Anoka-Hennepin Secondary Curriculum Unit Plan

Department:	Mathematics	Course:	AP Calculus AB	Unit 3 Title:	Integrals	Grade Level(s):	10-12
Assessed Trimester:	Trimester B	Pacing:	44-48 days	Date Created:	2/2/2010	Last Revision Date:	6/19/2014

Course Understandings: *Students will understand that:*

A. Students will understand that the meaning of limit represents function behavior.
C. Students will understand that 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. Students will understand that the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus.
E. Students will understand that you can model a written description of a physical situation with a function, a differential equation, or an integral.
F. Students will understand that 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: III. Integrals**
  - a. **Interpretations and properties of definite integrals**
    - Definite integral as a limit of Riemann sums
    - Definite integral of the rate of change of a quantity over an interval interpreted as the change of the quantity over the interval:
    - Basic properties of definite integrals (examples include additivity and linearity)
  - b. **Applications of integrals**
    - Appropriate integrals are used in a variety of applications to model physical, biological, or economic situations. Although only a sampling of applications can be included in any specific course, students should be able to adapt their knowledge and techniques to solve other similar application problems. Whatever applications are chosen, the emphasis is on using the method of setting up an approximating Riemann sum and representing its limit as a definite integral. To provide a common foundation, specific applications should include finding the area of a region, the volume of a solid with known cross sections, the average value of a function, the distance traveled by a particle along a line, and accumulated change from a rate of change.
  - c. **Fundamental Theorem of Calculus**
    - Use of the Fundamental Theorem to evaluate definite integrals
    - Use of the Fundamental Theorem to represent a particular antiderivative, and the analytical and graphical analysis of functions so defined
  - d. **Techniques of antidifferentiation**
    - Antiderivatives following directly from derivatives of basic functions
    - Antiderivatives by substitution of variables (including change of limits for definite integrals)
  - 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)

- Create a slope field

Meaning

Unit Understanding(s):	Essential Question(s):
Students will understand that: ● The connection between integrals and area under a curve ● The integral is a limit of a Riemann sum ● The definition of a integral as an antiderivative ● The Fundamental Theorem of Calculus (Parts 1 and 2) ● How to evaluate an integral graphically, numerically, and algebraically ● How integrals relate to net area and total area ● A slope field and differential equations	**Students will keep considering:** ● Are all functions integrable? ● What does an integral tell me? ● Is there some connection between an integrals and area? ● Are integrals used in any real-life situations? ● What are all these dashes on this coordinate plane?

Acquisition

Knowledge - Students will:	Reasoning - Students will:
● Integral Notation ● Definition of Integral ● Integral approximation methods ● FTOC (part 1 and 2) ● Slope Field ● Integrals on a calculator ● Area and Volume ● Integral Rules	● interpret the meaning of integral as accumulated areas ● interpret a slope field as a general solution to a differential equation ● Determine appropriate integral/cross-section to calculate area and volume ● Interpret the integral of a rate as net change ● Determine when to use which integral rule **Skills - Students will:** ● AB3-1: Use approximation methods and geometry to evaluate integrals ● AB3-2: Use a differential equation to model slope at points in the coordinate plane ● AB3-3: Use integrals to calculate area and volume ● AB3-4: Solve integral application problems ● AB3-5: Use integral rules and techniques to calculate integrals

Common Misunderstandings	Essential new vocabulary
● Students have trouble with integrating vs find total area ● Students have trouble with the "*u*" substitution method ● Students have trouble with key sequences using their calculator ● Students have trouble with volume problems when areas are revolved around something other than the x- or y-axis	● Definite Integral ● Differential Equation ● Indefinite Integral ● Initial Value Problem ● Integrable ● Integral ● Integration by Substitution ● LRAM ● MRAM ● RRAM ● Simpson's Rule ● Slope Fields ● Trapezoid approx.