Anoka-Hennepin Secondary Curriculum Unit Plan

Department:	Mathematics	Course:	AP Calculus BC	Unit 1 Title:	Advanced Topics of Limits, Derivatives, and Integrals	Grade Level(s):	10-12
Assessed Trimester:	Trimester A	Pacing:	13-19 days	Date Created:	2/2/2010	Last Revision Date:	6/19/2014

Course Understandings: *Students will understand that:*

A. The meaning of limit represents function behavior.
B. The meaning of the derivative represents a rate of change and is a local linear approximation and should understand that derivatives can be used to solve a variety of problems.
C. The meaning of the definite integral is a limit of Riemann sums and as the net accumulation of change and will understand that you can use integrals to solve a variety of problems.
D. The relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus.
E. You can model a written description of a physical situation with a function, a differential equation, or an integral.
F. You can use technology to help solve problems, experiment, interpret results, and support conclusions.

DESIRED RESULTS (Stage 1) - WHAT WE WANT STUDENT TO KNOW AND BE ABLE TO DO?

Established Goals

Minnesota State/Local/College Board/Technology Standard(s) addressed:

- **AP: I. Functions, Graphs, and Limits**
  - a. **Analysis of graphs**
    - With the aid of technology, graphs of functions are often easy to produce. The emphasis is on the interplay between the geometric and analytic information and on the use of calculus both to predict and to explain the observed local and global behavior of a function.
  - b. **Limits of functions (including one-sided limits)**
    - An intuitive understanding of the limiting process
    - Calculating limits using algebra
    - Estimating limits from graphs or tables of data
  - c. **Asymptotic and unbounded behavior**
    - Understanding asymptotes in terms of graphical behavior
    - Describing asymptotic behavior in terms of limits involving infinity
    - Comparing relative magnitudes of functions and their rates of change (for example, contrasting exponential growth, polynomial growth, and logarithmic growth)

- **AP: III. Integrals**
  - d. **Techniques of antidifferentiation**
    - Antiderivatives following directly from derivatives of basic functions
    - Antiderivatives by substitution of variables (including change of limits for definite integrals)
    - Antiderivatives using integration by parts
    - Antiderivatives by partial fractions
  - e. **Applications of antidifferentiation**
    - Finding specific antiderivatives using initial conditions, including applications to motion along a line
    - Solving separable differential equations and using them in modeling (including the study of the equation $y=ky$ and exponential growth)
  - f. **Numerical approximations to definite integrals**
    - Use of Riemann sums (using left, right, and midpoint evaluation points) and trapezoidal sums to approximate definite integrals of functions represented algebraically, graphically, and by tables of values

Transfer

Students will be able to independently use their learning to: (product, high order reasoning)

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Meaning

Unit Understanding(s):

Students will understand that:

- L'Hopital's Rule
- Faster, slower, same rate growth
- Improper Integrals
- Partial Fractions

Essential Question(s):

Students will keep considering:

- Is there a connection between a limit and a function's asymptotes?
- Can I find the limit by looking at the graph of the function?
- Can a function have a limit at a point of discontinuity?
- Can the limit approaching the *x*-value from the left be different from the limit approaching the same *x*-value from the right?
- Does the limit have to be a number?
- What is an indeterminate form?
- Is there another way to evaluate a limit?
- Do functions grow at different rates?
- Can you find infinite area?
- What is a partial fraction?

Acquisition

Knowledge - Students will:

- L'Hopital's rule
- Indeterminate form
- Improper Integrals
- Partial Fractions
- Euler's Method
- Rates of growth
- Arc Length
- Logistic Growth
- Integration by Parts
- Decomposing into Partial Fractions

Reasoning - Students will:

- Determine when L'Hopital's rule applies
- Compare growth rates of functions
- Use graphical or algebraic analysis to determine where integrals are improper
- Determine which integration technique is appropriate
- Determine when an approximation using Euler's method is needed
- Interpret arc length as distance traveled or displacement
- Analyze characteristics of population growth using logistic growth models

Skills - Students will:

- BC1-1: Use L'Hopital's rule to evaluate a limit
- BC1-2: Evaluate an improper integral
- BC1-3: Evaluate an integral using partial fractions
- BC1-4: Evaluate an integral using integration by parts
- BC1-5: Use Euler's method to approximate the value of a function
- BC1-6: Calculate the length of a curve
- BC1-7: Solve a logistic growth differential equation

Common Misunderstandings

- Overuse of L'Hopital's rule
- Missing vertical asymptotes inside the limits of integration (in an integral)

Essential new vocabulary

- Arc Length
- Euler's Method
- Indeterminate form
- Improper Fraction
- L'Hopital's Rule
- Logistic Growth
- Partial Fractions