This is the theory accumulated, throughout these years, while preparing for the Math Olympiad.

Algebra:

- Inequalities:
  - QM-AM-GM-HM inequality;
  - Sum of Squares (SOS) method;
  - Vornicu-Schür Inequality;
  - Abstract Concreteness (ABC) method;
  - Cauchy-Schwarz inequality;
  - Hölder's inequality (including T_2's lemma, Radon's, and Cauchy-Schwarz inequality);
  - Inequalities using convex/concave functions (Jensen, Karamata, Popoviciu);
  - Müirhead's inequality and Schür's inequality;
  - Lagrange multipliers;
  - Reversed Cauchy method;
  - Substitutions (e.g. Ravi's, trigonometric);
  - Kantorovich inequality;
  - Abel's summation formula and inequality;
  - Linear inequalities;
  - Newton's inequality, Maclaurin's inequality;
  - Vasile Cîrtoaje's inequality;
  - Chebyshev's inequality, Rearrangement inequality;
  - Gram determinant;
  - Vo Quoc Ba Can's lemma;
  - Bernoulli's inequality;
  - Mixing variables;
- Polynomial of degree 2 (its roots, minimum/maximum, and sign);
- Functional equations; Continuity and Monotony;
- Polynomials (algebraic numbers, Lagrange interpolation formula, irreducibility criterions, Mason-Stothers theorem);
- Beatty's theorem, Legendre's identity;
- Derivatives;
- Logarithm;
- Complex numbers;
- Vieta's formulas;
- Strings, Characteristic equations;
- Introduction to hyperbolic trigonometry;
- Floor and Ceiling functions, Fractional part of a number, Hermite's identity;

- Vector Spaces and Hamel Basis.

Geometry:

- Congruent and Similar triangles;
- Circles (tangents, power of a point, radical axis, radical center);
- Cyclic quadrilaterals, Tangential quadrilaterals, Monge-d'Alembert theorem;
- Geometric Constructions;
- Vectors and Position Vectors, Barycentric Coordinates, Method of solving hexagon-related problems using vectors;
- Characteristics of a symmedian;
- Trigonometry, Trigonometric identities;
- Area of a triangle formulas (7 short formulas: using height, circumradius, inradius, exradius, sine of an angle, Heron, coordinates), Bretschneider's formula;
- Isogonal and Isotomic Conjugates;
- Butterfly theorem and Haruki's theorem;
- Geometric Inequalities (e.g. Erdös-Mordell, Gerretsen, Walker);
- Collinearity and concurrence (Menelaus's, Ceva's (also in trigonometric interpretation), Pascal's, Newton's - related to circumscribed quadrilaterals, Desargues's, Pappus's, and Brianchon's theorem);
- Homothety, Inversion, and Spiral Similarity;
- Projective Geometry (harmonic quadrilaterals, harmonic division, pencil, poles, and polars);
- Projective transformation;
- Computational geometry (Cartesian Coordinate System, Trigonometry - using Law of Cosines, Law of Sines, and Metric - using Stewart's theorem, Steiner's relation, Pythagorean theorem, Van Aubel's relation, Casey's theorem etc.);
- Bashing Geometry using complex numbers;
- Advanced Space Geometry (including regular polyhedrons, Monge parallelepiped, Vogt's sphere, Euler's sphere, Crelle tetrahedron; properties of orthocentric, trirectangular, and isosceles tetrahedron);
- Poncelet's Porism;
- Properties of triangles:
    - Important points: centroid, incenter, circumcenter, orthocenter, excenters, Lemoine, isodynamic, Spieker, Nagel, Gergonne, Vecten, Feuerbach, Brocard, Torricelli-Fermat, Clawson, Napoleon, Prasolov, Rabinowitz, Longchamps, Steiner, Tarry, Morley, Coșniță (and its dual), Poncelet, Schiffler, Bevan;
    - Important lines: Nagel, Euler, Simson, Lemoine, Droz-Farny;
    - Important circles: incircle, circumcircle, excircle, Euler or nine-point, Apollonius, Lemoine;

    - Theorems: Sawayama Thébault, Conway, Morley, Fagnano's problem, Jacoby, Schooten, Schömilch, Grebe, Carnot, Pompey;
- Properties of quadrilaterals:
    - Important points: Mathot, Miquel (in particular, I studied the case of a cyclic quadrilateral);
    - Important lines: Newton-Gauss, Aubert, Newton - related to circumscribed quadrilaterals;
    - Important circles: Mathot;
    - Theorems: Ptolemy (including the inequality), Pierre-Leon Anne, Japanese theorem for cyclic quadrilaterals.

Combinatorics:

- Pigeonhole principle;
- Euler's relation (in both plane and space geometry);
- Permutations (with repetition), Arrangements (with repetition), Combinations (with repetition), and derangements;
- Identities using Combinations, Binomial theorem, Multinomial theorem;
- Double counting;
- Mathematical games;
- Graph Colouring method;
- "Stars and Bars" formula.
- Graph theory (including Túran's theorem, Hall's Marriage theorem);
- Ramsey's numbers;
- Introduction to Finite Geometry;
- Algebraic Combinatorics;
- Geometric Combinatorics, Convex Hull;
- Set theory;
- Chains and Antichains (including Sperner's, Erdős–Ko–Rado, Ramsey's, Erdős, Caro-Wei, Dilworth's, and Mirsky's theorem);

Number Theory:

- Congruence modulo, Divisibility;
- Diophantine equations;
- Lifting the exponent;
- Order of an element;
- The Legendre and Jacobi Symbols, Primitive roots, Thue's lemma and its applications;
- Zsigmondy's theorem;
- Arithmetic properties of polynomials;

- Euler’s algorithm, Bézout’s identity;
- Catalan’s conjecture or Mihăilescu’s theorem;
- Prime numbers, Fermat’s little and Euler’s theorem, Chebyshev’s theorem or Bertrand’s postulate, Wilson’s theorem, Green-Tao theorem, Dirichlet’s theorem;
- Algebraic integers;
- Factorial rings (including Euclidean rings and Gaussian integers)
- Cardinal assignment, Countable sets;
- Radix, Lucas’s theorem;
- Pell’s equations;
- Frobenius’s problem;
- Möbius function;
- Hermite’s identity, Gauss’s identity;
- Complex numbers in Combinatorics;
- Lagrange’s four-square theorem, Legendre’s three-square theorem, and Fermat’s two square theorem.

Problem Solving:

- Logic and Problem Solving (Stanford Pre-Collegiate Summer Institutes);
- Induction (including strong induction and Cauchy’s induction);
- Extremal Principle;
- Pigeonhole Principle;
- Proof by Contradiction;
- Vieta Jumping;
- The Method of Infinite Descent.