

## Single Variable Calculus Sequence TCSU MATH SEQ A

### A. Description

Differential and integral calculus of a single variable. Functions; limits and continuity; differentiation, integration, techniques of integration; infinite sequences and series; applications of differentiation and integration

### B. Recommended Preparation

Three years of high school mathematics (or equivalent); college level courses in the study of functions to include polynomial, rational, algebraic, trigonometric, exponential, logarithmic, and other transcendental functions.

### C. Prerequisites

Precalculus, or college algebra and trigonometry

### D. Minimum Unit Requirement

8 semester units (suggested two four-semester unit courses)

### E. Course Topics

1. Limits, left-hand and right-hand limits
2. Computing limits using numerical, graphical, and algebraic approaches
3. Continuity; continuity at a real number, discontinuity at a real number, removable discontinuity
4. Tangent lines
5. Derivative as a limit
6. Interpretation of the derivative as: slope of tangent line, a rate of change
7. Derivative as a function
8. Differentiation formulas; constants, power rule, product rule, quotient rule
9. Rates of change
10. Derivatives of trigonometric functions
11. Chain rule
12. Implicit differentiation
13. Higher-order derivatives
14. Related rates
15. Maximum and minimum values (absolute and local)
16. Critical numbers
17. Mean Value Theorem
18. Graphing functions using first and second derivatives
19. Limits at infinity, horizontal asymptotes
20. Infinite limits
21. Optimization
22. Antiderivatives

23. Area under a curve
24. Definite integral; Riemann sum
25. Properties of the integral
26. Fundamental Theorem of Calculus
27. Indefinite integrals
28. Integration by substitution
29. Areas between curves
30. Volume, volume of a solid of revolution
31. Derivatives of inverse functions
32. Logarithmic and exponential functions and their derivatives
33. Logarithmic differentiation
34. Inverse trigonometric functions and their derivatives
35. Indeterminate forms and L'Hopital's Rule
36. Techniques of integration; trigonometric integrals, trigonometric substitution, partial fractions
37. Numerical integration; trapezoidal and Simpson's rule
38. Improper integrals
39. Applications; arc length, area of a surface of revolution, moments and centers of mass
40. Separable first order differential equations
41. Exponential growth and decay
42. Parametric equations, calculus with parametric curves
43. Polar curves, calculus in polar coordinates
44. Conic sections
45. Sequences; convergence, divergence
46. Series; convergence and divergence, alternating series
47. Tests for convergence of series (including integral test, comparison tests, ratio test, and root test), divergence test
48. Estimating the sum of a series
49. Power series, radius of convergence, interval of convergence
50. Differentiation and integration of power series
51. Taylor and Maclaurin series; Taylor's Inequality
52. Binomial series

## F. Student Learning Outcomes

Upon successful completion of the course, students will be able to:

1. Compute the limit of a function at a real number
2. Determine if a function is continuous at a real number
3. Find the derivative of a function as a limit
4. Find the equation of a tangent line to a function
5. Compute derivatives using differentiation formulas
6. Apply differentiation to solve related rate problems, optimization problems
7. Use implicit differentiation
8. Graph functions using methods of calculus
9. Evaluate a definite integral as a limit
10. Evaluate a definite integral using integration formulas
11. Find indefinite integrals
12. Apply integration methods

13. Find areas and volumes by integration
14. Determine the limit of convergent sequences
15. Determine the limit of convergent series
16. Represent functions as power series