MAT 170 BRIEF CALCULUS WITH APPLICATIONS (3 credit hours)

KCTCS Course Information

Official Course Description	Provides an introduction to differential and integral calculus with applications in biological sciences, social sciences, physical sciences, or business with an analysis of algebraic, exponential, and logarithmic functions. (Students may not receive credit for both MAT 170 and MAT 175.)
	Pre-requisites: Successful completion of MAT 150 or Math ACT 27 or above.

OFFICIAL COURSE COMPETENCIES/OBJECTIVES

Upon completion of this course, the student can:

1. Approximate limits graphically and numerically and evaluate limits analytically.
2. List the conditions for the continuity of a function at a point and determine if a function is continuous or discontinuous at a point.
3. Determine the intervals of continuity of a function.
4. Evaluate infinite limits and limits at infinity.
5. Define the derivative of a function and evaluate the derivative of a function using the definition.
6. Evaluate the derivative of a function using differentiation rules for algebraic functions as well as product, quotient, and chain rules.
7. Use the derivative of a function to find the equation of the line tangent to the graph of the function at a given point.
8. Sketch the graph of a function using the first and second derivatives to determine the critical points, intervals on which the function is either increasing or decreasing, relative extrema, intervals on which the graph is either concave up or concave down, and inflection points of the graph.
9. Perform implicit differentiation.
10. Use derivatives to solve application problems including problems involving related rates and optimization for biological sciences, social sciences, physical sciences, or business.
11. Define the differential and use differentials to approximate function values.
12. Find indefinite and definite integrals of a function using integration rules for algebraic functions.
13. Find definite and indefinite integrals using substitution.
14. Find the average value of a function on an interval.
15. Use definite integrals to find the area under a curve and the area between two curves.
16. Determine if a function is differentiable or nondifferentiable at a point.
17. Find the derivative and integral of functions including polynomial, rational, root, exponential, and logarithmic functions.
18. Solve application problems using integrals for biological sciences, social sciences, physical sciences, or business.

OFFICIAL COURSE OUTLINE

I. Limits
    A. Finding limits graphically
    B. Approximating limits numerically
    C. Finding limits analytically
    D. One-sided limits
    E. Continuity
    F. Infinite limits ($f(x) \to \pm\infty$)
    G. Limits as $x \to \pm\infty$
    H. Horizontal asymptotes
    I. Vertical asymptotes
II. Differentiation
    A. Definition of the derivative
    B. Finding derivatives using the definition
    C. Finding the tangent line to the graph of a function
    D. Basic differentiation rules for algebraic functions, product and quotient rules, chain rule
    E. Finding the tangent line to a graph
    F. Implicit Differentiation
III. Applications of Differentiation
    A. Related rate applications

      B. Finding critical numbers
      C. First derivative test/increasing/decreasing
      D. Finding relative maxima and minima
      E. Concavity and inflection points
      F. Second derivative test
      G. Curve sketching
      H. Optimization applications
      I. Differentials
IV. Integration
      A. Fundamental theorem of calculus
      B. Finding the average value of a function
      C. Properties of definite integrals
      D. Integration using substitution
V. Applications of Integration
      A. Area under curve
      B. Area between two curves

GENERAL EDUCATION COMPETENCIES

A.   Knowledge of human cultures and the physical and natural worlds through study in the sciences and mathematics, social sciences, humanities, histories, languages, and the arts.

B.   Intellectual and practical skills, including
- inquiry and analysis
- critical and creative thinking
- written and oral communication
- quantitative literacy
- information literacy
- teamwork and problem solving

C.   Personal and social responsibility, including
- civic knowledge and engagement (local and global)
- intercultural knowledge and competence
- ethical reasoning and action
- foundations and skills for lifelong learning

D.   Integrative and applied learning, including synthesis and advanced accomplishment across general and specialized skills.

STUDENT LEARNING OUTCOMES FOR QUANTITATIVE REASONING (Approved Fall 2017)

In MAT 170, students will learn to:

1.   Interpret information presented in mathematical and/or statistical forms by (Gen Ed Comp B):
- Approximating limits graphically and numerically and evaluating limits analytically.
- Defining the derivative of a function and evaluating the derivative of a function using the definition.

2.   Illustrate and communicate mathematical and/or statistical information symbolically, visually, and/or numerically by (Gen Ed Comp A, B, C):
- Listing the conditions for the continuity of a function at a point and determining if a function is continuous or discontinuous at a point.
- Determining the intervals of continuity of a function.
- Sketching the graph of a function using the first and second derivatives to determine the critical points, intervals on which the function is either increasing or decreasing, relative extrema, intervals on which the graph is either concave up or concave down, and inflection points of the graph.

3.   Determine when computations are needed and execute the appropriate computations by (Gen Ed Comp A, B):
- Evaluating infinite limits and limits at infinity.
- Evaluating the derivative of a function using differentiation rules for algebraic functions as well as product, quotient, and chain rules.

- Performing implicit differentiation.
- Finding indefinite and definite integrals of a function using integration rules for algebraic functions.
- Finding definite and indefinite integrals using substitution.
- Determining if a function is differentiable or non-differentiable at a point.
- Finding the derivative and integral of functions including polynomial, rational, root, exponential, and logarithmic functions.

4. Apply an appropriate model to the problem to be solved by (Gen Ed Comp A, B, C):
   - Using the derivative of a function to find the equation of the line tangent to the graph of the function at a given point.

5. Make inferences, evaluate assumptions, and assess limitations in estimation modeling and/or statistical analysis by (Gen Ed Comp A, D):
   - Using derivatives to solve application problems including problems involving related rates and optimization for biological sciences, social sciences, physical sciences, or business.
   - Using definite integrals to find the area under a curve and the area between two curves.
   - Solving application problems using integrals for biological sciences, social sciences, physical sciences, or business.

LEARNING RESOURCES

- ✓ Berresford, G. & Rockett, A. (2004). *Brief applied calculus (3rd ed.).* Boston, MA: Houghton/Mifflin
- ✓ Lial, M. L., Greenwell, R. N., & Ritchey, N. P. (2005). *Calculus with applications, brief version (8th ed.).* Boston, MA: Pearson/Addison Wesley.