



Syllabus for Euclid (欧几里得数学竞赛教学大纲)¹

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OBJECTIVES (教学目标)

We expect students to achieve the following objectives after taking this course:

(学生通过我们的课程培训可以实现以下目标)

1. Master most problem-solving skills to analyze the greatest number of Euclid problems.
(掌握用于解答绝大部分欧几里得题目的解题技巧)
2. Get a score above 80.
(获得80分以上的高分)
3. Receive competition awards, such as Distinction (Top 25%) .
(获得竞赛奖励, 例如Distinction, 即前25%成绩)

Duration (总课时)

This is a 24-hour course (全课程总计 24 小时).

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COURSE CONTENTS (教学内容)

Module 1: Exponents and Logarithms (第一模块：指数和对数)

1. Skills to manipulate logarithmic expressions (对数表达式的处理技巧)
2. Skills of solving logarithmic equations (对数方程的求解技巧)
3. Properties of logarithmic functions (对数函数的性质)
4. Properties of exponential functions (指数函数的性质)
5. Skill to convert an exponential problem to a logarithmic problem (把指数问题转化为对数问题的技巧)
6. Universal skills to solve all logarithmic problems (解决所有对数问题的普适技巧)

Module 2: Trigonometry (第二模块：三角学)

1. Trigonometric Identities (三角函数的性质)
2. Skills to utilize law of cosine and law of sine (对正弦定理和余弦定理的利用技巧)
3. Skills to manipulate formulas of sum (和角公式使用技巧)
4. Skills to manipulate formulas of double angle (倍角公式使用技巧)
5. Skills of trigonometric function and angle transformation (三角函数方程种类和角度变换技巧)
6. Skills of using trigonometric function identities (三角函数恒等变换的使用技巧)
7. Skills of using the law of cosines and the law of sines without adding auxiliary lines (不添加辅助线，完全使用余弦定理和正弦定理求解几何问题的技巧)

Module 3: Functions, Equations, and Polynomials (第三模块：函数，方程，多项式)

1. Skills of analyzing composite functions (分析复合函数的技巧)



2. Skills of solving functional equations (求解函数方程的技巧)
3. Skills of factoring a polynomial expression and exploiting its properties (因式分解多项式表达式和利用相关性质解题的技巧)
4. Skills of using the relationship of polynomial function coefficients and zeros (利用多项式系数和零点的关系解决问题的技巧)
5. Skills of finding rational zeros (寻找有理数零点的技巧)

Module 4: Analytic Geometry (第四模块: 解析几何)

1. Skills of using various forms of equations of lines (使用不同种类直线方程的技巧)
2. Skills of analyzing the problems about the relationship between a point and a line (分析点和线关系问题的解题技巧)
3. Skills of analyzing the problems about the relationship between two lines (分析线和线关系问题的解题技巧)
4. Skills of analyzing transformation problems (分析涉及变换操作问题的技巧)
5. Skills of analyzing non-linear graphs (分析非线性图形的技巧)
6. Skills of using analytic geometry method to solve Euclidean geometry problems (使用解析几何方法求解平面几何问题的解题技巧)

Module 5: Sequences and Series (第五模块: 数列和级数)

1. Skills of analyzing arithmetic sequences (等差数列的分析技巧)
2. Skills of analyzing geometric sequences (等比数列的分析技巧)
3. Skills of using the recursive equations method to analyze general sequences (递归方程方法分析数列的技巧)

Module 6: Euclidean Geometry (第六模块: 欧式几何)



1. Triangles, quadrilaterals, polygons (三角形, 四边形, 多边形)
 - (a) Law of cosines (余弦定理)
 - (b) Law of sines (正弦定理)
 - (c) Skills of using the law of cosines and the law of sines without adding auxiliary lines (不添加辅助线, 完全使用余弦定理和正弦定理求解几何问题的技巧)
2. Circles (圆)
 - (a) Skills of analyzing problems with tangents (求解跟圆相切问题的技巧)
 - (b) Skills of using the power of a point (圆幂定理)
 - (c) Skills of analyzing problems with circles without drawing any circle (分析含有圆的问题但是不画圆的技巧)
 - (d) Skills of analyzing cyclic quadrilateral problems (分析四点共圆的技巧)
3. Triangular centers (三角形的各种心)

Module 7: Counting and Probability (第七模块: 计数和概率)

1. Set operations (集合运算)
2. Permutations (排列计数)
3. Combinations (组合计数)
4. Classical probability models (古典概率模型)
5. Geometric models of uniform distribution (均匀分布的几何概率模型)
6. Skills to analyze conditional probability problems (分析条件概率的技巧)
7. Recursive equations method in counting and probability (递归方程方法在排列组合和概率问题中的应用)
8. Skills of using the recursive equations method to solve counting problems (利用递归方程求解排列组合问题的技巧)



9. Skills of using the recursive equations method to solve probability problems (利用递归方程求解概率问题的技巧)

Module 8: Properties of Numbers (第八模块: 数论)

1. Skills of using the parity properties (奇偶性质的使用技巧)
2. Properties of primes, composites (质数和合数的性质)
3. Skills of prime factorization (分解质因数的技巧)
4. Skills of analyzing problems with greatest common divisors and least common multiples (分析含有最大公约数和最小公倍数问题的技巧)
5. Statistics of divisors (因数统计问题)
6. Modular arithmetic (同余运算)