http://www.corestandards.org/the-standards/mathematics>

**Learning Targets**

**Content Standards**

**Represent and solve equations and inequalities graphically.**

A-REI.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

**Understand the concept of a function and use function notation.**

F-IF.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

**Interpret functions that arise in applications in terms of the context.**

F-IF.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

F-IF.6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

**Analyze functions using different representations.**

F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-IF.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

F-BF.1. Write a function that describes a relationship between two quantities.

F-BF.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

**Build new functions from existing functions.**

F-BF.3. Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

F-BF.5. Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

**CONTENT STANDARDS LINK:** <http://www.corestandards.org/the-standards/mathematics/>

**Unit Essential Questions**

- Does the student understand how the tangent line problem leads to the formal definition of a derivative?
- Does the student understand how the derivative tells us the instantaneous rate of change for a function which means the same as the slope of the tangent line?
- Can the student apply the various differentiation rules to the appropriate problems?

**Unit Enduring Understandings**

*Students will understand that...*

- The tangent line problem leads to the formal definition of a derivative.
- The derivative tells us the instantaneous rate of change for a function which means the same as the slope of the tangent line.
- As the expression or equation varies so does the method of differentiation that must be applied.

**Unit Objectives**

*Students will know...*

- How to use the formal definition of a derivative.
- How to take derivatives using the power rule, the product rule, the quotient rule and implicit differentiation.

**Unit Objectives**

*Students will be able to...*

- Use the formal definition of a derivative.
- Take derivatives using the power rule, the product rule, the quotient rule and implicit differentiation.

**OCEAN COUNTY MATHEMATICS CURRICULUM  
SOUTHERN REGIONAL SCHOOL DISTRICT  
Evidence of Learning**

**Formative Assessments**

- Homework
- Teacher observation
- Class participation
- DO-NOW
- Notebook
- Open-Ended Writing Assignments

**Summative Assessments**

For additional ideas please refer to Resources page for the Common Core State Standards:  
<http://www.corestandards.org/resources>

- Chapter/Unit Test
- Open-Ended Writing Assignments
- Quizzes
- Unit Projects and Demonstrations
- Quarterly Tests

**Modifications (ELLs, Special Education, Gifted and Talented)**

- Teacher tutoring
- Peer tutoring
- Cooperative learning groups
- Modified assignments
- Differentiated instruction
- Native language texts and native language to English dictionary
- Follow all IEP modifications/504 plan

**Curriculum Development Resources/Instructional Materials/Equipment Needed Teacher Resources:**

- Textbook and Textbook Resources
- Graphing Calculator and/or Scientific Calculator
- Teacher-made tests, worksheets, warm-ups, and quizzes

**Teacher Notes:**

Derivatives of logarithmic and exponential expressions and functions are not covered in this unit. They will be addressed in unit 6.

**OCEAN COUNTY MATHEMATICS CURRICULUM  
SOUTHERN REGIONAL SCHOOL DISTRICT  
Unit Overview**

**Content Area: Mathematics**

**Unit Title: Applications of Differentiation**

**Target Course/Grade Level: Calculus I / 11, 12**

**Unit Summary**

This unit focuses on the following topics: related rates, extrema on an interval, intermediate value theorem, the first and second derivative tests, summarizing all skills from calculus and previous math courses in curve sketching, and optimization problems.

**Primary interdisciplinary connections:**

Infused within the unit is connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

**21<sup>st</sup> century themes:**

The unit will integrate the 21<sup>st</sup> Century Life and Career strand 9.1 strands A-D. These strands include: Critical thinking and problem solving, creativity and innovation, collaboration, teamwork and leadership, and cross cultural understanding and interpersonal communication.

**Technology connections:**

For further clarification refer to Common Core State Standards at:

<http://www.corestandards.org/the-standards/mathematics>

**Learning Targets**

**Content Standards**

**Represent and solve equations and inequalities graphically.**

A-REI.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

**Understand the concept of a function and use function notation.**

F-IF.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

**Interpret functions that arise in applications in terms of the context.**

F-IF.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

F-IF.6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

**Analyze functions using different representations.**

F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-IF.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

F-BF.1. Write a function that describes a relationship between two quantities.

F-BF.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

**Build new functions from existing functions.**

F-BF.3. Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

F-BF.5. Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

**Apply geometric concepts in modeling situations**

G-MG.3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

**CONTENT STANDARDS LINK:** <http://www.corestandards.org/the-standards/mathematics/>

**Unit Essential Questions**

- Can the students apply their calculus skills to solving related rates and optimization problems?
- Can the students solve problems dealing with extrema on an interval and the mean value theorem?
- Can the students understand and apply the first and second derivative tests?
- Can the students combine skills from calculus and previous math courses to accurately graph a wide variety of functions?

**Unit Enduring Understandings**

*Students will understand that...*

- Calculus can be used to solve a variety of real world application problems such as related rates and optimization.
- Extrema on an interval problems and mean value problems focus on just a particular part of a graph and not the entire function.
- The first and second derivative tests can be used in conjunction with skills from previous math courses in order to accurately graph a wide variety of functions.

**Unit Objectives**

*Students will know...*

- How to solve extrema on an interval problem.
- How to solve problems that apply the mean value theorem.
- How to use the first and second derivatives to identify when a function is increasing, decreasing, concave up and/or concave down.
- How to combine together calculus skills with skills from previous math courses to accurately graph a wide variety of functions.

**Unit Objectives**

*Students will be able to...*

- Solve extrema on an interval problem.
- Solve problems that apply the mean value theorem.
- Use the first and second derivatives to identify when a function is increasing, decreasing, concave up and/or concave down.
- Combine together calculus skills with skills from previous math courses to accurately graph a wide variety of functions.

**OCEAN COUNTY MATHEMATICS CURRICULUM**  
**SOUTHERN REGIONAL SCHOOL DISTRICT**  
Evidence of Learning

**Formative Assessments**

- Homework
- Teacher observation
- Class participation
- DO-NOW
- Notebook
- Open-Ended Writing Assignments

**Summative Assessments**

For additional ideas please refer to Resources page for the Common Core State Standards:  
<http://www.corestandards.org/resources>

- Chapter/Unit Test
- Open-Ended Writing Assignments
- Quizzes
- Unit Projects and Demonstrations
- Quarterly Tests

**Modifications (ELLs, Special Education, Gifted and Talented)**

- Teacher tutoring
- Peer tutoring
- Cooperative learning groups
- Modified assignments
- Differentiated instruction
- Native language texts and native language to English dictionary
- Follow all IEP modifications/504 plan

**Curriculum Development Resources/Instructional Materials/Equipment Needed Teacher Resources:**

- Textbook and Textbook Resources
- Graphing Calculator and/or Scientific Calculator
- Teacher-made tests, worksheets, warm-ups, and quizzes

**Teacher Notes:**

Particle motion application problems will be covered in unit 7.

**OCEAN COUNTY MATHEMATICS CURRICULUM  
SOUTHERN REGIONAL SCHOOL DISTRICT  
Unit Overview**

**Content Area: Mathematics**

**Unit Title: Integration**

**Target Course/Grade Level: Calculus I / 11, 12**

**Unit Summary**

This unit focuses on the following topics: calculating an anti-derivative, solving initial value problems, finding area under a curve by summing rectangles, using integrals to find the exact area under a curve, total area vs. net area, mean value theorem for integrals, and u-substitution.

**Primary interdisciplinary connections:**

Infused within the unit is connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

**21<sup>st</sup> century themes:**

The unit will integrate the 21<sup>st</sup> Century Life and Career strand 9.1 strands A-D. These strands include: Critical thinking and problem solving, creativity and innovation, collaboration, teamwork and leadership, and cross cultural understanding and interpersonal communication.

**Technology connections:**

For further clarification refer to Common Core State Standards at:

<http://www.corestandards.org/the-standards/mathematics>

**Learning Targets**

**Content Standards**

**Represent and solve equations and inequalities graphically.**

A-REI.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

**Understand the concept of a function and use function notation.**

F-IF.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

**Interpret functions that arise in applications in terms of the context.**

F-IF.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

F-IF.6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

**Analyze functions using different representations.**

F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-IF.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

F-BF.1. Write a function that describes a relationship between two quantities.

F-BF.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

**Build new functions from existing functions.**

F-BF.3. Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

F-BF.5. Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

**Apply geometric concepts in modeling situations**

G-MG.3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

**CONTENT STANDARDS LINK:** <http://www.corestandards.org/the-standards/mathematics/>

**Unit Essential Questions**

- What is an antiderivative and how is it calculated?
- How is an antiderivative related to an integral?
- Can the students evaluate definite and indefinite integrals by various methods including u-substitution?
- What is the difference between net area and total area and how are they calculated?
- What is the Mean Value Theorem for Integrals and how is it applied?

**Unit Enduring Understandings**

*Students will understand ...*

- What an antiderivative is and how it is calculated.
- How an antiderivative is related to an integral.
- How to evaluate definite and indefinite integrals by various methods including u-substitution.
- What the difference is between net area and total area and how are they calculated.
- What the Mean Value Theorem for Integrals is and how it is applied.

**Unit Objectives**

*Students will know...*

- How to calculate an antiderivative.
- How to solve an initial value problem.
- How to find the area under a curve by summing rectangles.
- How to find area under a curve by using definite integrals.
- How to solve problems involving net area and total area.
- How to apply the Mean Value Theorem for Integrals.
- How to integrate using u-substitution.

**Unit Objectives**

*Students will be able to...*

- Calculate an antiderivative.
- Solve an initial value problem.
- Find the area under a curve by summing rectangles.
- Find area under a curve by using definite integrals.
- Solve problems involving net area and total area.
- Apply the Mean Value Theorem for Integrals.
- Integrate using u-substitution.

**OCEAN COUNTY MATHEMATICS CURRICULUM  
SOUTHERN REGIONAL SCHOOL DISTRICT  
Evidence of Learning**

**Formative Assessments**

- Homework
- Teacher observation
- Class participation
- DO-NOW
- Notebook
- Open-Ended Writing Assignments

**Summative Assessments**

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**Modifications (ELLs, Special Education, Gifted and Talented)**

- Teacher tutoring
- Peer tutoring
- Cooperative learning groups
- Modified assignments
- Differentiated instruction
- Native language texts and native language to English dictionary
- Follow all IEP modifications/504 plans

**Curriculum Development Resources/Instructional Materials/Equipment Needed Teacher Resources:**

- Textbook and Textbook Resources
- Graphing Calculator and/or Scientific Calculator
- Teacher-made tests, worksheets, warm-ups, and quizzes

**Teacher Notes:**

Summation notation may have to be reviewed depending on background knowledge.

**OCEAN COUNTY MATHEMATICS CURRICULUM  
SOUTHERN REGIONAL SCHOOL DISTRICT  
Unit Overview**

**Content Area: Mathematics**

**Unit Title: Transcendental Functions**

**Target Course/Grade Level: Calculus I / 11, 12**

**Unit Summary**

A review of logarithm and exponent skills will typically be required as the intro to this unit. The topics covered once the review is completed include logarithm derivatives and integrals, integrating the remaining trig functions not yet covered, deriving and integrating exponential functions.

**Primary interdisciplinary connections:**

Infused within the unit is connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

**21<sup>st</sup> century themes:**

The unit will integrate the 21<sup>st</sup> Century Life and Career strand 9.1 strands A-D. These strands include: Critical thinking and problem solving, creativity and innovation, collaboration, teamwork and leadership, and cross cultural understanding and interpersonal communication.

**Technology connections:**

For further clarification refer to Common Core State Standards at:

<http://www.corestandards.org/the-standards/mathematics>

**Learning Targets**

**Content Standards**

**Represent and solve equations and inequalities graphically.**

A-REI.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

**Understand the concept of a function and use function notation.**

F-IF.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

**Interpret functions that arise in applications in terms of the context.**

F-IF.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

F-IF.6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

**Analyze functions using different representations.**

F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-IF.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

F-BF.1. Write a function that describes a relationship between two quantities.

F-BF.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

**Build new functions from existing functions.**

F-BF.3. Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

F-BF.5. Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

**CONTENT STANDARDS LINK:** <http://www.corestandards.org/the-standards/mathematics/>

**Unit Essential Questions**

- How do the logarithmic and exponential skills learned in pre-calculus carry over to calculus?
- Can the student calculate the derivatives and integrals of exponential and logarithmic functions?
- Can the students integrate the remaining trig functions not covered in Unit #5?

**Unit Enduring Understandings**

*Students will understand that...*

- The logarithm and exponent skills from pre-calculus are an essential part of calculus.
- Trigonometry and logarithms are interconnected topics that were once treated separately.
- The calculus skills learned earlier in the class also apply to exponents and logarithms.

**Unit Objectives**

*Students will know...*

- How to apply the logarithmic and exponential skills learned in pre-calculus to calculus level problems.
- How to calculate the derivatives and integrals of exponential and logarithmic functions.
- How to integrate the remaining trig functions not covered in Unit #5.

**Unit Objectives**

*Students will be able to...*

- Apply the logarithmic and exponential skills learned in pre-calculus to calculus level problems.
- Calculate the derivatives and integrals of exponential and logarithmic functions.
- Integrate the remaining trig functions not covered in Unit #5.

**OCEAN COUNTY MATHEMATICS CURRICULUM**  
**SOUTHERN REGIONAL SCHOOL DISTRICT**  
Evidence of Learning

**Formative Assessments**

- Homework
- Teacher observation
- Class participation
- DO-NOW
- Notebook
- Open-Ended Writing Assignments

**Summative Assessments**

For additional ideas please refer to Resources page for the Common Core State Standards:  
<http://www.corestandards.org/resources>

- Chapter/Unit Test
- Open-Ended Writing Assignments
- Quizzes
- Unit Projects and Demonstrations
- Quarterly Tests

**Modifications (ELLs, Special Education, Gifted and Talented)**

- Teacher tutoring
- Peer tutoring
- Cooperative learning groups
- Modified assignments
- Differentiated instruction
- Native language texts and native language to English dictionary
- Follow all IEP modifications/504 plans

**Curriculum Development Resources/Instructional Materials/Equipment Needed Teacher Resources:**

- Textbook and Textbook Resources
- Graphing Calculator and/or Scientific Calculator
- Teacher-made tests, worksheets, warm-ups, and quizzes

**Teacher Notes:**

Included in the text book with this unit are the inverse trig functions. This topic is optional and may be covered as time permits in Unit 8.

**OCEAN COUNTY MATHEMATICS CURRICULUM  
SOUTHERN REGIONAL SCHOOL DISTRICT  
Unit Overview**

**Content Area: Mathematics**

**Unit Title: Particle Motion**

**Target Course/Grade Level: Calculus I / 11, 12**

**Unit Summary**

Students will apply their ability to integrate and derive to particle motion problems.

**Primary interdisciplinary connections:**

Infused within the unit is connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

**21<sup>st</sup> century themes:**

The unit will integrate the 21<sup>st</sup> Century Life and Career strand 9.1 strands A-D. These strands include: Critical thinking and problem solving, creativity and innovation, collaboration, teamwork and leadership, and cross cultural understanding and interpersonal communication.

**Technology connections:**

For further clarification refer to Common Core State Standards at:

<http://www.corestandards.org/the-standards/mathematics>

**Learning Targets**

**Content Standards**

**Represent and solve equations and inequalities graphically.**

A-REI.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

**Understand the concept of a function and use function notation.**

F-IF.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

**Interpret functions that arise in applications in terms of the context.**

F-IF.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

F-IF.6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

**Analyze functions using different representations.**

F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-IF.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

F-BF.1. Write a function that describes a relationship between two quantities.

F-BF.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

**Build new functions from existing functions.**

F-BF.3. Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

F-BF.5. Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

**CONTENT STANDARDS LINK:** <http://www.corestandards.org/the-standards/mathematics/>

<p><b>Unit Essential Questions</b></p> <ul style="list-style-type: none"> <li>• Can the students apply integration and derivation skills to particle motion problems?</li> </ul>	<p><b>Unit Enduring Understandings</b> <i>Students will understand</i></p> <ul style="list-style-type: none"> <li>• The relationships between the position function, the velocity function and the acceleration function.</li> </ul>
<p><b>Unit Objectives</b> <i>Students will know...</i></p> <ul style="list-style-type: none"> <li>• How to apply integration and derivation skills to particle motion problems.</li> <li>• How to apply the relationships between the position function, the velocity function and the acceleration function to particle motion problems.</li> </ul>	<p><b>Unit Objectives</b> <i>Students will be able to...</i></p> <ul style="list-style-type: none"> <li>• Apply integration and derivation skills to particle motion problems.</li> <li>• Apply the relationships between the position function, the velocity function and the acceleration function to particle motion problems.</li> </ul>

**OCEAN COUNTY MATHEMATICS CURRICULUM  
SOUTHERN REGIONAL SCHOOL DISTRICT  
Evidence of Learning**

**Formative Assessments**

- Homework
- Teacher observation
- Class participation
- DO-NOW
- Notebook
- Open-Ended Writing Assignments

**Summative Assessments**

For additional ideas please refer to Resources page for the Common Core State Standards:  
<http://www.corestandards.org/resources>

- Chapter/Unit Test
- Open-Ended Writing Assignments
- Quizzes
- Unit Projects and Demonstrations
- Quarterly Tests

**Modifications (ELLs, Special Education, Gifted and Talented)**

- Teacher tutoring
- Peer tutoring
- Cooperative learning groups
- Modified assignments
- Differentiated instruction
- Native language texts and native language to English dictionary
- Follow all IEP modifications/504 plans

**Curriculum Development Resources/Instructional Materials/Equipment Needed Teacher Resources:**

- Textbook and Textbook Resources
- Graphing Calculator and/or Scientific Calculator
- Teacher-made tests, worksheets, warm-ups, and quizzes

**Teacher Notes:**

The particle motion problems are scattered throughout the textbook.

**OCEAN COUNTY MATHEMATICS CURRICULUM  
SOUTHERN REGIONAL SCHOOL DISTRICT  
Unit Overview**

**Content Area: Mathematics**

**Unit Title: Additional Integration Techniques**

**Target Course/Grade Level: Calculus I / 11, 12**

**Unit Summary**

All integration techniques learned to this point in the class are reviewed. The two new techniques which are covered in this unit are integration by parts and the use of partial fractions. If time permits the optional topic of inverse trig functions may be addressed.

**Primary interdisciplinary connections:**

Infused within the unit is connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

**21<sup>st</sup> century themes:**

The unit will integrate the 21<sup>st</sup> Century Life and Career strand 9.1 strands A-D. These strands include: Critical thinking and problem solving, creativity and innovation, collaboration, teamwork and leadership, and cross cultural understanding and interpersonal communication.

**Technology connections:**

For further clarification refer to Common Core State Standards at:

<http://www.corestandards.org/the-standards/mathematics>

**Learning Targets**

**Content Standards**

**Analyze functions using different representations.**

F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-IF.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

**CONTENT STANDARDS LINK:** <http://www.corestandards.org/the-standards/mathematics/>

<p><b>Unit Essential Questions</b></p> <ul style="list-style-type: none"> <li>• What are the key features of an expression or equation that indicate the integration technique that should be applied?</li> <li>• Once the technique is identified, does the student have the ability to successfully apply that given technique?</li> </ul>	<p><b>Unit Enduring Understandings</b> <i>Students will understand that...</i></p> <ul style="list-style-type: none"> <li>• Integration by parts and integration by partial fractions are skills necessary in order to integrate certain expressions/equations.</li> </ul>
<p><b>Unit Objectives</b> <i>Students will know...</i></p> <ul style="list-style-type: none"> <li>• How to integrate expressions/equations by using integration by parts and partial fractions.</li> <li>• Which integration technique applies to a given expression/equation.</li> </ul>	<p><b>Unit Objectives</b> <i>Students will be able to...</i></p> <ul style="list-style-type: none"> <li>• Choose the appropriate integration technique to a given equation/expression</li> <li>• Integrate using integration by parts and partial fractions.</li> </ul>

**OCEAN COUNTY MATHEMATICS CURRICULUM  
SOUTHERN REGIONAL SCHOOL DISTRICT  
Evidence of Learning**

**Formative Assessments**

- Homework
- Teacher observation
- Class participation
- DO-NOW
- Notebook
- Open-Ended Writing Assignments

**Summative Assessments**

For additional ideas please refer to Resources page for the Common Core State Standards:

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- Chapter/Unit Test
- Open-Ended Writing Assignments
- Quizzes
- Unit Projects and Demonstrations
- Quarterly Tests

**Modifications (ELLs, Special Education, Gifted and Talented)**

- Teacher tutoring
- Peer tutoring
- Cooperative learning groups
- Modified assignments
- Differentiated instruction
- Native language texts and native language to English dictionary
- Follow all IEP modifications/504 plans

**Curriculum Development Resources/Instructional Materials/Equipment Needed Teacher Resources:**

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- Graphing Calculator and/or Scientific Calculator
- Teacher-made tests, worksheets, warm-ups, and quizzes

**Teacher Notes:**

This does not follow the order of the textbook. This unit (#8) is in chapter 7. Unit #7 is in chapter 6.

**OCEAN COUNTY MATHEMATICS CURRICULUM  
SOUTHERN REGIONAL SCHOOL DISTRICT  
Unit Overview**

**Content Area: Mathematics**

**Unit Title: Applications of Integration**

**Target Course/Grade Level: Calculus I / 11, 12**

**Unit Summary**

This unit covers how integration can be used to find the area between two curves, the volume of a solid of revolution, the area of the surface of a revolution and the length of the plane curve.

**Primary interdisciplinary connections:**

Infused within the unit is connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

**21<sup>st</sup> century themes:**

The unit will integrate the 21<sup>st</sup> Century Life and Career strand 9.1 strands A-D. These strands include: Critical thinking and problem solving, creativity and innovation, collaboration, teamwork and leadership, and cross cultural understanding and interpersonal communication.

**Technology connections:**

For further clarification refer to Common Core State Standards at:

<http://www.corestandards.org/the-standards/mathematics>

**Learning Targets**

**Content Standards**

**Represent and solve equations and inequalities graphically.**

A-REI.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

**Understand the concept of a function and use function notation.**

F-IF.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

**Interpret functions that arise in applications in terms of the context.**

F-IF.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

F-IF.6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

**Analyze functions using different representations.**

F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-IF.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

F-BF.1. Write a function that describes a relationship between two quantities.  
 F-BF.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

**Build new functions from existing functions.**

F-BF.3. Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

F-BF.5. Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

**CONTENT STANDARDS LINK:** <http://www.corestandards.org/the-standards/mathematics/>

<p><b>Unit Essential Questions</b></p> <ul style="list-style-type: none"> <li>• How is integration used to find the area between two curves, the volume of a solid of revolution, the area of the surface of a revolution and the length of the plane curve?</li> </ul>	<p><b>Unit Enduring Understandings</b>  <i>Students will understand that...</i></p> <ul style="list-style-type: none"> <li>• Integration can be used to find the area between two curves, the volume of a solid of revolution, the area of the surface of a revolution and the length of the plane curve.</li> </ul>
<p><b>Unit Objectives</b>  <i>Students will know...</i></p> <ul style="list-style-type: none"> <li>• How to find the area of a region between two curves.</li> <li>• How to find the volume of a solid formed by the revolution of a line/curve about an axis of revolution by the disc and washer methods.</li> <li>• How to find the area of the surface of a revolution of a line/curve about an axis of revolutions.</li> <li>• How to find the length of a plane curve.</li> </ul>	<p><b>Unit Objectives</b>  <i>Students will be able to...</i></p> <ul style="list-style-type: none"> <li>• Find the area of a region between two curves.</li> <li>• Find the volume of a solid formed by the revolution of a line/curve about an axis of revolution by the disc and washer methods.</li> <li>• Find the area of the surface of a revolution of a line/curve about an axis of revolutions.</li> <li>• Find the length of a plane curve.</li> </ul>

**OCEAN COUNTY MATHEMATICS CURRICULUM**  
**SOUTHERN REGIONAL SCHOOL DISTRICT**  
**Evidence of Learning**

**Formative Assessments**

- Homework
- Teacher observation
- Class participation
- DO-NOW
- Notebook
- Open-Ended Writing Assignments

**Summative Assessments**

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**Modifications (ELLs, Special Education, Gifted and Talented)**

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**Curriculum Development Resources/Instructional Materials/Equipment Needed Teacher Resources:**

- Textbook and Textbook Resources
- Graphing Calculator and/or Scientific Calculator
- Teacher-made tests, worksheets, warm-ups, and quizzes

**Teacher Notes:**

Due to time constraints late in the course, it may be necessary to have students use graphing calculators for the purpose of evaluating definite integrals rather than evaluating by hand.