Walter Payton College Prep
Honors KAM II: Analysis Course Outline

Course Description
KAM II: Analysis aims to introduce students to three core areas of mathematics while developing the capacity to solve problems, make and probe conjectures, and prove theorems. Course topics will include number theory, analysis of functions, and, time permitting, the theory of computation; specific subtopics, and the amount of time allocated to each topic, will be decided throughout the year based on students needs and interests.

Course Objectives
At the end of the course, students will be able to:

- Use rigorous definitions of fundamental analytical concepts
- Apply axiomatic set theory to prove logical statements
- Prove that sets and functions satisfy or don't satisfy topological conditions
- Enumerate the natural numbers and other sets bijective thereto, or prove incommensurability
- Prove theorems contingent on the axioms of the integers
- Derive common theorems about order and divisibility
- Apply the principle of mathematical induction
- Develop a theory of convergence of sequences
- Construct the reals
- Articulate an analytic definition of continuity and prove related theorems
- Develop the theory of differentiation
- Develop the theory of Riemann integration, followed by the Fundamental Theorem of Calculus
- Engage in original mathematical research and present findings at QED: Chicago's Youth Math Symposium

Course Topics Calendar

Weeks 1-3	Set Theory Fundamentals and Logical Quantifiers
Weeks 4-5	Topology: Open and Closed Sets
Weeks 6-8	Countable and Uncountable Sets
Weeks 9-12	Equivalence Relations and Partitions; Axioms of the Integers
Weeks 13-16	Order and Divisibility
Weeks 17-20	Fundamental Theorem of Arithmetic; Induction; Modular Arithmetic
Weeks 21-25	Sequences and Limits
Weeks 26-28	Continuity
Weeks 29-31	Differentiation
Weeks 32-35	Integration
Weeks 36-39	Abstract Algebra; Complex Analysis; Computability Theory; Number Theory (based on student interest)

Resources Used
Course materials consist of a carefully sequenced set of sheets (of definitions, axioms, theorems, corollaries, and the like), developed in house over several years of experience offering this course. Some reference is made to Spivak's *Calculus*.