LAKELAND COMMUNITY COLLEGE – COURSE OUTLINE FORM

ORIGINATION DATE:	11/26/13	**APPROVAL DATE:**	2/27/23
LAST MODIFICATION DATE:	4/14/21	**EFFECTIVE TERM/YEAR:**	FALL/ 23
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COURSE ID: **MATH2400**

COURSE TITLE: Calculus for Business, Social, and Life Sciences

	LECTURE	LAB	CLINICAL	TOTAL	OBR MIN	OBR MAX
CREDITS:	5.00	0.00	0.00	5.00	3.00	5.00
CONTACT HOURS:	5.00	0.00	0.00	5.00		

PREREQUISITE:

MATH1650 or permission of instructor

COURSE DESCRIPTION:

This course explores differential and integral calculus as applied to business, social sciences, and life sciences. Topics include functions, limits, and derivatives of algebraic, exponential, and logarithmic functions; applications of derivatives to maximum and minimum values of a function; cost, revenue, profit, supply, and demand; growth rates; decay rates, definite and indefinite integrals, improper integrals, differential equations, multivariable calculus, applications of the integral, consumers' and producers' surplus, integration of rate functions, growth models, and Cobb-Douglas production functions. Students must supply a graphing calculator.

RATIONALE FOR COURSE:

The differential and integral calculus and its concepts are an important tool for applications in business, social, and biological sciences. This course is required in most baccalaureate business, accounting, economics, and finance programs.

OUTCOMES:
The course will

1. Further develop students' ability to use the language of mathematics correctly in speaking and writing.

2. Introduce, develop, and apply differential and integral calculus techniques and demonstrate their utility towards solving real-life problems.

3. Further develop the use of technology (graphing calculator and computer) as a tool for determining solutions to real-life dynamic problems.

4. Further develop students' abilities to solve real-life problems utilizing the derivative and analyze and solve these problems analytically and graphically.

5. Engage students in the exploration of the central ideas of calculus applications in groups or individually.

6. Introduce, develop and apply integral calculus techniques and to demonstrate how those techniques are used in real-life applications.

7. Further develop students' abilities to solve application problems using the anti-derivative and to analyze and interpret the solutions to the problems analytically, numerically, graphically, and verbally.

8. Engage students in the exploration of the key concepts of integral calculus through laboratory assignments, individually, and in groups.

9. Further strengthen students' ability to critically apply mathematical thinking to develop and test.

PERFORMANCE INDICATORS:
Upon completion of the course, the student should be able to

1. Apply the average rate of change concept to real-world problems and to write the equation of the secant line.

2. Apply the instantaneous rate of change concept to real-world problems.

3. Determine the limit of a function analytically, numerically and graphically, including limits at infinity and infinite limits.

4. Compute the derivative of a function via the definition of a derivative.

5. Compute the derivative of a function and write the equation of the tangent line at a given point.

6. Apply differentiation theorems to determine derivatives of algebraic functions.

7. Compute derivatives using the Generalized Power Rule.

8. Utilize differentials in applications.

9. Use properties of derivatives to determine relative and absolute extrema of functions.

10. Use the first and second derivative tests to determine the interval of increase and decrease, and intervals where the graph of a function is concave up and concave down.

11. Use the first and second derivative tests, along with asymptotic behavior, to sketch the graph of a function.

12. Apply derivatives to compute minimum costs, maximum profits, maximum revenue, marginal analysis, velocity and acceleration, growth, and decay rates.

13. Analyze a function and show the relationship between marginal cost and average cost.

14. Apply properties of exponential and logarithmic functions.

15. Compute the derivative of exponential and logarithmic functions.

16. Determine the inflection point of a logistic function.

17. Develop analytic as well as graphic and numeric techniques using technology for solving problems.

18. Apply appropriate technology to develop and test hypotheses, solve mathematical problems, and judge the reasonableness of the results.

19. Compute anti-derivatives.

20. Apply the Fundamental Theorem of Calculus (FTC) to compute definite integrals.

21. Apply the technique of *u*-substitution to compute indefinite and definite integrals.

22. Apply the integration by parts technique to compute indefinite and definite integrals.

23. Compute the area under a curve and the area between two curves via the definite integral.

24. Compute improper integrals and their applications.

25. Apply integration techniques to business applications including total money flow, present and future value problems, capital value, consumer, and producers' surplus.

26. Graph and evaluate a function at several variables.

27. Compute partial derivatives of multivariable functions.

28. Determine maxima and minima of multi-variable functions and using critical values and using Lagrange multipliers.

29. Develop analytic and graphical and numeric techniques using technology for solving problems.

COURSE OUTLINE:

I. Pre-calculus Review
   - A. Functions and Graphs
   - B. Average Rate of Change
   - C. Secant Line Slope

II. The Limit Concept
   - A. Definition of limit
   - B. Computing limits of functions by the rule-of-three
     1. Properties of limits
     2. Finding limits
        - a. One Sided Limits
        - b. Limits of rational functions
        - c. Limits of polynomials
        - d. Limits of exponential functions
        - e. Limits of logarithmic functions
        - f. Limits at Infinity
        - g. Infinite Limits
   - C. Continuity

III. The Derivative
   - A. Average and instantaneous rates of change
   - B. Definition of derivative
     1. Computation via definition
     2. Properties of the derivative
     3. Equation of a tangent line
   - C. Differentiation Techniques
     1. Fundamental Differentiation Theorems
     2. Product and Quotient Rules
     3. Chain Rule
     4. Higher order derivatives

IV. Curve Sketching

A. Increasing and decreasing functions
    1. The first derivative test
    2. Relative extrema
B. Concavity
    1. The second derivative test
    2. Points of inflection

V. Applications of the Derivative
A. Optimization
    1. Relative and absolute extrema
    2. Optimization of cost revenue and profit
B. Marginal Analysis
    1. Marginal profit
    2. Marginal revenue
    3. Marginal cost
    4. Elasticity of demand
C. Differentials

VI. Exponential and Logarithmic Functions
A. The graphs and properties of exponential and logarithmic functions
B. The derivatives of exponentials and logarithmic functions
C. Applications
    1. Exponential growth and decay
        a. Logistics curve
    2. Applications of finance
        a. Compound interest
        b. Continuous compound interest

V. Introduction to Integration
A. The anti-derivative
B. The indefinite integral
C. The Fundamental Theorem of Calculus

VI. Integration Techniques
A. *u*-substitution
B. Integration by parts
C. Numerical integration techniques (As time permits)

VII. Applications of the Definite Integral
A. The average value of a function
B. Integration of rate functions to obtain a continuous accumulation
C. Financial Applications
    1. Total money flow
    2. Present and future value
    3. Capital Value
    4. Consumer's and producer's surplus
    5. Lorenz Curves and the Gini Index

VIII. Introduction to Differential Equations (As time permits.)
A. Solution to differential equations
B. Solving differential equations via separation of variables
C. Solving linear first order differential equations
D. Applications of differential equations
    1. Unlimited growth models
    2. Limited growth and decay models

IX. Multivariable Calculus
A. Evaluating multivariable functions
B. Cross-Sectional analysis and level curves
C. Computing first and second order partial derivatives
D. Determining Maxima and Minima of multivariable functions
E. The Method of Lagrange Multipliers

INSTRUCTIONAL PROCEDURES THAT MAY BE UTILIZED:

Lecture and discussion.
Online activities.
Computer and/or graphing calculator based activities.
Group and/or individual activities.
Research projects utilizing real data gathered from the Internet or other sources.

GRADING PROCEDURES:

It is recommended that the instructors have at least five evaluative items on which to determine the student's course grade. In general, tests are given covering lecture and homework assignments.

COURSE EVALUATION PROCEDURES:

Student course evaluations.
Student success rate in subsequent Math courses.

LAKELAND LEARNING OUTCOMES

		I	R	D
	LEARNS ACTIVELY			
1.	Takes responsibility for his/her own learning.			D
2.	Uses effective learning strategies.			
3.	Reflects on effectiveness of his/her own learning strategies.			
	THINKS CRITICALLY	**I**	**R**	**D**
4.	Identifies an issue or idea.			
5.	Explores perspectives relevant to an issue or idea.			
6a.	Identifies options or positions.			
6b.	Critiques options or positions.			
7.	Selects an option or position.			D
8a.	Implements a selected option or position.			
8b.	Reflects on a selected option or position.			
	COMMUNICATES CLEARLY	**I**	**R**	**D**
9a.	Uses correct spoken English.			
9b.	Uses correct written English.			D
10.	Conveys a clear purpose.			
11.	Presents ideas logically.			D
12a.	Comprehends the appropriate form(s) of expression.			D
12b.	Uses the appropriate form(s) of expression.			D
13.	Engages in an exchange of ideas.			
	USES INFORMATION EFFECTIVELY	**I**	**R**	**D**
14.	Develops an effective search strategy.			
15a.	Uses technology to access information.			D
15b.	Uses technology to manage information.			
16.	Uses selection criteria to choose appropriate information.			
17.	Uses information responsibly.			
	INTERACTS IN DIVERSE ENVIRONMENTS	**I**	**R**	**D**
18a.	Demonstrates knowledge of diverse ideas.			
18b.	Demonstrates knowledge of diverse values.			
19.	Describes ways in which issues are embedded in relevant contexts.			
20a.	Collaborates with others.			
20b.	Collaborates with others in a variety of situations.			
21.	Acts with respect for others.			

Definitions:

Introduces (I)

Students first learn about key ideas, concepts, or skills related to the performance indicator. This usually happens at a general or very basic level, such as learning one idea or concept related to the broader outcome.

Reinforces (R)

Students are given the opportunity to synthesize key ideas of skills related to the performance indicator at increasingly proficient levels.

Demonstrates (D)

Students should demonstrate mastery of the performance indicator with the level of independence expected of a student attaining an associate's degree.