University at Buffalo
Gifted Math Program
Graduate School of Education

Course II Curriculum

TEXTBOOKS: Comprehensive School Mathematics Program, *Elements of Mathematics*, Book 0, Chapter 3; and *GMP Elements of Mathematics, Book 2 Logic and Sets*; *eMathInstruction*, Common Core Algebra I, https://emathinstruction.com/common-core-algebra-i/

SETS, SUBSETS, AND OPERATIONS WITH SETS

- SETS AND SUBSETS: equality, membership, singleton sets, the empty set, Venn diagrams, subsets, power sets, number of elements of a power set, number of *k*-element subsets of a set with *m* elements (Pascal's formula)
- OPERATIONS WITH SETS: intersection, union, difference, symmetric difference

LOGIC AND INFINITE SETS

- SETS: introduction; set theory; primitive notations; elementary properties of sets; operations with sets; counterexamples and examples; sets, classes, and Russell's paradox
- LOGIC: introduction and review, the real numbers, equivalence and cardinality, formal ideas about cardinality, finite and infinite cardinal numbers, cardinality of the continuum
- PROOFS: introduction, proofs from demonstrations, proofs involving ∅, proving sets equal, the deduction theorem revisited

COMPUTER PROGRAMMING with PYTHON

- TYPES: string, integer, float, bool, file, tuple; slicing and indexing; operators and built in functions by type
- LOOPS: for, while; nested loops; control flow with break, continue; branching
- CONDITIONALS: if, elif, else; logic and comparison operators;
- FUNCTIONAL PROGRAMMING: definitions and calls; parameters; scope
- LIBRARIES: general use of modules and packages; turtle, NLTK, and other examples
- DATA STRUCTURES: lists, dictionaries, sets, tuples

ALGEBRA I with EMATH INSTRUCTION

- LINEAR EXPRESSIONS, EQUATIONS, AND INEQUALITIES: solving linear equations; linear applications; linear equations with unspecified constants; solving linear inequalities; compound inequalities; interval notation; modeling with inequalities
- FUNCTIONS: function notation; graphs of functions; graph features; graphing calculator use; average rate of change; domain and range
- LINEAR FUNCTIONS AND ARITHMETIC SEQUENCES: proportional relationships; conversions; non-proportional linear relationships; slope-intercept form; modeling; horizontal and vertical lines; absolute value and step functions; graphs of linear inequalities; arithmetic sequences
- SYSTEMS OF LINEAR EQUATIONSNAD INEQUALITIES: methods of solving; properties of systems; modeling
- EXPONENTS: simplifying expressions; zero and negative exponents; exponential growth and decay; exponential functions; percent review; exponential models; linear vs exponential; geometric sequences
- POLYNOMIALS: operations on polynomials; factoring polynomials
- QUADRATIC FUNCTIONS: parabolas; transformations of parabolas; completing the square; zeros of quadratic functions; applications

- ROOTS AND IRRATIONAL NUMBERS: square roots; irrational numbers; square root function and transformations; solving quadratics using inverse operations and completing the square; quadratic formula; cube roots
- STATISTICS: graphical displays of data; quartiles and box plots; measures of central tendency; variation; frequency tables; bivariate data analysis; linear regression; other types of regression; quantifying prediction; residuals
- FUNCTIONS AND MODELING: general function transformations; discrete functions; linear and exponential models; step functions; piecewise linear functions; quadratic models; limits on the accuracy of models