

**COLLIN COUNTY COMMUNITY COLLEGE  
COURSE SYLLABUS**

**COURSE NUMBER:** Math 2413

**COURSE TITLE:** Calculus I

**CREDIT HRS:** 4      **LECTURE HRS:** 3      **LAB HRS:** 3      **CLN/REC HRS:** 0

**ASSESSMENTS:**

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

**PREREQUISITE:** MATH 2312

**COREQUISITE:** None

**TEXTBOOK:**

Onsite courses: Thomas' Calculus / Early Transcendentals, Eleventh Edition, Weir-Hass Giordano, ©2006, Pearson Education.

Online courses: e-mail your professor, [vantohe@cccCd.edu](mailto:vantohe@cccCd.edu) or [dbrown@cccCd.edu](mailto:dbrown@cccCd.edu), for textbook information.

**SUPPLIES:** Graphing calculator required

**COURSE DESCRIPTION:**

Study of limits, continuity, derivatives, applications of the derivative, definite, and indefinite integrals. Graphing calculator required. Lab included.

**COURSE MEASURABLE LEARNING OUTCOMES:**

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

1. Prove limits using the formal definition; and then calculate various problems using properties of limits and the L'Hopital's Rule. Find instantaneous rate of change, continuities, and tangent lines.
2. Compute the derivative as a limit; and then differentiate transcendental and algebraic functions using rules of differentiation. Solve related rates, linearization and differential problems
3. Use first and second derivatives to find absolute and local extrema, to sketch graph of functions, to solve optimization problems, and to find roots of functions using Newton's method.

4. Derive the definite integral as a limit; and then use the fundamental theorem of calculus, properties of definite and indefinite integrals, and the substitution method to evaluate integrals with applications.

**COURSE REQUIREMENTS:**

Completion of required exams, labs, and assignments.

**COURSE FORMAT:**

Lecture, lab and guided practice.

**METHOD OF EVALUATION:**

A minimum of four written exams, a lab component grade, and a comprehensive final exam. 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 take-home exams, 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 exams given in the class or testing center, 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.

**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.

**COURSE REPEAT POLICY:**

All students may repeat this course only once after receiving a grade, including W. For example students who have taken this course twice have to choose a different course to take after two trials.

**ADA STATEMENT:**

It is the policy of Collin County Community College to provide reasonable and appropriate accommodations for individuals with documented disabilities. This College will adhere to all applicable Federal and State 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 (G-200) or 972.881.5898, (TDD 972.881.5950) in a timely manner if he/she desires to arrange for accommodations.

### **ACADEMIC ETHICS:**

The college may initiate disciplinary proceedings against a student accused of scholastic dishonesty. Scholastic dishonesty includes, but is not limited to, statements, acts, or omissions related to applications for enrollment or the award of a degree, and/or the submission of material as one's own work that is not one's own. Scholastic dishonesty may involve one or more of the following acts: cheating, plagiarism, collusion, and/or falsifying academic records.

Cheating is the willful giving or receiving of information in an unauthorized manner during an examination, illicitly obtaining examination questions in advance, using someone else's work for assignments as if it were one's own, copying computer disks or files, and any other dishonest means of attempting to fulfill the requirements of a course.

Plagiarism is the use of an author's words or ideas as if they were one's own without giving credit to the source, including, but not limited to, failure to acknowledge a direct quotation. Contact the Dean of Students at 972.881.5771 for the student disciplinary process and procedures or consult the CCCC Student Handbook.

### **COURSE CONTENT:**

Note: Proofs and derivations will be assigned at the discretion of the instructor.

#### **Module 1: Limits and Continuity**

The student will be able to do:

1. Rates of change and limits:  
average and instantaneous speed, average rates of change and secant lines, limits of function values, using calculators and computers to estimate limits
2. Calculating limits using the limit laws:  
the limit laws, estimating zero denominators algebraically, the sandwich theorem,
3. The precise definition of a limit:  
definition of limit, testing the definition, finding deltas algebraically for given epsilons, using the definition to prove theorems
4. One-sided limits and limits at infinity:  
one-sided limits, precise definitions of one-sided limits, limits involving  $\sin(\theta)/\theta$ , finding limits as  $x \rightarrow \pm\infty$ , limits at infinity of rational functions, horizontal asymptotes, sandwich theorem revisited, oblique asymptotes
5. Infinite limits and vertical asymptotes:  
infinite limits, precise definitions of infinite limits, vertical asymptotes, dominant terms
6. Continuity:  
continuity at a point, continuous functions, composites, continuous extension to a point, intermediate value theorem for continuous functions
7. Tangents and Derivatives:  
tangent to a curve,  
finding a tangent to the graph of a function, rates of change and derivative at a point

**Module 2: Differentiation**

The student will be able to do:

1. The derivative as a function:  
calculating derivatives from the definition, notations, graphing the derivative, differentiable on an interval, one-sided derivatives, when does a function not have a derivative at a point, differentiable functions are continuous, intermediate value property of derivatives
2. Differentiation rules for polynomials, exponentials, products and quotients:  
powers multiples sums and differences, derivatives of exponential functions, products and quotients, negative integer powers of  $x$ , second and higher-order derivatives
3. The derivative as a rate of change:  
instantaneous rates of change, motion along a line displacement velocity speed acceleration and jerk, derivatives in economics, sensitivity to change
4. Derivatives of trigonometric functions:  
derivative of the sine function, derivative of the cosine function, simple harmonic motion, derivatives of the other basic trigonometric functions
5. The chain rule and parametric equations:  
derivative of a composite function, outside-inside rule, repeated use of the chain rule, chain rule with powers of a function, parametric equations, slopes of parameterized curves
6. Implicit differentiation:  
Implicitly defined functions, implicit differentiation, lenses tangents and normal lines, derivatives of higher order, rational powers of differentiable functions, power rule for rational functions
7. Derivatives of inverse functions and logarithms:  
derivatives of inverses of differentiable functions, the derivative rule for inverses, parametrizing inverse functions, derivative of the natural logarithm function, the derivative of  $a^u$ , the derivative of  $\log_a u$ , logarithmic differentiation, the power rule general form, the number  $e$  expressed as a limit
8. Inverse trigonometric functions:  
inverse of  $\tan(x)$   $\cot(x)$   $\sec(x)$  and  $\csc(x)$ , arctangent and arccotangent functions, the derivative of  $\arcsin(u)$ , the derivative of  $\arctan(u)$ , the derivative of  $\arcsec(u)$ , derivatives of the other three
9. Related rates:  
related rates equations, related rates problem strategy
10. Linearization and differentials:  
linearization, standard linearization approximation, differentials, estimating with differentials, error in differential approximation, change in  $y = f(x)$  near  $x = a$ , sensitivity to change

**Module 3: Applications of Derivatives**

The student will be able to do:

1. Extreme values of functions:  
absolute maximum and minimum, the extreme value theorem,  
local relative extreme values, local maximum and minimum, finding extrema,  
first derivative theorem for local extreme values, critical point,  
how to find the absolute extrema of a continuous function on a finite closed interval
2. Mean value theorem:  
Rolle's theorem, the mean value theorem, physical interpretation,  
proofs of laws of logarithms, laws of exponents,  
finding velocity and position from acceleration
3. Monotonic functions and the first derivative:  
increasing and decreasing functions, first derivative test for monotonic functions,  
first derivative test for local extrema
4. Concavity and curve sketching:  
concavity, concave up and down, second derivative test for concavity,  
points of inflection, second derivative test for local extrema,  
strategy for graphing  $y = f(x)$ , learning about functions from derivatives
5. Applied optimization problems:  
examples from business and industry, solving applied optimization problems,  
examples from mathematics and physics, examples from economics
6. Indeterminate forms and L'Hopital's Rule:  
indeterminate form  $0/0$ , L'Hopital's rule, Cauchy's mean value theorem,  
using L'Hopital's theorem, indeterminate forms  $\infty/\infty$ ,  $\infty \cdot 0$ ,  $\infty - \infty$ ,  
indeterminant powers
7. Newton's method:  
procedure for Newton's method, applying Newton's method,  
convergence of Newton's method, but things can go wrong
8. Antiderivatives:  
finding antiderivatives, initial value problems and differential equations,  
antiderivatives and motion, indefinite integrals

#### Module 4: Integration

The student will be able to do:

1. Estimating with finite sums:  
area, distance traveled, displacement versus distance traveled,  
average value of a nonnegative function
2. Sigma notation and limits of finite sums:  
finite sums and sigma notation, algebra rules for finite sums, limits of finite sums,  
Riemann sums,
3. The definite integral:  
limits of Riemann sums, the definite integral as a limit of Riemann sums,  
notation and existence of the definite integral, integrable and nonintegrable functions,  
properties of the definite integral, area under the graph of a nonnegative function,  
average value or mean value of a function
4. The fundamental theorem of calculus:  
the mean value theorem for definite integrals, fundamental theorem of calculus part one,

fundamental theorem of calculus part two, total area

5. Indefinite integrals and the substitution rule:  
the power rule in integral form, substitution running the chain rule backwards,  
integrals of  $\sin^2(x)$  and  $\cos^2(x)$
6. Substitution and area between curves:  
substitution in definite integrals, definite integrals of symmetric functions,  
area between curves, integration with respect to  $y$ ,  
combining integrals with formulas from geometry