# Calculus Notes

Test User

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## 1 Introduction to Calculus

Calculus is a branch of mathematics that studies continuous change. It is divided into two main branches: differential calculus and integral calculus. This document focuses on the basics of differential calculus, particularly derivatives.

## 2 Derivatives

The derivative of a function $f(x)$ is a measure of how $f(x)$ changes as $x$ changes. It is defined as:

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

**Theorem 1.** *If $f(x) = x^n$, then $f'(x) = nx^{n-1}$.*

## 3 Example

Consider the function $f(x) = x^2$. The derivative is calculated as follows:

- $f'(x) = 2x$
- At $x = 3$, the slope is $f'(3) = 6$

# 4 Key Properties

Derivatives have several important properties that simplify calculations:

1. **Linearity:** $(af + bg)' = af' + bg'$
2. **Product Rule:** $(fg)' = f'g + fg'$
3. **Chain Rule:** $(f \circ g)' = (f' \circ g) \cdot g'$

These properties are fundamental in solving complex calculus problems and are widely used in various applications of mathematics and science.