

**COLLIN COUNTY COMMUNITY COLLEGE
COURSE SYLLABUS**

COURSE NUMBER: Math 2417

COURSE TITLE: Accelerated 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:

Calculus; Early Transcendental Functions, 4rd ed., Larson, Hostetler, & Edwards, ©2007, Houghton Mifflin

SUPPLIES: Graphing Calculator required

COURSE DESCRIPTION:

A study of limits, continuity, the derivative, applications of the derivatives, the definite and indefinite integral and their applications, techniques of integration, derivatives and integrals of trigonometric, logarithmic, hyperbolic, and exponential functions, separable differential equations and their applications. Lab included.

COURSE MEASURABLE LEARNING OUTCOMES:

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

1. Find limits of functions both graphically and analytically, including former proves of limits.
2. Find the derivatives of transcendental functions using derivatives formulas and former definition and understand the relationship between continuous and differentiable functions.
3. Solve applications to derivatives including graphing techniques, related rates, optimizations, Newton's method, Linear Approximation, and separable differential equations.
4. Solve application involving parametric equations and polar functions using both differentiation and integration.
5. Find the area under the curve and between curves using integration techniques and Riemann's Sums.
6. Use integration to find the volumes of solids using the cross sectional method and the

volume of solid of revolutions using the washer method and the shell method.

7. Use integrations to solve problems in Mathematics, Sciences, and Engineering and study in detail the integration techniques.

COURSE REQUIREMENTS:

Completion of required exams, labs, projects, 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 CCCCD Student Handbook.

COURSE CONTENT:

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

MODULE 1: LIMITS AND THEIR PROPERTIES

The student will be able to do:

A Preview of Calculus

- Understand what calculus is and how it compares with pre-calculus.
- Understand that the tangent line problem is basic to calculus.
- Understand that the area problem is also basic to calculus.

Finding Limits Graphically and Numerically

- Estimate a limit using a numerical or graphical approach.
- Learn different ways that a limit can fail to exist.
- Study and use a formal definition of a limit.

Evaluating Limits Analytically

- Evaluate a limit using properties of limits.
- Develop and use a strategy for finding limits.
- Evaluate a limit using dividing out and rationalizing techniques.
- Evaluate a limit using the Squeeze Theorem.

Continuity and One-Sided Limits

- Determine continuity at a point and continuity on an open interval.
- Determine one-sided limits and continuity on a closed interval.
- Use properties of continuity.

Understand and use the Intermediate Value Theorem.

Infinite Limits

Determine infinite limits from the left and from the right.

Find and sketch the vertical asymptotes of the graph of a function.

MODULE 2: DIFFERENTIATION

The student will be able to do:

The Derivative and the Tangent Line Problem

Find the slope of the tangent line to a curve at a point.

Use the limit definition to find the derivative of a function.

Understand the relationship between differentiability and continuity.

Basic Differentiation Rules and Rates of Change

Find the derivative of a function using the Constant Rule.

Find the derivative of a function using the Power Rule.

Find the derivative of a function using the Constant Multiple Rule.

Find the derivative of a function using the Sum and Difference Rules.

Find the derivative of the sine, cosine and exponential functions.

Use derivatives to find rates of change.

The Product and Quotient Rules and Higher-Order Derivatives

Find the derivative of a function using the Product Rule.

Find the derivative of a function using the Quotient Rule.

Find the derivative of a trigonometric function.

Find a higher-order derivative of a function.

The Chain Rule

Find the derivative of a composite function using the Chain Rule.

Find the derivative of a function using the General Power Rule.

Simplify the derivative of a function using algebra.

Find the derivative of a transcendental function using the Chain Rule.

Find the derivative of a function involving the natural logarithmic function.

Define and differentiate exponential functions that have bases other than e .

Implicit Differentiation

Distinguish between functions written in implicit form and explicit form.

Use implicit differentiation to find the derivative of a function.

Find derivatives of functions using logarithmic differentiation.

Derivatives of Inverse Functions

Find the derivative of an inverse function.

Differentiate an inverse trigonometric function.

Review the basic differentiation formulas for elementary functions.

Related Rates

Find a related rate.

Use related rates to solve real-life problems.

Newton's Method

Approximate a zero of a function using Newton's method.

MODULE 3: APPLICATIONS OF DIFFERENTIATION

The student will be able to do:

Extrema on an Interval

- Understand the definition of extrema of a function on an interval.
- Understand the definition of relative extrema of a function on an open interval.
- Find extrema on a closed interval.

Rolle's Theorem and the Mean Value Theorem

- Understand and use Rolle's Theorem.
- Understand and use the Mean Value Theorem.

Increasing and Decreasing Functions and the First Derivative Test.

- Determine intervals on which a function is increasing or is decreasing.
- Apply the First Derivative Test to find relative extrema of a function.

Concavity and the Second Derivative Test

- Determine intervals on which a function is concave upward or is concave downward.
- Find any points of inflection of the graph of a function.
- Apply the Second Derivative Test to find relative extrema of a function.

Limits at Infinity

- Determine (finite) limits at infinity.
- Determine the horizontal asymptotes, if any, of the graph of a function.
- Determine infinite limits at infinity.

A Summary of Curve Sketching

- Analyze and sketch the graph of a function.

Optimization Problems

- Solve applied minimum and maximum problems.

Differentials

- Understand the concept of a tangent line approximation.
- Compare the value of the differential, dy , with the actual change in y , Δy .
- Estimate a propagated error using a differential.
- Find the differential of a function using differentiation formulas.

MODULE 4: INTEGRATION

The student will be able to do:

Antiderivatives and Indefinite Integration

- Write the general solution of a differential equation.
- Use indefinite integral notation for antiderivatives.
- Use basic integration rules to find antiderivatives.
- Find a particular solution of a differential equation.

Area

- Use sigma notation to write and evaluate a sum.
- Understand the concept of area.
- Approximate the area of a plane region.
- Find the area of a plane region using limits.

Riemann Sums and Definite Integrals

- Understand the definition of a Riemann sum.
- Evaluate a definite integral using limits.
- Evaluate a definite integral using properties of definite integrals.

The Fundamental Theorem of Calculus

- Evaluate a definite integral using the Fundamental Theorem of Calculus.
- Understand and use the Mean Value Theorem for Integrals.
- Find the average value of a function over a closed interval.
- Understand and use the Second Fundamental Theorem of Calculus

Integration by Substitution

- Use pattern recognition to find an indefinite integral.
- Use a change of variables to find an indefinite integral.
- Use the General Power Rule for Integration to find an indefinite integral.
- Use a change of variables to evaluate a definite integral.
- Evaluate a definite integral involving an even or odd function.

Numerical Integration

- Approximate a definite integral using the Trapezoidal Rule.
- Approximate a definite integral using Simpson's Rule.
- Analyze the approximate errors in the Trapezoidal Rule and in the Simpson's Rule.

The Natural Logarithmic Function: Integration

- Use the Log Rule for Integration to integrate a rational function.
- Integrate trigonometric functions.

Inverse Trigonometric Functions: Integration

- Integrate functions whose antiderivatives involve inverse trigonometric functions.
- Use the method of completing the square to integrate a function.
- Review the basic integration rules involving elementary functions.

Hyperbolic Functions

- Develop properties of hyperbolic functions.
- Differentiate and integrate hyperbolic functions.
- Develop properties of inverse hyperbolic functions.
- Differentiate and integrate functions involving inverse hyperbolic functions.

MODULE 5: INTEGRATION

The student will be able to do:

Differential Equations: Growth and Decay

- Use separation of variables to solve a simple differential equation.
- Use exponential functions to model growth and decay in applied problems.

Differential Equations: Separation of Variable

- Recognize and solve differential equations that can be solved by separation of variables.
- Recognize and solve homogenous differential equations.
- Use differential equations to model and solve applied problems.

MODULE 6: APPLICATIONS OF INTEGRATION

The student will be able to do:

Area of a Region between Two Curves

- Find the area of a region between two curves using integration.
- Find the area of a region between intersecting curves using integration.
- Describe integration as an accumulation process.

Volume: The Disk Method

- Find the volume of a solid revolution using the disk method.
- Find the volume of a solid revolution using the washer method.
- Find the volume of a solid with known cross sections.

Volume: The Shell Method

- Find the volume of a solid revolution using the shell method.
- Compare the uses of the disk method and the shell method.

Arc Length and Surfaces of Revolution

- Find the length of a smooth curve.
- Find the area of a surface of a revolution.

Work

- Find the work done by a constant force.
- Find the work done by a variable force.

Moments, Centers of Mass, and Centroids

- Understand the definition of mass.
- Find the center of mass in a one-dimensional system.
- Find the center of mass in a two-dimensional system.
- Find the center of mass of a planar lamina.
- Use the theorem of Pappus to find the volume of a solid of revolution.

Fluid Pressure and Fluid Force

- Find fluid pressure and fluid force.

MODULE 7: INTEGRATION TECHNIQUES, L'HÔPITAL'S RULE, AND IMPROPER INTEGRALS

The student will be able to do:

Basic Integration Rules

- Review procedures for fitting an integrand to one of the basic integration rules.

Integration by Parts

- Find an antiderivative using integration by parts.
- Use a tabular method to perform integration by parts.

Trigonometric Integrals

- Solve trigonometric integrals involving powers of sine and cosine.
- Solve trigonometric integrals involving powers of secant and tangent.
- Solve trigonometric integrals involving sine-cosine products with different angles.

Trigonometric Substitution

- Use trigonometric substitution to solve an integral.
- Use integrals to model and solve real-life applications.

Partial Fractions

Understand the concept of partial fraction decomposition.

Use partial fraction decomposition with linear factors to integrate rational functions.

Use partial fraction decomposition with quadratic factors to integrate rational functions.

Integration by Tables and Other Integration Techniques

Evaluate an indefinite integral using a table of integrals.

Evaluate an indefinite integral using reduction formulas.

Evaluate an indefinite integral involving rational functions of sine and cosine.

Indeterminate Forms and L'Hôpital's Rule

Recognize limits that produce indeterminate forms.

Apply L'Hôpital's Rule to evaluate a limit.

Improper Integrals

Evaluate an improper integral that has an infinite limit of integration.

Evaluate an improper integral that has an infinite discontinuity.