

AP Calculus BC

Chapters 7 and 8 – Integration Applications and Techniques

Modeling Applications:

1. Accumulation of change, or “net change” given a rate of change.
 - a) Rectilinear Motion: displacement, distance traveled, change in velocity.
2. Initial value problems
 - a) Rectilinear Motion: Velocity function given acceleration function and initial velocity, Position function given velocity function and initial position
3. Average Value of a Function

Geometric Applications

1. Area of a region bounded by curves
2. Volume of a solid of revolution (disk and washer methods)
3. Volume of a solid with known cross sections
4. Length of a planar curve

Integration Techniques

1. Critical:
 - a) Simplify algebraically and recognize basic antiderivatives
 - b) U-substitution, including changing limits of integration for a definite integral
 - c) Integration by parts
 - d) Nonrepeating linear partial fractions or long division
 - e) Completing the square
2. Rare:
 - a) Trigonometric integrals using Pythagorean identities
 - b) Trigonometric substitutions

Improper Integrals

1. Identify improper integrals
2. Evaluate an improper integral or show that an improper integral diverges

Reminder:

“Explain” – clarify thought process

“Justify” – Cite theorem/test/rule, including the condition.

Cumulative Topics

Limits

1. Intuitive understanding, including cases where the limit does not exist
2. Algebraic methods
3. Trigonometric limits
4. Squeeze Theorem
5. L'Hospital's Rule for indeterminate forms
6. Criteria for continuity

Derivatives

1. Limit definition
2. Connection to instantaneous rate of change and slope
3. Sum, difference, product, quotient, chain rules
4. Implicit differentiation
5. Logarithmic differentiation
6. Continuity as a condition for differentiability
7. Derivative of an inverse function

Derivative Applications

1. Interpret a derivative in context with units
2. Local linear approximation
3. Related rates
4. Rectilinear motion
5. Optimization

Function Analysis using Derivatives

1. Intervals of increasing/decreasing behavior, intervals of positive and negative concavity
2. Locating local extrema: First and second derivative tests
3. Locating points of inflection
4. Extreme Value Theorem
5. Mean Value Theorem and Rolle's Theorem

Integration

1. Limit definition: Write the definite integral as the limit of a related Riemann sum.
2. Approximate definite integral using left, right, midpoint, or trapezoidal sum.
3. Antiderivative concept and notation
4. Use geometry when applicable
5. Integral properties
6. Fundamental Theorem of Calculus, Parts I and II