Course Title – Calculus

Implement start year – 2015-2016

Revision Committee Members, email, extension –
Paula Marques, pmarques@lrhsd.org, ext. 8981, Deborah Jenson, djenson@lrhsd.org, ext. 8560,
Dana Palumbo, dpalumbo@lrhsd.org, ext. 8422, Brian Moore, bmoore@lrhsd.org, ext. 8129

Unit # 4, topic – Integrals

Transfer Goal –

Students will be able to independently use their learning to evaluate and understand integrals.

Stage 1 – Desired Results

Established Goals

2009 NJCCC Standard(s), Strand(s)/CPI #
(http://www.nj.gov/education/cccs/2009/final.htm)

Common Core Curriculum Standards for Math and English
(http://www.corestandards.org/)

Since the Calculus curriculum goes beyond the Common Core Curriculum Standards for Math, the NCTM standards have been adopted:

- Analyze change in various contexts.
- Represent and analyze mathematical situations using algebraic symbols.
- Use mathematical models to represent and understand quantitative relationships.
- Apply and adapt a variety of appropriate strategies to solve problems.
- Apply appropriate techniques, tools, and formulas to determine measurements.
- Use the language of mathematics to express mathematical ideas precisely.
- Understand how mathematical ideas interconnect and build on one another.

21st Century Themes
(www.21stcenturyskills.org)

_x__ Global Awareness
_x__Financial, Economic, Business and Entrepreneurial Literacy
___Civic Literacy
_x__Health Literacy
_x__Environmental Literacy

21st Century Skills

Learning and Innovation Skills:
_x__Creativity and Innovation
_x__Critical Thinking and Problem Solving
_x__Communication and Collaboration

Information, Media and Technology Skills:
_x__Information Literacy
_x__Media Literacy
_x__ICT (Information, Communications and Technology) Literacy

Life and Career Skills:
_x_Flexibility and Adaptability
_x__Initiative and Self-Direction
_x__Social and Cross-Cultural Skills
_x__Productivity and Accountability
_x__Leadership and Responsibility

Enduring Understandings: *Students will understand that . . .*	**Essential Questions:**
EU 1 integration is a summation process. *EU 2* the fundamental theorems of calculus relate differentiation and integration. *EU 3* antiderivatives can be used to solve initial condition problems. *EU 4* there are several numerical techniques to approximate the definite integral.	*EU 1* • What is integration? *EU 2* • How are the derivative and the integral related? • How can knowledge of derivatives be used to find the integral of a function? *EU 3* • What is the purpose of an antiderivative? *EU 4* • How can the area under a curve be approximated?
Knowledge: *Students will know . . .*	**Skills:** *Students will be able to . . .*
EU 1 • integration is the limit of a summation. EU2 • the relationship between derivative and the integral EU3 • differential equations and initial condition problems have unique solutions. EU4 • definite integrals can be evaluated.	*EU 1* • compute Riemann sums using left, right, and midpoint evaluation points. EU2 • show that integration rules follow directly from the derivatives rules of basic functions. EU3 • solve initial condition problems including separable differential equations. EU4 • evaluate the definite integral using the Fundamental Theorem of Calculus

Stage 2 – Assessment Evidence

Performance Task #1:

Other Recommended Evidence: *Tests, Quizzes, Prompts, Self-assessment, Observations, Dialogues, etc.*

- Quiz on Antiderivatives and Indefinite Integration
- Quiz on Area
- Quiz on Riemann Sums and Definite Integrals
- Quiz on The Fundamental Theorem of Calculus
- Quiz on U-Substitution
- Quiz on Trapezoidal Rule
- Quiz on The Natural Log Function: Integration
- Quiz on Exponential Functions: Integration
- Quiz on Bases Other than e and Applications: Integration
- Quiz on Inverse Trig Functions: Integration
- Unit Test
- Assessed elements from recommended performance tasks

Stage 3 – Learning Plan

Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections:

- Activity #1 TI-Nspire Riemann Sums (M)
  http://education.ti.com/en/timathnspired/us/detail?id=3CD2788D70CE46C6837BED58EA69C255&t=2596C50B247541C1B54AC803ECC87BD1

- Activity #2 TI-Nspire Definite Integral (A, M)
  http://education.ti.com/en/timathnspired/us/detail?id=95E10AB515E046ABA11198316E389FB6&t=2596C50B247541C1B54AC803ECC87BD1

- Activity #3 TI-Nspire Trapezoid and Midpoint Approximations (A)
  http://education.ti.com/en/timathnspired/us/detail?id=D8C74AF3BF67474A86A40DA7457BF048&t=2596C50B247541C1B54AC803ECC87BD1

- Activity #4: TI-Nspire The First Fundamental Theorem of Calculus (A, M)
  http://education.ti.com/en/timathnspired/us/detail?id=13662A371429479B9E6A33ACF8EB8ABD&t=A83C9A2C88E44245ADF6A76FBA4BCB2C

- Activity #5: TI-Nspire The Second Fundamental Theorem of Calculus (A, M)
  http://education.ti.com/en/timathnspired/us/detail?id=F75E97ED4BB14511B1BE92F0F6113CC0&t=A83C9A2C88E44245ADF6A76FBA4BCB2C

- Activity #6: The Dead Body Lab (A, M, T)

  Materials:

  1. meter stick
  2. large piece of white paper
  3. several sturdy pencils/pens
  4. notebook for recording data

  Procedures:

  1. Choose a partner and decide who dies (who is going to be the dead body)
  2. Go to a location in the school directed by the teacher
  3. Lie on the paper keeping feet and arms on the paper (no mummies!)
  4. Trace around the body carefully
  5. Draw a vertical line down the center of the body and measure every 3 inches
  6. Draw a horizontal line and measure every 3 inches across (measure to nearest quarter inch)
  7. Add the lengths and write down on the paper.
  8. Make a table of horizontal and vertical distances and record.
  9. Make a good copy of the table on the back of this paper to hand in
  10. Design a calculus method to calculate the area of the body. Put the final answer on the back of this paper.

The following is a suggested sequence of learning activities for the Accelerated Calculus class. Approximate days for completion: 37.

- YWBAT write a general solution of a differential equation and use indefinite integral notation for antiderivatives.
- YWBAT use basic integration rules to find antiderivatives.
- YWBAT find a particular solution of a differential equation.
- YWBAT use sigma notation to write and evaluate a sum.
- YWBAT understand the concept of area.
- YWBAT approximate the area of a plane region.
    - Activity #1
    - Activity #3
    - Activity #6
- YWBAT find the area of a plane region using limits.
    - Activity #1
- YWBAT explain the definition of a Riemann sum.
    - Activity #1
- YWBAT evaluate a definite integral using limits.
    - Activity #4
- YWBAT evaluate a definite integral using properties of definite integrals.
- YWBAT evaluate a definite integral using the Fundamental Theorem of Calculus.
    - Activity #2
    - Activity #4
- YWBAT explain and use the Mean Value Theorem for integrals.
- YWBAT find the average value of a function over a closed interval.
- YWBAT apply and use the Second Fundamental Theorem of Calculus.
    - Activity #5
- YWBAT explain and use the Net Change Theorem.
    - Activity #4
- YWBAT use pattern recognition to find an indefinite integral.
- YWBAT use a change of variables to find an indefinite integral.
- YWBAT use the General Power Rule for integration to find an indefinite integral.
- YWBAT use a change of variables to evaluate a definite integral.
- YWBAT evaluate a definite integral involving even or odd functions.
- YWBAT approximate a definite integral using the Trapezoidal Rule.
    - Activity #3
- YWBAT use the Log Rule for integration to integrate a rational function.
- YWBAT integrate trigonometric functions.
- YWBAT differentiate and integrate exponential functions that have bases other than e.
- YWBAT use exponential functions to model compound interest and exponential growth.
- YWBAT integrate functions whose antiderivatives involve inverse trigonometric functions.
- YWBAT use a method of completing the square to integrate functions.
- Performance Task

Critical Vocabulary:

- Antiderivative
- Integration
- Differential Equation
- Initial Condition
- Particular Solution
- Definite Integral
- Indefinite Integral
- Upper/Lower Sum
- Left/Right Sum
- Midpoint Sum
- Riemann Sum
- Net Change
- Displacement
- Transcendental
- Completing the Square
- Compound Interest
- Half-Life
- Natural Exponential Function
- Common Logarithmic Function
- Long Division
- Base
- Natural Logarithmic Function
- Logarithm