

# *Geometry*

Fifth Edition



# CONTENTS

Welcome to <i>GEOMETRY!</i>	viii
Using Your Book	ix
<b>Chapter 1: Foundations of Geometry</b>	<b>2</b>
1.1 Sets	4
1.2 Definitions & Undefined Terms	9
1.3 An Ideal Geometry	14
<b>Geometry in History</b> —Not Your Usual Math Club (Part 1)	20
1.4 Subsets of Lines & Planes	21
1.5 Segment & Angle Measures	27
<b>Technology Corner</b> —Dynamic Geometry Software	34
1.6 2-Dimensional Figures	35
1.7 3-Dimensional Figures	44
<b>Geometry around Us</b> —DNA: Life's Blueprint	50
1.8 Sketches, Drawings & Constructions	51
Chapter 1 Review	56
<b>Chapter 2: Reasoning &amp; Proof</b>	<b>60</b>
2.1 Inductive Reasoning	62
<b>Geometry around Us</b> —Parallel Processing	68
2.2 Statements & Truth Values	69
2.3 Conditionals & Biconditionals	75
<b>Geometry in History</b> —Not Your Usual Math Club (Part 2)	81
2.4 Deductive Reasoning	82
2.5 Algebraic Reasoning	89
2.6 Proofs Using Segments	95
<b>Technology Corner</b> —Angle Conjectures	100
2.7 Proofs Using Angles	101
2.8 Using Bisectors	109
Chapter 2 Review	115
<b>Chapter 3: Parallel &amp; Perpendicular Lines</b>	<b>120</b>
3.1 Parallel Lines & Transversals	122
3.2 Proving Lines Are Parallel	128
<b>Geometry in History</b> —Not Your Usual Math Club (Part 3)	134
3.3 Constructing Parallel & Perpendicular Lines	135
<b>Technology Corner</b> —Exploring Midpoints & Slopes	141
3.4 Distance, Midpoint & Slope	142
<b>Geometry around Us</b> —Designers & Patterns	149
3.5 Equations of Lines	150
Chapter 3 Review	156

<b>Chapter 4: Congruent Triangles</b>	<b>160</b>
4.1 Angles in Triangles	162
4.2 Congruent Figures	171
<b>Geometry around Us</b> —Architects & Buildings	178
4.3 Congruence Postulates	179
4.4 Applying Congruence Postulates	185
<b>Technology Corner</b> —Exploring AAA & SSA	193
4.5 Conditions for Congruent Triangles	194
4.6 Right Triangle Congruence	203
<b>Geometry in History</b> —A Revolutionary Museum (Part 1)	210
4.7 Coordinate Geometry of Triangles	211
<b>Chapter 4 Review</b>	218
<b>STEM Activity</b> —Do Parallel Lines Exist?	223
<b>Chapter 5: Relationships in Triangles</b>	<b>224</b>
5.1 Circumcenters & Orthocenters	226
5.2 Incenters & Centroids	234
<b>Technology Corner</b> —Triangle Relationships	242
5.3 Inequalities in Triangles	243
<b>Geometry in History</b> —A Revolutionary Museum (Part 2)	249
5.4 Indirect Proofs	250
5.5 More Inequalities in Triangles	256
<b>Geometry around Us</b> —Carpentry	265
<b>Chapter 5 Review</b>	266
<b>Chapter 6: Quadrilaterals</b>	<b>270</b>
6.1 Classifying Quadrilaterals	272
<b>Technology Corner</b> —Exploring Quadrilaterals	280
6.2 Characteristics of Parallelograms	281
6.3 Proofs of Parallelograms	288
6.4 Rectangles, Rhombi & Squares	295
<b>Geometry around Us</b> —Sports	302
6.5 Trapezoids & Kites	303
<b>Geometry in History</b> —A Revolutionary Museum (Part 3)	312
6.6 Coordinate Geometry of Quadrilaterals	313
<b>Chapter 6 Review</b>	320
<b>Chapter 7: Area</b>	<b>324</b>
7.1 Areas of Rectangles, Parallelograms & Triangles	326
<b>Technology Corner</b> —Center of Gravity	334
7.2 Areas of Other Quadrilaterals	335
7.3 The Pythagorean Theorem	342
7.4 Special Right Triangles	348
<b>Geometry in History</b> —Another Purpose (Part 1)	354

7.5	Areas of Regular Polygons . . . . .	355
	<b>Geometry around Us</b> —Home Ownership . . . . .	361
7.6	Circles, Sectors & Segments . . . . .	362
	<b>Chapter 7 Review</b> . . . . .	369
	<b>Chapter 8: Circles</b> . . . . .	<b>374</b>
8.1	Circles & Chords . . . . .	376
8.2	Tangents . . . . .	383
	<b>Technology Corner</b> —Constructing Common Tangents . . . . .	392
8.3	Arc Measure & Length . . . . .	393
8.4	Inscribed Angles . . . . .	402
	<b>Geometry around Us</b> —Transportation . . . . .	408
8.5	Angles & Circles . . . . .	409
	<b>Geometry in History</b> —Another Purpose (Part 2) . . . . .	415
8.6	Circular Constructions . . . . .	416
8.7	Coordinate Geometry of Circles . . . . .	422
	<b>Chapter 8 Review</b> . . . . .	428
	<b>Chapter 9: Surface Area &amp; Volume</b> . . . . .	<b>432</b>
9.1	Analyzing 3-Dimensional Figures . . . . .	434
	<b>Technology Corner</b> —Platonic Solids . . . . .	441
9.2	Surface Areas of Prisms & Cylinders . . . . .	442
9.3	Surface Areas of Pyramids & Cones . . . . .	450
9.4	Volumes of Prisms & Cylinders . . . . .	459
	<b>Geometry around Us</b> —Engineering . . . . .	466
9.5	Volumes of Pyramids & Cones . . . . .	467
9.6	Surface Area & Volume of Spheres . . . . .	474
	<b>Geometry in History</b> —Another Purpose (Part 3) . . . . .	480
9.7	Geometry of Spheres . . . . .	481
9.8	Drawing 3-Dimensional Figures . . . . .	488
	<b>Chapter 9 Review</b> . . . . .	495
	<b>STEM Activity</b> —Fragile, Pack It Right! . . . . .	499
	<b>Chapter 10: Transformations &amp; Symmetry</b> . . . . .	<b>500</b>
10.1	Reflections . . . . .	502
10.2	Translations . . . . .	510
	<b>Geometry around Us</b> —Video Games . . . . .	518
10.3	Rotations . . . . .	519
10.4	Isometries . . . . .	528
10.5	Symmetry . . . . .	536
10.6	Dilations . . . . .	543
	<b>Geometry in History</b> —Computer Graphics (Part 1) . . . . .	550
10.7	Tessellations . . . . .	551
	<b>Technology Corner</b> —Drawing Tessellations . . . . .	557
	<b>Chapter 10 Review</b> . . . . .	558

<b>Chapter 11: Similarity</b>	<b>564</b>
11.1 Similar Figures . . . . .	566
11.2 Proving Similarity in Triangles . . . . .	574
11.3 Similarity within Right Triangles . . . . .	582
<b>Technology Corner</b> —Investigating Parallel Partitions . . . . .	588
11.4 Proportional Partitions . . . . .	589
<b>Geometry in History</b> —Computer Graphics (Part 2) . . . . .	597
11.5 Lengths, Areas & Volumes of Similar Figures . . . . .	598
11.6 Circles & Proportions . . . . .	605
<b>Geometry around Us</b> —Art . . . . .	612
11.7 The Golden Ratio . . . . .	613
<b>Chapter 11 Review</b> . . . . .	620
<b>Chapter 12: Introduction to Trigonometry</b>	<b>624</b>
12.1 Trigonometric Ratios . . . . .	626
12.2 Solving Right Triangles . . . . .	632
<b>Geometry around Us</b> —Space Exploration . . . . .	639
12.3 Area . . . . .	640
12.4 Vectors . . . . .	646
<b>Technology Corner</b> —Discovering Trigonometric Identities . . . . .	653
12.5 Trigonometric Identities . . . . .	654
12.6 Law of Cosines & Law of Sines . . . . .	659
<b>Geometry in History</b> —Computer Graphics (Part 3) . . . . .	665
<b>Chapter 12 Review</b> . . . . .	666
<b>Selected Answers</b>	<b>670</b>
<b>Glossary</b>	<b>719</b>
<b>Index</b>	<b>728</b>
<b>Photo Credits</b>	<b>735</b>
<b>Postulates &amp; Theorems</b>	<b>740</b>
<b>Constructions</b>	<b>745</b>
<b>Quick Reference</b>	<b>746</b>
<b>Symbols</b>	<b>748</b>

## FEATURES

### Mind over Math

Hinged Dissection . . . . .	43
Puzzling Logic . . . . .	88
Rusty Compass Construction . . . . .	140
Counting Triangles. . . . .	192
Matchstick Puzzle . . . . .	241
Cross Section of a Cube. . . . .	294
Rearranged Domino. . . . .	333
Perimeter & Area with Arcs . . . . .	421
Truncated Platonic Solids . . . . .	449
A Transformational Proof of the Pythagorean Theorem . . . . .	517
Verifying the Construction of a Square Root . . . . .	596
Basketball Tetrahedron . . . . .	638

### Technology Corner

Dynamic Geometry Software . . . . .	34
Angle Conjectures . . . . .	100
Exploring Midpoints & Slopes. . . . .	141
Exploring AAA & SSA . . . . .	193
Triangle Relationships . . . . .	242
Exploring Quadrilaterals . . . . .	280
Center of Gravity . . . . .	334
Constructing Common Tangents. . . . .	392
Platonic Solids . . . . .	441
Drawing Tessellations. . . . .	557
Investigating Parallel Partitions. . . . .	588
Discovering Trigonometric Identities . . . . .	653

### Geometry in History

Not Your Usual Math Club (Part 1) . . . . .	20
Not Your Usual Math Club (Part 2) . . . . .	81
Not Your Usual Math Club (Part 3) . . . . .	134
A Revolutionary Museum (Part 1) . . . . .	210
A Revolutionary Museum (Part 2) . . . . .	249
A Revolutionary Museum (Part 3) . . . . .	312
Another Purpose (Part 1). . . . .	354
Another Purpose (Part 2). . . . .	415
Another Purpose (Part 3). . . . .	480
Computer Graphics (Part 1) . . . . .	550
Computer Graphics (Part 2) . . . . .	597
Computer Graphics (Part 3) . . . . .	665

### Geometry around Us

DNA: Life's Blueprint. . . . .	50
Parallel Processing. . . . .	68
Designers & Patterns . . . . .	149
Architects & Buildings. . . . .	178
Carpentry . . . . .	265
Sports. . . . .	302
Home Ownership . . . . .	361
Transportation . . . . .	408
Engineering . . . . .	466
Video Games . . . . .	518
Art . . . . .	612
Space Exploration . . . . .	639

### STEM Activity

Do Parallel Lines Exist? . . . . .	223
Fragile, Pack It Right! . . . . .	499