MATH-161H: HONORS CALCULUS I

Cuyahoga Community College

Viewing:MATH-161H : Honors Calculus I
Board of Trustees:
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2016-08-23

Subject Code
MATH - Mathematics

Course Number:
161H

Title:
Honors Calculus I

Catalog Description:
First of a three-semester sequence designed for math, science, business, and engineering majors. Focus on conceptual understanding of verbal, numerical, visual, and algebraic representations of functions, their graphs, and operations. Includes limits, continuity, rates of change, derivatives, implicit differentiation of algebraic and trigonometric functions, application of differentials, differentiation, integrals, and application of integration. Emphasizes challenging calculus exercises, problems, projects, cooperative group work, students presentation of one of the course projects, and use of technology: graphing calculators and computers.

Credit Hour(s):
5

Lecture Hour(s):
5

Requisites

Prerequisite and Corequisite
MATH-1540 Trigonometry or MATH-154H Honors Trigonometry or MATH-1580 Precalculus; or departmental approval: equivalent coursework.

I. ACADEMIC CREDIT

Academic Credit According to the Ohio Department of Higher Education, one (1) semester hour of college credit will be awarded for each lecture hour. Students will be expected to work on out-of-class assignments on a regular basis which, over the length of the course, would normally average two hours of out-of-class study for each hour of formal class activity. For laboratory hours, one (1) credit shall be awarded for a minimum of three laboratory hours in a standard week for which little or no out-of-class study is required since three hours will be in the lab (i.e. Laboratory 03 hours). Whereas, one (1) credit shall be awarded for a minimum of two laboratory hours in a standard week, if supplemented by out-of-class assignments which would normally average one hour of out-of-class study preparing for or following up the laboratory experience (i.e. Laboratory 02 hours). Credit is also awarded for other hours such as directed practice, practicum, cooperative work experience, and field experience. The number of hours required to receive credit is listed under Other Hours on the syllabus. The number of credit hours for lecture, lab and other hours are listed at the beginning of the syllabus. Make sure you can prioritize your time accordingly. Proper planning, prioritization and dedication will enhance your success in this course.

The standard expectation for an online course is that you will spend 3 hours per week for each credit hour.

II. ACCESSIBILITY STATEMENT

If you need any special course adaptations or accommodations because of a documented disability, please notify your instructor within a reasonable length of time, preferably the first week of the term with formal notice of that need (i.e. an official letter from the Student Accessibility Services (SAS) office). Accommodations will not be made retroactively.
III. ATTENDANCE TRACKING

Regular class attendance is expected. Tri-C is required by law to verify the enrollment of students who participate in federal Title IV student aid programs and/or who receive educational benefits through other funding sources. Eligibility for federal student financial aid is based in part on enrollment status.

Students who do not attend classes for the entire term are required to withdraw from the course(s). Additionally, students who withdraw from a course or stop attending class without officially withdrawing may be required to return all or a portion of their financial aid based on the date of last attendance. Students who do not attend the full session are responsible for withdrawing from the course(s).

Tri-C is responsible for identifying students who have not attended a course before financial aid funds can be applied to students’ accounts.

Therefore, attendance is recorded in the following ways:
- For in-person and blended-learning courses, students are required to attend the course by the 15th day of the semester (or equivalent for terms shorter than five weeks) to be considered attending. Students who have not met all attendance requirements for in-person and blended courses, as described herein, within the first two weeks or equivalent, will be considered not attending.
- For online courses, students are required to login at least two times per week and submit one assignment per week for the first two weeks of the semester, or equivalent to the 15th day of the term. Students who have not met all attendance requirements for online courses, as described herein, within the first two weeks or equivalent, will be considered not attending.

At the conclusion of the first two weeks of a semester or equivalent, instructors report any registered students who have "Never Attended" a course. Those students will be administratively withdrawn from that course. However, after the time period in the previous paragraphs, if a student stops attending a class or wants or needs to withdraw, for any reason, it is the student’s responsibility to take action to withdraw from the course. Students must complete and submit the appropriate Tri-C form by the established withdrawal deadline.

Tri-C is required to ensure that students receive financial aid only for courses that they attend and complete. Students reported for not attending at least one of their registered courses will have all financial aid funds held until confirmation of attendance in registered courses has been verified. Students who fail to complete at least one course may be required to repay all or a portion of their federal financial aid funds and may be ineligible to receive future federal financial aid awards. Students who withdraw from classes prior to completing more than 60 percent of their enrolled class time may be subject to the required federal refund policy.

If illness or emergency should necessitate a brief absence from class, students should confer with instructors upon their return. Students having problems with coursework due to a prolonged absence should confer with the instructor or a counselor.

IV. LEARNING OUTCOMES ASSESSMENT

Occasionally, in addition to submitting assignments to their instructors for evaluation and a grade, students will also be asked to submit completed assignments, called ‘artifacts,’ for assessment of course and program outcomes and the College's Essential Learning Outcomes (ELOs). The artifacts will be submitted in Blackboard or a similar technology. The level of mastery of the outcome demonstrated by the artifact DOES NOT affect the student’s grade or academic record in any way. However, some instructors require that students submit their artifact before receiving their final grade. Some artifacts will be randomly selected for assessment, which will help determine improvements and support needed to further student success. If you have any questions, please feel free to speak with your instructor or contact the Learning Outcomes Assessment office.

V. CONCEALED CARRY STATEMENT

College policy prohibits the possession of weapons on college property by students, faculty and staff, unless specifically approved in advance as a job-related requirement (i.e., Tri-C campus police officers) or, in accordance with Ohio law, secured in a parked vehicle in a designated parking area only by an individual in possession of a valid conceal carry permit.

As a Tri-C student, your behavior on campus must comply with the student code of conduct which is available on page 29 within the Tri-C student handbook, available athttp://www.tri-c.edu/student-resources/documents/studenthandbook.pdfYou must also comply with the College’s Zero Tolerance for Violence on College Property available athttp://www.tri-c.edu/policies-and-procedures/documents/3354-1-20-10-zero-tolerance-for-violence-policy.pdf

Outcomes
Course Outcome(s):
Use algebra and technology to solve a variety of challenging exercises with equations and inequalities.
Course Outcome(s):
Use formulas of differentiation, the Chain Rule, and implicit differentiation to find derivatives and higher-order derivatives of various algebraic and trigonometric functions.

Course Outcome(s):
Apply derivatives as rates of change to solve various types of problems in the natural and social sciences: physics, chemistry, biology, economics and other sciences, including maxima and minima, related rates, mathematical optimization, and graphing functions; use analytical, graphical, and computer algebra system approaches.

Course Outcome(s):
Demonstrate use of linear approximation and differentials in a variety of estimating applications.

Course Outcome(s):
State, interpret, and apply the Mean Value Theorem to explore and solve problems.

Course Outcome(s):
Graph functions using horizontal and vertical asymptotes; investigate graphs.

Course Outcome(s):
Use systematic procedures to sketch a curve by the "pencil and paper method"; use graphing calculator/computer algebra systems for graphing.

Course Outcome(s):
Use Newton's method to approximate solutions of n th-degree equations.

Course Outcome(s):
Determine antiderivatives of algebraic functions.

Course Outcome(s):
State and interpret the Fundamental Theorem of Calculus and apply this theorem to real-life situations.

Course Outcome(s):
Apply the properties of definite integrals and critical thinking skills to solving a variety of challenging problems, including areas, volumes, lengths of curves, population predictions, cardiac output, forces on a dam, fluid pressure, and work.

Course Outcome(s):
Identify types of functions and their graphs from four ways of presentation: verbally, numerically, visually, and algebraically.

Course Outcome(s):
Explore and develop four projects—one each of applied, discovery, laboratory, and writing—to demonstrate comprehensive honors calculus' competencies and skills.

Course Outcome(s):
Enhance mathematical reasoning, decision-making, and problem-solving skills through research and small group activities.

Course Outcome(s):
Prove a variety of theorems and mathematics statements; derive and verify mathematical models.

Course Outcome(s):
Use technology: graphing calculator or computer algebra systems to graph, compute, evaluate, estimate, and develop projects.
Course Outcome(s):
Perform operations on functions: transformations, combinations, and compositions.

Course Outcome(s):
Apply problem-solving principles to real-life problems.

Course Outcome(s):
Describe the process of using functions as mathematical models.

Course Outcome(s):
Investigate limits and their properties.

Course Outcome(s):
Compute limits and solve advanced applications using special techniques and limit theorems.

Course Outcome(s):
Demonstrate use of the definition of continuity, continuity theorems, and decision-making skills in solving real-life problems.

Course Outcome(s):
Apply definition and interpretations of a derivative to solve challenging problems.

Methods of Evaluation:
1. Periodic comprehensive exams (at least four exams)
2. Quizzes
3. Homework
4. In class collaborative and cooperative group work
5. Four course projects: applied, discovery, laboratory, and writing
6. Student presentation of one of the above course projects
7. Graphing calculator/computer application problems Comprehensive final exam

Course Content Outline:
1. Fundamental concepts with technology
   a. Real number system and estimating strategies
   b. Equations and their graphs
   c. Applying the problem-solving principles, strategies, and skills to real-life problems
   d. Use of graphing calculator/computer algebra systems to solve challenging word problems
   e. Inequalities and their graphs
2. Functions and mathematical models
   a. Four ways of the function presentation: verbally, numerically, visually, and algebraically
   b. Linear models of functions and their graphs, characteristics, and use
   c. Polynomial functions and their graphs, characteristics, and use
   d. Power functions and their graphs, characteristics, and use
   e. Algebraic functions and their graphs, characteristics, and use
   f. Trigonometric functions and their graphs, characteristics, and use
   g. Transformation, combining, composition, and decomposition of functions and exploratory problems
   h. Use graphing calculator/computer algebra systems for graphing
3. Limits and their properties:
   a. The concept of limit and its graphical interpretation: tangent line and elocity problems
   b. Proof of limit theorems
   c. Analytical and graphical approaches to evaluate one-sided limits, limits at infinity, infinite limits of functions; solving advanced applications
d. Limits of trigonometric functions; exploring and solving real-life situation problems

e. Use of graphing calculator/computer algebra systems to calculate limits and solve challenging problems

f. Continuity of the function; physical and geometric interpretation of continuity

g. Proof of continuity theorems and applying decision-making skills to solving advanced applications

4. Derivatives and differentiation:

a. Derivatives and their interpretations; the tangent line problems

b. Proof of theorems of differentiability and continuity of functions

c. Formulas of differentiation and higher-order derivatives

d. Use of analytical approach and graphical analysis to solve physical applications of the derivative

Differential of trigonometric functions

e. The Chain Rule and solving exploration problems

f. Implicit differentiation, higher derivatives, and their advanced applications

5. Applications and differentiation

a. Rate of change and problem-solving applications

b. Relative and absolute extrema and solving critical-thinking-skill applications

c. Related rates and mathematical modeling

d. Rolle’s theorem and the Mean Value Theorem and their graphical presentation and problem-solving applications

e. Analysis of functions: using the First and Second Derivative Tests

f. Limits at Infinity; Horizontal Asymptotes

g. Use of graphing calculator/computer algebra systems to sketch curves and analyze functions

h. Solving optimization and economics problems

i. Newton’s method of approximation of real solutions of polynomial equations

6. The differential and antiderivatives

a. determining differentials

b. Antiderivatives, and their notation and geometric interpretations

c. Challenging applications problems

7. The definite integral and integration

a. Summation formulas and Riemann sums: special notation and terminology

b. The definite integral and its integration and applications

c. Use graphing calculators/computer algebra systems to evaluate integrals

d. Use area formula to evaluate integrals

e. Properties of definite integrals and solving exploration problems

The Fundamental Theorem of Calculus and solving decision-making-skill applications

f. Trapezoidal and Simpson’s Rules and solving advanced applications

8. Exploration of four projects—one from each category: applied, discovery, laboratory, and writing

Resources


Resources Other
1. The textbook’s software and a variety of computer algebra systems: Derive, Maple, Mathematica and others.
2. Mathematical articles from newspapers and mathematical journals.

Instructional Services

OAN Number:
TMM005, and TMM017 (1 of 2 courses, both must be taken)