College of Arts and Science
Division of Mathematical Sciences

# Calculus I Theory

Calculus theory is to be memorized and may be tested over on chapter tests, the Midterm Theory Test, and the Semester Theory Test. Chapter tests typically cover only theory from the current chapter. The Midterm Theory Test covers theory from Appendix C and Chapters P, 1, and 2. The Semester Theory Test is cumulative for the entire course.

The following list represents the majority of theory for Calculus I. Theory may be added to this list during the semester. *Indicates proofs are also required.

**Appendix C and Chapter P**

*absolute value*
*less than*
Properties of Inequalities*
Triangle Inequality*
*slope* (of a line through two points)
*function*
*one-to-one function*
*inverse function*
*odd function/even function*

**Chapter One**

*limit* (at a point)
Properties of Limits*
*continuity* (at a point)
*continuity* (over an interval)
Squeeze (Sandwich) Theorem*
Intermediate Value Theorem
*Infinite limits*

**Chapter Two**

*derivative* (general definition)
*derivative* (of a function at a point)
Differentiability Implies Continuity Theorem*
Derivative Rules*

**Chapter Three**

*maximum/minimum*
*relative maximum/relative minimum*
*increasing function/decreasing function*
*critical value*
*concave downward/concave upward*
*inflection point*
First- and Second-Derivative Tests
Extreme Value Theorem
Relative Extreme Theorem*
Rolle's Theorem*
Mean Value Theorem*
*limits at infinity*

**Chapter Four**

*antiderivative/indefinite integral*
Antiderivative Rules
*area* (of a planar region)
*Reimann Sum*
*definite integral*
Continuity Implies Integrability Theorem
First Fundamental Theorem of Calculus*
Mean Value Theorem for Integrals*
Second Fundamental Theorem of Calculus*
Antidifferentiation of a Composite Function

The point of learning mathematical theory is not just rote memorization; the point is understanding. Definitions, theorems, and proofs are the foundations upon which the manipulations and applications of mathematics rest. Without understanding theory, it is impossible to think critically about applications or gain insight into the relationships between various applications. Theory is “why things work”. Understanding why a procedure works is incredibly helpful in determining when and how to use that procedure to solve a problem.

The principles of communication of theory and the techniques of proof presented in this course lay the foundation for mathematical work and theory in future courses.

- Clear communication of ideas is important. Even as there are specific symbols and syntax used in mathematical expressions, there are specific organizational structures used in the stating and proving of mathematical theory. These structures are used to create a concise, clear logical argument.
- Several proof techniques (including direct proof, proof by contradiction, proof by mathematical induction, and proof by exhaustion) are covered.