



# Syllabus for AMC 8, MATHCOUNTS (教学大纲)<sup>1</sup>

PROFESSOR CHEN EDUCATION PALACE (陈教授教育学院)

## OBJECTIVES (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. Build up solid foundation for AMC 8 and MATHCOUNTS.  
(为参加AMC 8和MATHCOUNTS竞赛打下坚实的基础)
2. Master both basic and advanced problem-solving skills to analyze the greatest number of AMC 8 and MATHCOUNTS problems.  
(掌握用于解答绝大部分AMC 8和MATHCOUNTS题目的基础的和高阶的技巧)
3. Receive competition awards (example: honor rolls or above in AMC 8) or advance to a higher level contest (example: MATHCOUNTS School level -> Chapter level -> State level -> National level).  
(获得竞赛奖励, 例如在AMC 8中获得honor rolls, 或者在MATHCOUNTS中晋级).
4. Be prepared to advance to our AMC 10 and AMC 12 courses.  
(为进一步学习 AMC 10 和 AMC 12 打下基础)

## Duration (总课时)

This is a 60-hour course (全课程总计 60 小时).

## TEXTBOOKS (教材)

1. We use our own notes developed by Professor Chen (我们用陈教授亲自编写的教材).

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2. Sandor Lehoczky and Richard Rusczyk, 2006. The Art of Problem Solving, Volume 1: The Basics, 7<sup>th</sup> edition.

3. Richard Rusczyk and Sandor Lehoczky, 2006. The Art of Problem Solving, Volume 2: And Beyond, 7<sup>th</sup> edition.

## COURSE CONTENTS (教学内容)

### Module 1: Algebra (第一模块：代数)

1. Arithmetic operations, expressions (代数运算, 表达式)
  - (a) Four basic arithmetic operations (四则运算)
  - (b) Fractions (分数)
  - (c) Exponents (指数)
  - (d) Factorials (阶乘)
  - (e) Factoring expressions (分解因式)
  - (f) Radicals (根号运算)
  - (g) Simplifying expressions (简化表达式)
2. Equations (方程)
  - (a) Linear equations (线性方程)
  - (b) Quadratic equations (二次方程)
  - (c) Equations with absolute values (含有绝对值的方程)
  - (d) Change-of-variable technique (换元法)
  - (e) System of equations with special structures (含有特殊结构的方程组)
3. Inequalities (不等式)
  - (a) Linear inequalities (线性不等式)
  - (b) Quadratic inequalities (二次不等式)
  - (c) Inequalities with fractions (含有分数的不等式)
  - (d) Inequalities with radicals (含有根号的不等式)
  - (e) Inequalities with absolute values (含有绝对值的不等式)



4. Real-life problems (文字应用题)
  - (a) Arithmetic method (算术方法)
  - (b) Equation method (方程方法)
  - (c) Inequality method (不等式方法)
  - (d) Proportional reasoning (比例问题)
  - (e) Converting units (单位转换)
  - (f) Fractions and percentages (分数, 百分数问题)
5. Functions (函数)
  - (a) Basic properties (函数基本性质)
  - (b) Composite functions (复合函数)
  - (c) Computing functional values (计算方程输出变量的值)
  - (d) Solving input arguments (求解方程因变量的值)
  - (e) Functional equations (函数方程)
  - (f) Graphing functions (函数图像)
6. Sequences (数列)
  - (a) Arithmetic sequences (等差数列)
  - (b) Geometric sequences (等比数列)
  - (c) General sequences, recursive equation method (一般数列, 递归方程)

## **Module 2: Geometry (第二模块: 几何)**

1. Points, lines, angles (点, 线, 角)
2. Triangles (三角形)
  - (a) Sum of interior angles (三角形内角和性质)
  - (b) Triangle inequality (三角不等式)
  - (c) Pythagorean theorem (勾股定理)
  - (d) Congruent triangles (全等三角形)
  - (e) Similar triangles (相似三角形)



- (f) Cevians in triangles (三角形里的塞瓦线)
- 3. Quadrilaterals (四边形)
  - (a) Properties of general quadrilaterals (一般四边形的性质)
  - (b) Special-shape quadrilaterals: Trapezoids, parallelograms, rhombuses, rectangles, squares (特殊四边形, 例如梯形, 平行四边形, 菱形, 长方形, 正方形)
- 4. Polygons (多边形)
  - (a) Properties of general polygons (一般多边形的性质)
  - (b) Regular polygons (正多边形)
- 5. Circles (圆)
  - (a) Area, circumference (面积, 周长)
  - (b) Central and inscribed angles (圆心角, 圆周角)
  - (c) Tangents to circles (和圆相切有关的问题)
- 6. Computing areas of irregular shapes (计算不规则图形的面积)
- 7. Analytic geometry (解析几何)
  - (a) Distance between two points in a coordinate plane (坐标系上两点的距离)
  - (b) Coordinates of a point on a ray (射线上任意一点的坐标)
  - (c) Multiple forms of equations of a line (直线方程的各种表达形式)
  - (d) Properties of two parallel lines (两线平行的性质)
  - (e) Properties of two perpendicular lines (两线垂直的性质)
  - (f) Properties between a point and a line (点和线的性质)
- 8. Solid geometry (立体几何)
  - (a) Special-shaped solids: Spheres, prisms and cylinders, pyramids and cones, parallelepipeds, cubes (特殊形状体, 例如球, 棱柱, 圆柱, 锥体, 平行六面体, 正方体)
  - (b) Volumes, surface areas (体积, 表面积)
  - (c) Space visualization (空间想象力)

### **Module 3: Counting and probability (第三模块: 排列组合和概率)**



1. Set operations (集合运算)
  - (a) Venn diagram (文恩图)
  - (b) Rule of sum (加法原理, 分类讨论)
  - (c) Complement (补集计数方法)
  - (d) Principle of inclusion-exclusion (容斥原理)
  - (e) Rule of product (乘法原理, 分步计数)
2. Permutations (排列计数)
3. Combinatorics (组合计数)
  - (a) Canonical model (经典组合模型)
  - (b) Counting with resource allocation models (资源分配计数模型)
  - (c) Counting the number of travel paths on graphs (图上路径计数模型)
4. Classical probability (古典概率)
5. Geometric models of uniform distribution (均匀分布的几何概率)
6. Statistics (统计)
  - (a) Mean, median, mode, range (平均数, 中位数, 众数, 范围)
  - (b) Graphs, tables (图, 表)

#### **Module 4: Number theory (第四模块: 数论)**

1. Parity (奇偶性分析)
2. Primes, composites (质数, 合数)
3. Factorization (分解因数)
4. Greatest common divisors, least common multiples (最大公约数, 最小公倍数)
5. Number bases (进制数)
6. Modular arithmetic (同余运算)
  - (a) Modular arithmetic with addition, subtraction, multiplication, exponentiation (同余的加法, 减法, 乘法, 指数运算)
  - (b) Special modulus (特殊模数的性质)



(c) Solving a single linear modular equation (求解线性同余方程)

(d) Solving a system of linear modular equations (求解线性同余方程组)

