

Calculus I: Core Concepts

1. Limits and Continuity

- Definition: $\lim_{x \rightarrow a} f(x) = L$
- Key Techniques:
 - * Direct substitution
 - * Factoring (e.g., for $0/0$ forms)
 - * L'Hopital's Rule (for infinity/infinity or $0/0$)

2. Derivatives

- Power Rule: $\frac{d}{dx}[x^n] = nx^{n-1}$
- Chain Rule: $\frac{d}{dx}[f(g(x))] = f'(g(x)) \cdot g'(x)$
- Applications:
 - * Tangent lines
 - * Optimization problems

3. Integrals

- Fundamental Theorem: $\int_a^b f(x)dx = F(b) - F(a)$
- Techniques:
 - * Substitution
 - * Integration by parts

4. Example Problems

Q1: Find $\lim_{x \rightarrow 3} (x^2 - 9)/(x - 3)$

A: After factoring $\rightarrow \lim_{x \rightarrow 3} (x + 3) = 6$

Q2: Differentiate $f(x) = \sin(2x)$

A: $f'(x) = 2\cos(2x)$ (Chain Rule)