APPM 1340 - Calculus 1 with Algebra, Part B

Course Objectives: This is the second in a two-semester sequence that covers the Calculus I curriculum.

Specifically, students will:

- Understand the concepts, techniques and applications of differential and integral calculus including limits, rate of change of functions, and derivatives and integrals of algebraic and transcendental functions.
- Improve problem solving and critical thinking.
- Strengthen algebra and trigonometry skills.

This course and APPM 1345 together are equivalent to APPM 1350 (Calculus 1 for Engineers). The sequence of this course and APPM 1345 is specifically designed for students whose manipulative skills in the techniques of high school algebra and precalculus may be inadequate for APPM 1350.

Textbook: *Essential Calculus*, 2nd Edition by James Stewart. We will cover Chapters 3-5. You will also need an access code for WebAssign's online homework system. The access code can also be purchased separately.

Schedule and Topics Covered

Day	Section	Topics
1	3.3	Derivatives and Shapes of Graphs
2	3.4	Curve Sketching
3	3.3/3.4	Review of 3.3-3.4
4	3.5	Optimization Problems
5	3.5	Optimization Problems
6	3.6	Newton's Method
7	3.7	Antiderivatives
8	3.6/3.7	Review of 3.7/3.7
9	Exam 1 Review	Sec 3.3-3.7
10	Exam 1 Review	Sec 3.3-3.7
11	Appendix B	Sigma Notation
12	4.1	Areas and Distance
13	4.1	Areas and Distance
14	4.2	The Definite Integral
15	4.3	Evaluating Definite Integrals
16	4.3	Evaluating Definite Integrals
17	4.4	The Fundamental Theorem of Calculus
18	4.4	The Fundamental Theorem of Calculus
19	4.5	Substitution Rule
20	4.5	Substitution Rule
21	Exam 2 Review	Sec 4.1-4.5
22	Exam 2 Review	Sec 4.1-4.5
23	5.1	Inverse Functions
24	Handout	Logarithms and Exponentials
25	5.2	The Natural Logarithm Function
26	5.1/5.2	Review of 5.1-5.2
27	5.3	The Natural Exponential Function
28	5.4	General Log and Exponential Functions
29	5.3/5.4	Review of 5.3-5.4
30	5.5	Exponential Growth and Decay
31	5.6	Inverse Trig Functions
33	5.5/5.6	Review of 5.5-5.6

34	Exam 3 Review	Sec 5.1-5.6
35	Exam 3 Review	Sec 5.1 - 5.6
36	5.7	Hyperbolic Functions
37	5.7	Hyperbolic Functions
38	5.8	l'Hospital's Rule
39	5.8	l'Hospital's Rule
40	5.7/5.8	Review of 5.7-5.8
41	5.7/5.8	Review of 5.7-5.8
42	Final Review	Cumulative: Chapter 1-5
43	Final Review	Cumulative: Chapter 1-5

Prerequisites:

- APPM 1340 (minimum grade C-)

Equivalent Courses: Duplicate Degree Credit Not Granted: The APPM 1340-1345 sequence is equivalent to any of these ONE courses:

- APPM 1350 or ECON 1088 or MATH 1081 or MATH 1300 or MATH 1310 or MATH 1330

Learning Objectives by Section

Section	Topics	Learning Objectives – After completing this section, students should be able to do the following:
3.3	Derivatives and Shapes of Graphs	• Use the first derivative to determine whether a function is increasing or decreasing. • Sketch a graph of the second derivative, given the original function. • Sketch a graph of the original function, given the graph of its first or second derivative. • Define and find inflection points • State and apply the Second Derivative Test • Sketch a graph of a function satisfying certain constraints on its higher-order derivatives. • State the relationship between concavity and the second derivative.
3.4	Curve Sketching	• Use asymptotes, intercepts, and symmetry to sketch the approximate graph • Look for intervals of increasing/decreasing value, local max/local min, concavity, and inflection points to better estimate the curve for a graph

3.5	Optimization Problems	• Recognize optimization problems. • Translate a word problem into the problem of finding the extreme values of a function. • Set-up an optimization problem by identifying the objective function and appropriate constraints. • Solve optimization problems by finding the appropriate extreme values.
3.6	Newton's Method	• Understand, derive, and implement Newton's method for finding solutions to equations • Implement Newton's method by hand • Identify when Newton's method fails to work • Explain how the equation in Newton's method works graphically.
3.7	Antiderivatives	• Define an antiderivative. • Compute basic antiderivatives. • Compare and contrast finding derivatives and finding antiderivatives. • Define initial value problems. • Solve initial value problems. • Use antiderivatives to solve word problems. • Discuss the meaning of antiderivatives of the velocity and acceleration.
Appendix B	Sigma Notation	• Express the sum of n terms using sigma notation. • Apply the properties of sums when working with sums in sigma notation. • Know and apply the formulas for the following sums:
4.1	Areas and Distances	• Understand the relationship between area under a curve and sums of areas of rectangles. • Approximate area of the region under a curve. • Compute left, right and midpoint Riemann sums. • Compute definite integrals using geometry. • Interpret the product of rate and time as an area. • Recognize Riemann sums.

4.2	The Definite Integral	• Understand how limits of Riemann sums are used to find exact area. • State the definition of the definite integral. • Evaluate definite integrals using the limit definition. • Define and approximate net area. • Split the area under a curve into several pieces to aid with calculations. • Use symmetry to calculate definite integrals.
4.3	Evaluating Definite Integrals	• Evaluate definite integrals using the Second Fundamental Theorem of Calculus • Properties of indefinite integration
4.4	The Fundamental Theorem of Calculus	• Define accumulation functions. • Calculate and evaluate accumulation functions. • State the First Fundamental Theorem of Calculus • Take derivatives of accumulation functions using the First Fundamental Theorem of Calculus • State the Second Fundamental Theorem of Calculus • Evaluate definite integrals using the Second Fundamental Theorem of Calculus. • Understand the relationship between indefinite and definite integrals. • Compute the average value of a function on an interval. • State and apply the mean value theorem for integrals.
4.5	The Substitution Rule	• Determine when a function is a composition of two or more functions. • Calculate indefinite and definite integrals requiring complicated substitutions. • Recognize common patterns in substitutions.

5.1	Inverse Functions	• Define one-to-one functions • Determine when an inverse function exists and find inverse functions. • Understand how the derivative of an inverse function relates to the original derivative graphically and algebraically • Find the derivative of an inverse function using the derivative of the original function.
5.2	The Natural Logarithmic Function	• Define the natural logarithm • Identify and utilize properties of logarithmic functions • State the derivative of the natural logarithm • Identify situations where logs can be used to help find derivatives. • Use logarithmic differentiation to simplify taking derivatives.
5.3	The Natural Exponential Function	• Define and graph the natural exponential function. • Identify and utilize properties of exponentials. • State the derivative of the natural exponential function • State the antiderivative of the natural exponential function. • Define e as a limit.
5.4	General Logarithmic and Exponential Functions	• Define and graph general logarithmic functions • Define and graph general exponential functions • Take derivatives of functions involving logs and exponents • Find antiderivatives of functions involving logs and exponents.
5.5	Exponential Growth and Decay	• Understand and solve basic differential equations • Apply differential equations to population growth and Newton's law of cooling
5.6	Inverse Trigonometric Functions	• Identify domain and range of inverse trig functions • Derive the derivatives of inverse trignometric functions • Evaluate integrals related to inverse trigonometric functions.

5.7	Hyperbolic Functions	• State the definition of hyperbolic functions • Evaluate derivatives of Hyperbolic functions • Use properties of hyperbolic functions • Hyperbolic identities • Inverse Hyperbolic functions and their derivatives
5.8	Indeterminate Forms and L'Hospital's Rule	• Determine if a form is indeterminate • Convert some indeterminate forms to the form zero over zero or infinity over infinity • Determine when L'Hopital's Rule can be used. • Use L'Hopital's rule to compute limits