

University at Buffalo
GIFTED MATH PROGRAM

Course II Curriculum

Textbooks: Comprehensive School Mathematics Program, *Elements of Mathematics*, Book 0, Chapter 10; and *GMP Elements of Mathematics, Book 2 Logic and Sets*; Mathematics Department of Phillips Exeter Academy, *Mathematics 1*.

MATHEMATICS 1 (Phillips Exeter Curriculum)

Focus throughout is on problem solving and application with particular coverage of these topics:

- COORDINATE GEOMETRY: Connecting graphs to tables, equations, and contexts; Graphing from linear equations and inequalities; Slope as a rate, Intercepts, Graphing from quadratic equations, tables and contexts; Transformations of absolute value functions, parabolas and radical functions; Use of graphing facility; Distinguishing between linear and non-linear; Scatter plots with approximated line of best fit; functions and function notation; exponential functions
- ALGEBRA MECHANICS: Operations on polynomials, Operations on rational expressions, Solving linear, quadratic, rational, radical, and absolute value equations, Solving linear inequalities, Factoring, Solving systems of 2 and 3 linear equations, Exponent rules, Operations on radicals, Percent, generalizing from a pattern, algebratizing from contexts
- GEOMETRY: Surface area, Volume, Perimeter, Scale factors, Triangle congruence theorems, Angle relationships when 2 parallel lines are cut by a transversal, Congruence and similarity

All above topics are taught in context. Some examples of specific applications include percent error, average rate of change, mixtures (rational equations), Finding maximum or minimum values (quadratics), linear programming.

STATISTICS

- SINGLE VARIABLE: summarize and represent data, use and interpretation of measures of central tendency, spread, and shape of distributions
- BIVARIATE: scatter plots and functions of best fit including linear, quadratic, exponential; 2-way tables for categorical data; use and interpret correlation coefficient; correlation vs. causation

ALGEBRA IN OPERATIONAL SYSTEMS

- GROUPS: Review of one-fold operational systems, Examples of non-commutative groups, Cancellation property and uniqueness of inverses, Solving equations in groups, Notational conventions of inverses, Opposite operation in a group
- RINGS: Review of two-fold operational systems and distributivity, Definition of a ring, Notation for rings, Ring properties, Iterated sums and products
- FIELDS: Zero divisors, Definition of a field, Solving equations in fields, Fractional notation, Field formulas
- RELATIONS: Definition and graphs, Set operations with relations, Converse of a relation, Properties of relations, Equivalence relations
- FUNCTIONS: Determine if a relationship is a function, Properties of functions
- MAPPINGS AND EQUATIONS OVER FIELDS: Mappings, Mappings as relations, Converse of a function, Composition of functions, Invertible mappings, The mappings (+a) and (-a), Additive and multiplicative inverse mappings, Power mappings
- RELATIONAL SYSTEMS: Definition and examples, Linearly ordered sets

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- ORDERED GROUPS, RINGS, AND FIELDS

LOGIC AND 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 \emptyset , Proving Sets Equal, The Deduction Theorem Revisited