COLLIN COLLEGE EXPANDED GENERIC COURSE SYLLABUS

COURSE INFORMATION

Course Number: MATH 2413
Course Title: Calculus I
Credit Hours: 4
Lecture Hours: 3
Lab Hours: 3

Prerequisite
MATH 2412 with a C or better; or equivalent preparation.

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/Supplies
Calculus: Early Transcendentals, 3rd edition, 2019, Pearson, by Briggs, Cochran, Gillet, Schulz.

Supplies: Graphing calculator required.

STUDENT LEARNING OUTCOMES (SLO)

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. (Empirical/Quantitative Skills, Critical Thinking)
2. Draw graphs of algebraic and transcendental functions considering limits, continuity, and differentiability at a point. (Communication Skills, Critical Thinking, Empirical/Quantitative Skills)
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. (Empirical/Quantitative Skills, Critical Thinking)
5. Identify appropriate calculus concepts and techniques to provide mathematical models of real-world situations and determine solutions to applied problems. (Critical Thinking, Communication Skills, Empirical/Quantitative Skills)

6. Evaluate definite integrals using the Fundamental Theorem of Calculus. (Empirical/Quantitative Skills)
7. Articulate the relationship between derivatives and integrals using the Fundamental Theorem of Calculus. (Critical Thinking, Communication Skills, Empirical/Quantitative Skills)

REQUIRED CORE OBJECTIVES FOR MATHEMATICS

As per the Texas Higher Education Coordinating Board, mathematics students must develop and demonstrate the following three required core objectives:

- Critical Thinking Skills - creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information.
- Communication Skills - effective development, interpretation and expression of ideas through written, oral and visual communication.
- Empirical and Quantitative Skills - manipulation and analysis of numerical data or observable facts resulting in informed conclusions.

METHOD OF EVALUATION

Course requirements

Attending class**,** completing homework assignments**,** completing labs, and completing required exams.

Course format

Lecture, lab, and guided practice.

A minimum of four proctored exams, a lab component grade, and a proctored comprehensive final exam will be given. The final exam must count at least as much as any regular 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 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.

COURSE POLICIES

College-wide policies are pre-loaded into the Concourse Syllabi and are not duplicated in the Expanded Generic Syllabi for each course.
Instructor specific policies should be added to the Concourse Syllabus.

COURSE CONTENT

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

Module 1: Limits and Continuity

The student will be able to:

1. Solve applications involving average and instantaneous velocity. SLO 1
2. Estimate the limit of a function numerically and graphically, including infinite limits. SLO 1
3. Evaluate one- and two-sided limits analytically using limit laws and theorems, including the Squeeze Theorem. SLO 1
4. Evaluate limits at infinity. SLO 1
5. Determine vertical, horizontal, and slant asymptotes. SLO 1
6. Determine if functions are continuous at given values. SLO 3
7. Solve applications involving limits and continuity. SLO 1 & 3
8. Use the Intermediate Value Theorem to show equations have solutions on given intervals. SLO 2
9. Sketch graphs of functions given information about limits, function values, asymptotes, end behavior, and continuity. SLO 2
10. Use the precise ε-δ definition of limit to prove statements. SLO 1

Module 2: Derivatives

The student will be able to:

1. Use the limit definition of derivative to find the derivative of a function. SLO 1
2. Use the limit definition of derivative to find equations of tangent lines. SLO 1 & 3
3. Determine where functions are differentiable. SLO 1 & 3
4. Obtain the graphs of derivative functions from graphs of functions. SLO 2
5. Calculate derivatives using rules of differentiation. SLO 4
6. Calculate derivatives using the product and quotient rules. SLO 4
7. Calculate derivatives of trigonometric functions. SLO 4
8. Solve applications involving derivatives as rates of change. SLO 4 & 5
9. Calculate derivatives using the chain rule. SLO 4
10. Calculate derivatives using implicit differentiation. SLO 4
11. Calculate derivatives involving logarithms and exponential functions. SLO 4
12. Calculate derivatives using logarithmic differentiation. SLO 4
13. Calculate derivatives of inverse trigonometric functions. SLO 4
14. Calculate higher order derivatives of functions. SLO 4
15. Use rules of differentiation to find equations of tangent lines. SLO 1 & 4
16. Solve applications involving related rates. SLO 5

Module 3: Applications of the Derivative

The student will be able to:

1. Identify local and absolute extrema of a function using a graph. SLO 5
2. Determine the existence, location, and value of absolute extrema on a given interval of a function. SLO 4 & 5
3. Determine the point(s) guaranteed to exist by Rolle's and the Mean Value Theorem. SLO 4
4. Determine the intervals where a function is increasing or decreasing. SLO 4
5. Determine if critical points correspond to extrema using the first and second derivative tests. SLO 4
6. Determine the concavity of a function and use it to find inflection points, if any. SLO 4
7. Graph functions using analytic methods involving derivatives. SLO 2
8. Solve applications involving optimization. SLO 5
9. Calculate the linear approximation of a function at a point and use it to make estimates. SLO 4 & 5
10. Approximate the change in y using the differential dx. SLO 4
11. Evaluate limits using L'Hôpital's Rule. SLO 4
12. Solve applications involving Newton's Method. SLO 5
13. Calculate the antiderivative of a function satisfying an initial value. SLO 5

Module 4: Integration

The student will be able to:

1. Use geometry to find area of a described region. SLO 1
2. Illustrate, calculate, and compare left, right, and midpoint Riemann sums for functions. SLO 1
3. Evaluate areas as limits of Riemann sums. SLO 1
4. Evaluate definite integrals using the Fundamental Theorem of Calculus, properties of integrals, and symmetry. SLO 6
5. Calculate derivatives of functions defined by integrals. SLO 7
6. Solve applications involving integrals and average values of integrals. SLO 1 & 7
7. Evaluate integrals using the substitution rule. SLO 1 & 6
8. Solve applications involving velocity and net change. SLO 6
9. Calculate the area between two curves. SLO 1 & 6