HSSP Syllabus: Problem Solving
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Description: We will extend basic mathematical concepts introduced in high school to a more sophisticated level and develop mathematical problem-solving tools and techniques through a variety of interesting problems. Emphasis will be placed on conceptual understanding and connections between mathematical ideas rather than on computation. These techniques will be useful in high school mathematics competitions as well as in college.

[1] Algebra I: Logarithms and Exponentials
Definitions of exponentials/logarithms, base-n counting system, identities for logarithms

[2] Algebra II: Sequences and Series
Fibonnaci sequences, geometric sequences, harmonic series, telescoping sums

[3] Geometry I: Circles and Polygons
Trigonometry, circles, triangles, quadrilaterals, power of a point, angle chasing

[4] Geometry II: Analytic Geometry
Vectors, planes, determinants, three-dimensional geometry, algebra-geometry correspondences

[5] Counting I: Combinatorics
Combinatorics, binomial theorem, simple generating functions, block-walking

[6] Counting II: Probability
Basic problems, independent variables, inclusion-exclusion

[7] Number Theory: Basics
Modular arithmetic, Diophantine equation, Chinese remainder theorem, Fermat's little theorem