Math League Event Topics per Meet

Meet 1

1A Pre-algebra Topics

- Fractions to add and express as the quotient of two relatively prime integers
- Complex fractions and continued fractions
- Decimals, repeating decimals
- Percentage, interest, and discount
- Least common multiple, greatest common divisor
- Number bases; change of base

1B Angles and Special Triangles

- The Theorem of Pythagoras; familiar Pythagorean triples
- Complementary, supplementary, and vertical angles
- Interior and exterior angles for triangles and polygons
- Angles formed by transversals cutting parallel lines
- Properties of isosceles and equilateral triangles
- Relationships in 30°-60°-90° and 45° -45° -90° triangles

1C Elementary Trigonometry

- Definitions and solution of right triangles
- Elementary identities
- Radian measure and graphs of elementary functions
- Trigonometric functions of multiples of $\frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}$

1D Roots of Quadratic and Polynomial Equations

- Solution of quadratic equations by factoring, by completing the square, by formula
- Complex roots of quadratic equations; the discriminant and the character of the roots
- Relations between roots and coefficients
- Synthetic Division
- Function notation

Math League Event Topics per Meet

Meet 2

2A Linear Equations in One Unknown

- Solving numeric equations (perhaps involving a second degree term which drops out)
- Solving literal equations
- Story problems leading to linear equations in one variable
- Linear inequalities

2B Triangular figures and solids

- Medians, angle bisectors, and altitudes
- Ceva's and Stewart's Theorems
- Area of a triangle (including Hero's Formula)
- Triangular prisms & pyramids (including volume and surface area)

2C Trigonometry

- Functions of sums of angles and sums of functions of angles
- Half and double angle formulas
- Reduction formulas

  (Not required: formulas for sin A + sin B, etc.)

2D Analytic Geometry of Straight Lines and Circles

- Slope, families of parallel, perpendicular, or coincident lines
- Point-slope, slope-intercept, intercept, normal forms of the straight line
- Intersections (solution of simultaneous systems)

Math League Event Topics per Meet

Meet 3

3A Systems of Linear Equations in Two (or on occasion three) Variables

- Numeric and literal systems
- Relation to graphical procedures
- Word problems leading to such systems
- Systems of inequalities used to define a region in the plane
- Determinants

3B Polygonal figures and solids

- Special quadrilaterals and regular polygons (including area formulas)
- Intersecting diagonals
- Ptolemy's Theorem
- Polygonal prisms & pyramids (including volume and surface area)

3C Trigonometry

- Law of sines, law of cosines
- Inverse functions and their graphs
- Solving trigonometric equations
- De Moivre's Theorem and the roots of unity

3D Exponents and Logarithms

- Use of fractional, negative exponents
- Simplifying expressions involving radicals
- Solving equations involving radicals
- Use of logarithms; identities involving logarithms
- Solving logarithmic equations
- Relationships between logarithms to different bases

Math League Event Topics per Meet

Meet 4

4A Algebraic Manipulation

- Factoring (including $x^3 + y^3$, $x^3 - y^3$)
- Sums, products, quotients of rational expressions
- Solving equations (including radical equations) involving these skills, but ultimately solvable by factoring or the quadratic formula (but no complex roots)
- Rational exponents
- Simplifying radical expressions
- Function notation and variational dependencies

4B Circular figures and solids

- Central, inscribed, tangential, and exterior angles
- Power of a point (chords, secants, tangents)
- Interior and exterior tangents of two circles
- Intercepted arcs
- Area of circles, sectors, circular segments
- Cylinders, cones, & spheres (including volume and surface area)

4C Miscellaneous Topics

- Sequences: patterns and recursion formulas, arithmetic and geometric sequences
- Series: partial sums, formulas for sums of consecutive integers $1 + 2 + \cdots + n$, consecutive squares $1^2 + 2^2 + \cdots + n^2$, and consecutive cubes $1^3 + 2^3 + \cdots + n^3$
- Function notation
- Factorial notation and the Binomial Theorem

4D Analytic Geometry of the Conic Sections

- Using the standard forms of equations of the conic sections
- Graphs, including the location of foci, directrices, and asymptotes
- Use of properties of conics to solve applied problems, including max-min for parabolas

Math League Event Topics per Meet

Meet 5

5A Puzzle Problems (20 minutes)

- Word problems, one or more variables
- Max-min problems not requiring calculus
- Problems found in "brain-teaser" type books
- Logic puzzles, including the use of Venn Diagrams

5B Congruence and Similarity

- Ratio and proportion
- Segments intercepted by parallel lines
- Identification of similar/congruent figures
- Ratios of areas and volumes
- Elementary trigonometric ratios

5C Counting and Probability

- Permutations, with and without replacement
- Combinations, with and without replacement
- Using the principle of inclusion, exclusion
- Using the binomial and multinomial expansions
- Nonnegative integer solutions to $x_1 + x_2 + \cdots + x_n = b$
- Definition, simple applications of probability (when to multiply, when to add, etc.)

5D Variations of Problems appearing on the previous year's AMC 12 (contest A and B)