

Calculus with Life Science Applications TCSU MATH 270

A. Description

Functions and graphs; limits; derivatives, antiderivatives, and differential equations with emphasis on applications in the life sciences.

B. Recommended Preparation

College algebra or Pre-calculus

C. Prerequisites

Completion of General Education quantitative reasoning

D. Minimum Unit Requirement

3 semester units

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. Second derivative, concavity, inflection points, and acceleration
11. Derivatives of polynomial, rational, exponential, and logarithmic functions
12. Chain rule
13. Maxima and minima, global extrema, second derivative test
14. Rolle's Theorem and Mean Value Theorem
15. Limits at infinity, horizontal asymptotes
16. Leading behavior, indeterminate forms and L'Hopital's Rule
17. Polynomial approximation, Taylor Polynomials
18. Differential equations, autonomous differential equations, $y' = f(y)$, pure-time differential equations, $y' = f(t)$
19. Antiderivatives, indefinite integrals
20. Rules for antiderivatives, power rule, constant product rule, sum rule
21. Antiderivatives of polynomial, rational, and exponential functions
22. Integration by substitution
23. Integration by parts
24. Riemann sums, left- and right-hand sums

25. Definite integral
26. Properties of the integral
27. Fundamental Theorem of Calculus
28. Applications of the integral, area, average value
29. Improper integrals
30. Solving differential equations, Euler's method, separable equations
31. Applications of differential equations such as Newton's law of cooling, bacterial population growth, predator-prey dynamics

F. Student Learning Outcomes

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

1. Compute first and second derivatives of a function;
2. Graph functions using the methods of calculus;
3. Apply differentiation to life science areas;
4. Compute antiderivatives;
5. Evaluate a definite integral as a limit;
6. Evaluate a definite integral using integration formulas;
7. Apply integration to life science areas; and
8. Solve differential equations that arise in life sciences.