I. Basic Course Information

A. Course Number and Title: MATH 151 Calculus I Honors

B. New or Modified Course: Modified Course

C. Date of Proposal: Spring 2015

D. Effective Term: Fall 2015

E. Sponsoring Department: Mathematics

F. Semester Credit Hours: 4

G. Weekly Contact Hours: 5
   Lecture: 3
   Laboratory: 2

H. Prerequisites: GPA of 3.5 or permission of the instructor; AND Three-and-one-half years of college preparatory mathematics including Trigonometry and a satisfactory score on a placement test or a CLEP test, or grade of C or better in MATH 113 Precalculus II, or MATH 114H Precalculus Honors

I. Laboratory Fees: None

J. Name and Telephone Number or E-Mail Address of Department Chair:
   Rosemarie Gorini (908) 526-1200 extension 8546,
   rosemarie.gorini@raritanval.edu

II. Catalog Description

   Prerequisite: GPA of 3.5 or permission of the instructor, AND
   Three-and-one-half years of college preparatory mathematics including
   Trigonometry and a satisfactory score on a placement test or a CLEP test, or
   grade of C or better in MATH 113 Precalculus II, or MATH 114H Precalculus Honors.

   Introductory calculus with a technology-based computer laboratory component.
   Topics include limits, differentiation, applications of derivatives, integration, the
   Fundamental Theorem of Calculus, and logarithmic, exponential, and other
   transcendental functions as well as the Binomial Theorem and Mathematical
Induction. Calculus application problems from business, the natural sciences and mathematics

III. Statement of Course Need

A. Enrollment History: In the fall 2014 semester we have approximately 184 students who registered for Calculus I.

B. The two-hour lab is standard for all of our Calculus I, II, and III sections. It enables the students to use technology to help them become proficient in the course material.

C. This course is a prerequisite for MATH 152 Calculus II. This course also serves as a math requirement for programs in Biology, Chemistry, Physics, Computer Science, Engineering Science, General Science, and Mathematics.

IV. Place of Course in College Curriculum

A. This course is a free elective and a Mathematics elective for all programs.
B. This course serves as a General Education requirement in Mathematics.
C. This course meets a program requirement in Biology, Chemistry, Physics, Computer Science, Engineering Science, General Science, Mathematics and in the Honor’s College Program.
D. This course transfers as a first semester honors calculus course. Course transferability: for New Jersey schools go to the NJ Transfer website, www.njtransfer.org. For all other colleges and universities go to their individual websites.

V. Outline of Course Content

A. Limits and their properties
   1. Preview
   2. Finding limits graphically, numerically, and analytically
   3. Continuity and one-sided limits
   4. Infinite limits

B. Differentiation
   1. The derivative and the tangent line problem
   2. Basic Differentiation rules and rates of change
   3. Product rule, quotient rule, higher-order derivatives
   4. Chain rule
   5. Implicit differentiation
   6. Related rates

C. Applications of differentiation
1. Extrema
2. Rolle's Theorem, mean value theorem
3. Increasing and decreasing functions and the first derivative test
4. Concavity and the second derivative test
5. Limits at infinity
6. Summary of curve sketching
7. Optimization problems
8. Newton's method, differentials

D. Integration
1. Antiderivatives and indefinite integration
2. Area, Riemann sums, and definite integrals
3. Fundamental theorem of calculus
4. Integration by substitution; numerical integration

E. Logarithmic, exponential, and other transcendental functions
1. Natural logarithmic functions: differentiation, integration
2. Inverse functions
3. Exponential functions: differentiation, integration
4. Bases other than $e$ and their applications
5. Differential equations: growth and decay, separation of variables
6. Inverse trigonometric functions: differentiation and integration
7. Hyperbolic functions

F. Enrichment and proofs
1. Selected proofs appropriate to the level of the course
2. Mathematical Induction
3. The Binomial Theorem

G. Applications problems from business and the natural sciences

VI. Educational Goals and Learning Outcomes

A. General Education Learning Outcomes

At the completion of the course, students will be able to:

1. evaluate various limits. (GE-NJ 2)
2. utilize the concept of instantaneous rate of change to solve problems in physics, biology, economics, and other real-world phenomena. (GE-NJ 2)
3. differentiate polynomial, rational, exponential, logarithmic, and trigonometric functions algebraically. (GE-NJ 2)
4. demonstrate the relationship between the algebraic and geometric properties of the derivative. (GE-NJ 2)
5. use the Fundamental Theorem of Calculus and the concept of antiderivative to algebraically evaluate integrals. (GE-NJ 2)
6. utilize the derivative procedure to solve various application problems. (GE-NJ 2)
7. prove selected theorems appropriate to the level of the course. (GE-NJ 2)

B. Course Learning Outcomes

See above

C. Assessment Instruments

A. tests
B. final examination
C. projects
D. laboratory products
E. quizzes

VII. Grade Determinants

Factors that may enter into the determination of the final grade:

A. Tests
B. Quizzes
C. Cumulative final examination
D. Projects
E. Homework
F. Small Groups

Primary formats, modes, and methods for teaching and learning that may be used in the course:

A. lecture
B. small groups
C. labs with technology component
D. homework
E. quizzes
F. projects
G. tests
H. cumulative Final Examination
I. individual teacher determinants
VIII. Texts and Materials


Please Note: The course outline is intended only as a guide to course content and resources. Do not purchase textbooks based on this outline. The RVCC Bookstore is the sole resource for the most up-to-date information about textbooks.

B. A graphing calculator may be required; TI-84 is recommended

IX. Resources

This course is held in a computer lab for two hours a week. The computers need to be installed with the calculus software currently licensed to the math department. Contact the math department chair to determine which software to install.