

**PENN STATE UNIVERSITY
MATH 140: CALCULUS WITH ANALYTIC GEOMETRY I**

Text: Calculus: Early Transcendental Functions, 4th ed, 2007

Author: Larson/Hostetler/Edwards

Publisher: Houghton Mifflin, ISBN 0-618-60624-5

Course Outline

Chapter 1: PREPARATION FOR CALCULUS

- 1.1 Graphs and Models **
- 1.2 Linear Models and Rates of Change **
- 1.3 Functions and Their Graphs **
- 1.4 Fitting Models to Data **
- 1.5 Inverse Functions
- 1.6 Exponential and Logarithmic Functions

Chapter 2: LIMITS AND THEIR PROPERTIES

- 2.1 A Preview of Calculus
- 2.2 Finding Limits Graphically and Numerically (1 optional)
- 2.3 Evaluating Limits Analytically
- 2.4 Continuity and One-Sided Limits
- 2.5 Infinite Limits

Chapter 3: DIFFERENTIATION

- 3.1 The Derivative and the Tangent Line Problem
- 3.2 Basic Differentiation Rules and Rates of Change
- 3.3 The Product and Quotient Rules and Higher Order Derivatives
- 3.4 The Chain Rule
- 3.5 Implicit Differentiation
- 3.6 Derivatives of Inverse Functions
- 3.7 Related Rates
- 3.8 Newton's Method **

Chapter 4: APPLICATIONS OF THE DERIVATIVE

- 4.1 Extrema on an Interval
- 4.2 Rolle's Theorem and the Mean-Value Theorem
- 4.3 Increasing and Decreasing Functions and the First Derivative Test
- 4.4 Concavity and the Second Derivative Test
- 4.5 Limits at Infinity
- 4.6 A Summary of Curve Sketching
- 4.7 Optimization Problems
- 4.8 Differentials

Chapter 5: INTEGRATION

- 5.1 Antiderivatives and Indefinite Integration
- 5.2 Area
- 5.3 Riemann Sums and Definite Integrals
- 5.4 The Fundamental Theorem of Calculus
- 5.5 Integration by Substitution
- 5.6 Numerical Integration **
- 5.7 The Natural Logarithmic Function: Integration
- 5.8 Inverse Trigonometric Functions: Integration
- 5.9 Hyperbolic Functions (1/2 day)

Chapter 6: DIFFERENTIAL EQUATIONS

- 6.1 Differential Equations: Growth and Decay
- 6.2 Differential Equations: Separation of Variables
- 6.3 First-Order Linear Differential Equations **

NOTES:

1. INSTRUCTORS OF COURSES THAT HAVE MULTIPLE SECTIONS MUST CONSULT WITH EACH OTHER TO DESIGN FINAL EXAMS THAT TEST THE SAME TOPICS.
2. Use of calculators and calculators with Computer Algebra System are up to the discretion of each instructor.
3. All items except those with ** MUST be covered.
4. Sections 5 and 6 of Chapter 1 should be covered quickly. (1 or 2 days)
5. Section 5.9 could be covered lightly.
6. Students should see the proofs of some theorems.
7. The final exam must be comprehensive and should include questions on these topics:
 - The concept of a limit
 - The definition of a derivative
 - What a derivative represents (slope, velocity, rate of change, etc.)
 - Implicit differentiation
 - The First and Second Derivative Tests
 - Word problems applying derivatives (Optimization, related rates, etc.)
 - Curve sketching
 - The Fundamental Theorem of Calculus
 - Area
 - Integration:
 - Substitution
 - Integrals that yield $\ln u$
 - Integrals that yield inverse trigs
 - Exponentials
 - Completing the square