UIL "Mathematics" Contest Topics & Overview

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According to UIL, test material spans topics from:
Algebra I
Algebra II
Geometry
Trigonometry
Math Analysis
Analytic Geometry
Pre-Calculus
Elementary Calculus

Useful Graphing Calculator Techniques:
- tracing real roots (zeros)
- factorial operation / nPr, nCr functions
- using trig & inverse trig functions
- matrices & matrix operations
- regressions: models, best-fit, and regression equations

Vocabulary: knowing proper mathematical vocabulary is KEY to success in the "Mathematics" contest!

Tips:
- Know how scoring works (+6 points for correct answer, -2 for incorrect, ±0 if left blank, and NO PENALTY for skipping!)
- Questions may or MAY NOT be in order of difficulty (SKIP AROUND!)
- Many questions can be solved in multiple ways
- Remember your test-taking strategies: eliminate answer choices, work backwards from answer choices, use the calculator to your advantage, substitute in real number values for theoretical situations, don't spend too much time on one problem if you feel like you're "getting nowhere" (less than one minute is given per problem)
- Set Theory, probability, and calculus problems are normally EASY if you just know the basics of the material!
- Study up on your own outside of school (Google, Khan Academy, Wikipedia, MathWorld, PurpleMath.com, etc.)
- Our goal is **three-digit scores**! (at least 17 questions ALL CORRECT!)

Specifics: (things that I've noticed tend to come up a lot)
*** Set Theory** – elements, union, intersection, complement, operations & closure, algebraic properties of the Reals
Conic Sections – circles, ellipses, parabolas, hyperbolas
Linear Equations – point-slope formula, standard form, parallel / perpendicular lines
**** Roots of Polynomials** – real and complex, number / nature of roots given a polynomial function
*** Triangle Centers** – incenter, circumcenter, centroid, etc.
Triangle Inequality Theorem
***** Trigonometry** – right triangle formulas, law of sines / law of cosines, trig function behavior & transformations
***** Elementary Calculus** – limits, derivatives of polynomials, position / velocity / acceleration problems
***** Counting Problems** – multiplication rule, factorials, combinations, permutations
***** Probability** – independent events, conditional probability, counting problems & probability, statistical analysis
***** Complex Numbers** – add/subtract/multiply/divide, write in standard form, express in polar & rectangular form
Central Tendency – arithmetic mean, median, mode, range, standard deviation, variance
***** Matrices** – finding determinants, matrix multiplication, inverting / reducing / various operations
**** Piecewise Functions**
Composite Functions
***** Polar Coordinates** – graphing polar functions, naming polar functions
**** Arithmetic / Geometric Sequences** – finding the nth term in a sequence or pattern, common difference / ratio
**** Summation & Series** – Sigma notation, partial sums, convergence of infinite series
**** Binomial Theorem** – expanding binomials, binomial coefficients, using Pascal's triangle, nth binomial term
*** Number Theory** – primes, prime factorization, "perfect"/ "abundant"/ "deficient" numbers, etc.
*** Congruences and Modular Arithmetic** – divisors, congruence modulo n (not tested specifically, but useful to know)
* **Newly-Defined Operations** – Interpreting operations as functions in unfamiliar context
*** Biographies of Mathematicians / History of Mathematics / Names of Theorems**

* denotes topics not normally covered in depth or AT ALL in regular-level high school math courses
** denotes topics normally covered ONLY in Pre-AP classes
*** denotes topics covered in classes which may be taken only AFTER Algebra 2