COLLIN COUNTY COMMUNITY COLLEGE
COURSE SYLLABUS

COURSE NUMBER: MATH 2413

COURSE TITLE: Calculus I

CREDIT HOURS: 4 LECTURE HOURS: 3 LAB HOURS: 3

ASSESSMENTS: Prior to enrolling in this course, the student must demonstrate eligibility to enroll in the following: MATH 2413 or higher.

PREREQUISITE: MATH 2412; or equivalent.

COREQUISITE: None

COURSE DESCRIPTION: Limits and continuity; the Fundamental Theorem of Calculus; definition of the derivative of a function and techniques of differentiation; applications of the derivative to maximizing or minimizing a function; the chain rule, mean value theorem, and rate of change problems; curve sketching; definite and indefinite integration of algebraic, trigonometric, and transcendental functions, with an application to calculation of areas. Lab included.

TEXTBOOK: Onsite courses: Calculus by James Stewart – Early Transcendentals, 8th edition. 2016, Cengage Learning. Online courses: e-mail your professor, vantohe@collin.edu or dbrown@collin.edu for textbook information.

SUPPLIES: Graphing calculator required

STUDENT LEARNING OUTCOMES:

Upon completion of this course the students should be able to do the following:

1. Develop solutions for tangent and area problems using the concepts of limits, derivatives, and integrals.
2. Draw graphs of algebraic and transcendental functions considering limits, continuity, and differentiability at a point.
3. Determine whether a function is continuous and/or differentiable at a point using limits.
4. Use differentiation rules to differentiate algebraic and transcendental functions.
5. Identify appropriate calculus concepts and techniques to provide mathematical models of real-world situations and determine solutions to applied problems. (Critical Thinking and Communication Skills)
6. Evaluate definite integrals using the Fundamental Theorem of Calculus.
7. Articulate the relationship between derivatives and integrals using the Fundamental Theorem of Calculus. (Critical Thinking and Communication Skills)

COURSE REQUIREMENTS: Completion of required exams, labs, and assignments.

COURSE FORMAT: Lecture, lab and guided practice.
METHOD OF EVALUATION: A minimum of four proctored exams, a lab component grade, and a proctored comprehensive final exam will be given. Homework and/or quizzes may be used in place of one exam or in addition to exams. The weight of each of these components of evaluation will be specified in the individual instructor’s addendum to this syllabus. All out-of-class course credit, including home assignments, service-learning, etc. may not exceed 25% of the total course grade; thus, at least 75% of a student’s grade must consist of proctored exams, and no student may retake any of these exams.

ATTENDANCE POLICY: Attendance is expected of all students. If a student is unable to attend, it is his/her responsibility to contact the instructor to obtain assignments. Please see the schedule of classes for the last day to withdraw from the course with a grade of W.

RELIGIOUS HOLY DAYS: In accordance with section 51.911 of the Texas Education Code, the college will allow a student who is absent from class for the observance of a religious holy day to take an examination or complete an assignment scheduled for that day within a reasonable time. A copy of the state rules and procedures regarding holy days and the form for notification of absence from each class under this provision are available from the Admissions and Records Office. Please refer to the current Collin Student Handbook.

ADA STATEMENT: Collin College will adhere to all applicable federal, state and local laws, regulations and guidelines with respect to providing reasonable accommodations as required to afford equal educational opportunity. It is the student's responsibility to contact the ACCESS Office, SCC-D140 or 972.881.5898, (V/TDD 972.881.5950) to arrange for appropriate accommodations. See the current Collin student Handbook for additional information.

ACADEMIC ETHICS: Please see section 7-2.2 of the Collin Student Handbook. Contact the Dean of Students at 972.881.5771 for the student disciplinary process and procedures.

COURSE CONTENT: Proofs and derivations will be assigned at the discretion of the instructor. The student will be responsible for knowing all definition and statements of theorems for each section outlined in the following modules.

Module 1: Limits and Derivatives
The student will be able to do:

1. Estimate tangent lines and instantaneous velocity
2. Find the Limit of a function numerically and graphically using left and right-hand limits, infinite limits, and vertical asymptotes
3. Calculate limits using laws of limits, evaluate limits algebraically with zero denominators and the squeeze theorem
4. Prove limits using the precise definition of a Limit and the ε-δ definition
5. Find continuity at a point and on an intervals, continuity of composite functions, and the intermediate value theorem
6. Find limits at Infinity, horizontal asymptotes limits as \( x \to \pm \infty \), and vertical asymptotes
8. Find derivatives and rates of change using definitions of tangent lines, instantaneous velocity, and derivative of a function at a point
9. Calculate the derivative as a function using the limit definition, derivative notations, differentiability at points and on intervals, and higher order derivatives

Module 2: Differentiation Rules
The student will be able to do:

1. Calculate derivatives of constants, polynomials, exponential functions,
2. Calculate derivatives using the power rule, constant multiple, sum and difference, and exponential functions
3. Calculate derivatives using the product and quotient rules
4. Find derivatives of trigonometric functions and the limit of \( \frac{\sin(\theta)}{\theta} \)
5. Use the Chain rule and differentiation of composite functions, power rule combined with the chain rule
6. Apply implicit differentiation to explicit and implicit functions and calculate derivative of inverse trigonometric functions
7. Derivatives of logarithmic functions and logarithmic differentiation
8. Rates of change in the Natural and Social Sciences derivative applications in physics, chemistry, biology, economics, and other sciences
9. Exponential growth and decay population growth, radioactive decay, Newton’s law of cooling, continuous compound interest
10. Related rates and problem solving strategies as well as related rates equations
11. Linear approximations and differentials linearization, relative and percentage errors
12. Definitions of hyperbolic functions, identities, derivatives, and derivatives of inverse hyperbolic functions

Module 3: Applications of Differentiation
The student will be able to do:

1. Local maximum and minimum values, absolute maximum and minimum values, extreme value theorem for continuous functions on closed bounded intervals, critical numbers, strategy for finding absolute maximum and minimum
2. The Mean Value theorem, Rolle’s theorem, physical interpretations, functions with zero derivative and equal derivatives
3. How derivatives affect the shape of a graph, increasing /decreasing functions, first derivative test for local extreme values, concavity, second derivative test for concavity, inflection points, second derivative test for local extreme values
4. L’Hospital’s rule for indeterminate forms of type \( \frac{0}{0} \) or \( \frac{\infty}{\infty} \), other indeterminate forms
5. Summary of curve sketching, guidelines for sketching curves, and slant asymptotes
6. Graphing with calculus and calculators or computers with graphing software
7. Solving optimization problems, first derivative test for absolute extreme values, and Newton’s method procedure
8. Basic antiderivatives and separable differential equations
Module 4: Integrals
The student will be able to do:

1. Estimate areas and distances of regions bounded by the functions and the x-axis using sigma notation,
2. Evaluate areas as a limit
3. Definition of definite integral, Riemann sums, the definite integral as a limit of a Riemann sum, and properties of the definite integral
4. Evaluate definite integrals using The Fundamental Theorem of Calculus parts 1 and 2,
5. Evaluate indefinite integrals and the net change theorem and indefinite integrals
6. Evaluate integrals using the substitution rule and symmetric functions