Curriculum Map for **Calculus**

Targeted Standard(s): NJCCCS

4.3 Patterns and Algebra

A. Patterns
B. Functions and Relationships
C. Modeling
D. Procedures

4.5. Mathematical Processes

A. Problem Solving
B. Communication
C. Connections
D. Reasoning
E. Representations
F. Technology

Interdisciplinary: NJCCCS Technological Literacy 8.1A, 8.1B

Enduring Understandings (*The big ideas*):

- The symbolic language of algebra is used to communicate and generalize the patterns in mathematics.
- Algebraic representation can be used to generalize patterns and relationships.
- Patterns and relationships can be represented graphically, numerically, symbolically, or verbally.
- Mathematical models can be used to describe and quantify physical relationships.
- Physical models can be used to clarify mathematical relationships.
- Algebraic and numeric procedures are interconnected and build on one another to produce a coherent whole.
- Reasoning and/or proof can be used to verify or refute conjectures or theorems in algebra.
- 4.5 - Big ideas, essential questions, or enduring understandings are imbedded in the content-specific ideas, questions, and understandings delineated for the first four standards.

Essential Questions:

September: **What are the key concepts for calculus?**
How do we estimate rate of change and definite integral?
October: What is meant by limit f(x)? x→

When is a function continuous at x = c?
What are infinite limits?

Core Content/Objectives		Instructional Actions	
Concepts *What students will know*	Skills *What students will be able to do*	Activities/Strategies *Learning Activities/ Differentiation* *Interdisciplinary Connections*	Assessment *How learning will be assessed*
September • Given the equation for a function, to estimate the rate of change at a given point • Given the graph of a function, to estimate the definite integral in two ways • Given a graph, to determine a limit as x→c in different ways **October** • Use formal limit def to find limits of f(x) given the equation or graph of f (x) • Apply limit theorems • Define left and right limits • Study continuity at x=c	**September** • Approximate rate of change at x=c by calculator • Evaluate definite integral by counting squares • Apply trap rule to find def. integral • Find limits using algebra **October** • Use algebra to reduce expressions in order to find limit as x→c • Use definition of continuity at point to determine whether graph is or is not continuous at x=c • Graph "piece" functions in order to answer questions about continuity	**September** • Integrate slope formula from Algebra with rate of change • Integrate area formula for trapezoid with traprule. **October** • E, F problems involving finite limits are integrated with problems involving infinite limits. • Integrate Int. Value with completeness and continuity	**September** • Quiz 1.1 – 1.4 • Exploration 1.1, 1.3, 1.5 • Problem Set R1-4, T1-4 p 33-34 • Test on Chapter 1 **October** • Quiz on 2.1 – 2.3 • Quiz on 2.4 • Quiz on 2.5 – 2.6 • Problem sets • Test on Chapter 2
Resources/Technology:			

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Essential Questions:

November - December: **What is the formal "limit definition" of the derivative?**

What is a "difference quotient"?
What is an "anti-derivative"?

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Concepts *What students will know*	Skills *What students will be able to do*	Activities/Strategies *Learning Activities/ Differentiation* *Interdisciplinary Connections*	Assessment *How learning will be assessed*
November – December • Using difference quotients – forward, backward and symmetric • Finding f''(x) by limit definition (and algebra) • Learn various symbols for derivative • Introduce first derivative rules • Introduce chain rule • Start anti-derivative rules	**November – December** • Use algebra to find f''(x) starting with f '(x)=lim $\frac{f(xth)-f(x)}{n}$ n→o • Use TI-82 calculator to evaluate difference quotients • Given a function, find f '(x) using derivative rules • Use derivatives to solve problems involving velocity and acceleration	**November – December** • Integrate trig rules from pre-calculus into calculus derivatives • Integrate slope formula from algebra with different quotients	**November – December** • Quiz on 3.3 • Quiz on 3.5 – 3.7 • Test 3.1 – 3.4 • Test 3.5 – 3.9
Resources/Technology:			

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Essential Questions:

December – January – What is differentiability?
What is the parametric chain rule?
How do we differentiate implicit and parametric functions?

Core Content/Objectives		Instructional Actions	
Concepts *What students will know*	Skills *What students will be able to do*	Activities/Strategies *Learning Activities/ Differentiation* *Interdisciplinary Connections*	Assessment *How learning will be assessed*
December – January • Product rule with chain rule • Quotient rule with chain rule • Differentiability from a graph • Parametric functions • Implicit functions/relations	**December – January** • Use rules to differentiate and simplify functions that are products/quotients • Test functions for differentiability/continuity from a graph and from functions that must be graphed in "pieces". • Find derivatives of parametric functions • Find y' for an implicit function and interpret its meaning	**December – January** • Integrate limits, continuity, differentiability for a graph • Trig identifies for pre-calculus to derivative rules	**December – January** • Quiz 4.1 – 4.3 • Quiz 4.4 • Quiz 4.6 – 4.7 • Test 4.1 – 4.4 • Test 4.6 – 4.8 • Mid-Term
Resources/Technology:			

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Essential Questions:

February – March: What is the connection between the derivative and the definite integral?
How are definite integral and area related?
What is the Fundamental Theorem of Calculus?

Core Content/Objectives		Instructional Actions	
Concepts *What students will know*	Skills *What students will be able to do*	Activities/Strategies *Learning Activities/ Differentiation* *Interdisciplinary Connections*	Assessment *How learning will be assessed*
February – March • Indefinite integrals • Definite integrals using Riemann Sums? • Mean-value theorem and Rolle's theorem • Definite integrals using anti-derivatives • Fundamental theorem of calculus	**February – March** • To find a rectangle sum using the TI-83 calculator • To estimate a rectangle sum by hand • To evaluate a definite integral by hand and by calculator • To use mean value theorem to locate the point where instantaneous rate of change equals average rate • To use Simpson's Rule to estimate a definite integral	**February – March** • Integrate derivatives and anti-derivatives • Integrate slope and mean value theorems • Integrate Simpson's Rule with Riemann sums.	**February – March** • Quiz on 5.2, 5.4, 5.5 • Quiz on 5.9 • Quiz on 5.6 and 5.10
Resources/Technology:			

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Essential Questions:

March – April – What is the natural log function?

What is the inverse of the natural log functions?
How do we define derivative and anti-derivative rules for these functions?

Core Content/Objectives		Instructional Actions	
Concepts *What students will know*	Skills *What students will be able to do*	Activities/Strategies *Learning Activities/ Differentiation* *Interdisciplinary Connections*	Assessment *How learning will be assessed*
March – April • Review of logarithms • Derivative rules for lnx and e^x • Anti-derivative rules for .1/x and e^x • Logarithmic differentiation • L'Hospitals Rule	**March – April** • Use rules to find y' for functions involving e^x, lnx, bx, and log bx • Use rules to find anti-derivatives for functions involving e^x, 1/x, eu/u, e^u • Use logarithmic differentiation to find y' • Use L'Hospitals Rule to find limits	**March – April** • Integrate logs (natural and common) • Integrate e^x and ln x	**March – April** • Quiz on logs and exponents (review) • Quiz on derivatives and anti-derivatives • Test 6.1 – 6.5 • Test 6.6 – 6.10
Resources/Technology:			

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Essential Questions:

May – June – How are derivatives used to analyze graphs?

How is calculus used to find area of a pkene region?
How is calculus used to determine volume of a solace?

Core Content/Objectives		Instructional Actions	
Concepts *What students will know*	Skills *What students will be able to do*	Activities/Strategies *Learning Activities/ Differentiation* *Interdisciplinary Connections*	Assessment *How learning will be assessed*
May – June • First derivative and its relationship to graph of f (x) • Second derivative and its relationship to graph of f(x) and f(x) • Maxima and minima word problems • Area of a plane region • Volume of a solace of rotation	**May – June** • Use information about f '(x) and F"(x) to identify critical points on a graph of F(x) • Use definite integral to determine area of a plane region • Find volume of a solid by plane slicing	**May – June** • Maximum word problems for pre-calculus with new calculus methods • Area and volume methods from geometry with calculus	**May – June** • Quiz on 8.1 – 8.2 • Quiz on 8.4 • Quiz on 8.5 • Test on Chapter 8 • Final Exam
Resources/Technology:			