THE PHILLIPS ACADEMY

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TOPICAL OUTLINE FOR CALCULUS

A. LIMITS

1. Introduction to Limits
2. Understanding Limits Graphically
3. Calculating Limits Intuitively Using a Table of Values
4. The Definition of a Limit
5. Proving Limits with Epsilon Delta Proofs
6. Sum and Difference of Limits
7. Products and Quotients of Limits
8. Powers and Radicals of Limits
9. Trigonometric Limits
10. Indeterminate Limits
11. The Squeeze Theorem
12. One-Sided Limits
13. Continuity
14. The Greatest Integer Function and Applications
15. The Intermediate Value Theorem
16. Infinite Limits and the Indeterminate Form

B. DIFFERENTIATION

1. Introduction to Differentiation
2. The Definition of a Derivative
3. The Alternate Definition of a Derivative
4. Calculating Derivatives Using Both Definitions
5. Interpreting the Derivative as the Slope of the Tangent Line
6. The Power and Product Rules for Differentiation
7. The Reciprocal and Quotient Rules for Differentiation
8. Calculating Derivatives Using the Chain Rule
9. Differentiating Trigonometric Functions
10. Understanding Higher Order Derivatives
11. Calculating Higher Order Derivatives
12. Implicit Differentiation
13. Rates of Change Application Problems
14. Related Rates Application Problems
15. Velocity and Acceleration Application Problems
16. Using Newton's Method for Approximating Zeros
17. Indeterminate Forms and L'Hospital's Rule

C. APPLICATIONS OF DIFFERENTIATION

1. The Extreme Value Theorem
2. Extreme Values on Intervals
3. Inverse Trigonometric Functions
4. The First Derivative Test and Critical Numbers
5. The Mean Value Theorem
6. Rolle's Theorem
7. The Second Derivative and Inflection Points
8. Concavity
9. Curve Sketching Using Differentiation
10. Optimization Applications

D. INTEGRATION

1. Introduction to Differentiation
2. The Definition of the Definite Integral
3. Reimann Sums and Areas
4. Properties of the Definite Integral
5. The Fundamental Theorem of Calculus
6. Anti-Differentiation
7. Indefinite Integrals
8. Integration by Substitution
9. The Mean Value Theorem for Integrals
10. Average Value and Integration with Applications

E. APPLICATIONS OF INTEGRATION

1. Calculating the Area Under a Curve
2. Calculating the Area Between Two Curves
3. Exponential, logarithmic, and Partial Fraction Applications
4. Determining Volumes Using the Slicing Technique
5. Determining Volumes of Revolution Using the Disk Method
6. Determining Volumes of Revolution Using the Washer Method
7. Determining Volumes of Revolution Using the Cylindrical Shell Method
8. Integration by Parts
9. Center of Mass Application Problems
10. Centroids of Planar Region Application Problems