

Contents

CHAPTER 1

The Basics 1

- 1A Introduction and Apology 1
- 1B Congruent Triangles 5
- 1C Angles and Parallel Lines 11
- 1D Parallelograms 14
- 1E Area 18
- 1F Circles and Arcs 23
- 1G Polygons in Circles 34
- 1H Similarity 39

CHAPTER 2

Triangles 50

- 2A The Circumcircle 50
- 2B The Centroid 56
- 2C The Euler Line, Orthocenter, and Nine-Point Circle 60
- 2D Computations 67
- 2E The Incircle 73
- 2F Exscribed Circles 80
- 2G Morley's Theorem 82
- 2H Optimization in Triangles 85

CHAPTER 3

Circles and Lines 94

- 3A Simson Lines 94
- 3B The Butterfly Theorem 105
- 3C Cross Ratios 107
- 3D The Radical Axis 119

CHAPTER 4

Ceva's Theorem and Its Relatives 125

- 4A Ceva's Theorem 125
- 4B Interior and Exterior Cevians 131
- 4C Ceva's Theorem and Angles 136
- 4D Menelaus' Theorem 146

CHAPTER 5

Vector Methods of Proof 156

- 5A Vectors 156
- 5B Vectors and Geometry 158
- 5C Dot Products 163
- 5D Checkerboards 166
- 5E A Bit of Trigonometry 170
- 5F Linear Operators 172

CHAPTER 6

Geometric Constructions 182

- 6A Rules of the Game 182
- 6B Reconstructing Triangles 187
- 6C Tangents 191
- 6D Three Hard Problems 196
- 6E Constructible Numbers 203
- 6F Changing the Rules 208

Some Further Reading 216

Index 218