

TABLE OF CONTENTS

Why Use This Book	ii
Teaching Suggestions	vi
About the Author.....	vi
Student Introduction	vii
Dedication.....	viii
Chapter 1 Fundamentals of Geometry Reasoning.....	Pages 1-7
Geometry Notation.....	1-2
Geometry Notation Practice.....	3
All About Lines	4
All About Planes.....	5
Build It!.....	6
Three Planes in Space	7
Chapter 2 Uncovering All the Angles	Pages 8-20
Types of Angles	8
Angles Activity.....	9
Triangle Activity.....	10
Triangle Practice	11
Quadrilateral Activity	12
Complementary and Supplementary Angles	13-14
Vertical Angles	15
Angles Puzzle 1	16
Angles Puzzle 2	17
Parallel Lines and Transversals I.....	18
Parallel Lines and Transversals II	19
Puzzle 3 - The 20-Angle Problem.....	20
Chapter 3 Triangle Properties	Pages 21-29
Sum of Angle Measures	21
Exterior Angle Exploration	22
Sum of Two Sides.....	23
Triangle Properties Practice.....	24
Triangle Opposite Property.....	25
Properties of Equilateral and Isosceles Triangles.....	26-27
Algebra and Geometry.....	28-29
Chapter 4 The Pythagorean Theorem	Pages 30-41
Exploration - What Is a Theorem?	30
Pythagorean Triples.....	31
Pythagorean Triples Practice.....	32
Using the Pythagorean Theorem.....	33-34
Pythagorean Theorem Applications.....	35-36
Solving Multi-Step Right Triangle Problems	37
Special Right Triangles - An Introduction.....	38-41

Free resource from www.criticalthinking.com. Commercial redistribution prohibited

TABLE OF CONTENTS (Cont.)

Chapter 5	Uncovering All Polygons	Pages 42-51
	Polygons – Investigation of Angles and Sides	42
	Polygons Angle Exploration	43-45
	Summary of Polygon Properties	46
	Diagonal Exploration	47-49
	The Handshake Problem	50-51
Chapter 6	Quadrilateral and Parallelogram Properties	Pages 52-78
	The Quadrilateral Family.....	52-54
	Venn Diagram Activity	55
	Parallelogram Discovery	56-57
	Parallelogram Properties.....	58-59
	Working With Parallelograms.....	60-63
	Experimenting With Parallelograms	64-66
	A Look at Trapezoids.....	67-72
	Kite! Kite! Kite!.....	73
	Critical Thinking About Quadrilaterals	74
	Midsegment Investigation	75
	Using Algebra to Solve Quadrilateral Problems	76-77
	Quadrilateral Matching	78
Chapter 7	Metric Geometry	Pages 79-96
	Perimeter and Circumference	79
	Pi (π) Investigation	80
	Perimeter and Circumference Activity	81
	Archimedes’ Idea for Approximating Pi	82-83
	Area of Parallelograms.....	84-85
	Parallelogram Area Activity	86
	Area of Triangles and Trapezoids	87-89
	Discovering the Area of a Trapezoid	90
	Area of a Trapezoid.....	91-92
	Area of Circles.....	93-95
	The Arbelos Problem.....	96
Chapter 8	Geometric Constructions	Pages 97-119
	A Geometric Construction	97
	How to Bisect an Angle	98-99
	How to Copy an Angle.....	100
	How to Construct a Perpendicular Bisector to a Line.....	101-103
	Finding the Median in a Triangle	104-105
	How To Construct a Line Parallel To Another Line	106
	Geometric Construction Review.....	107
	Problem-Solving With Geometric Constructions	108-117
	Problem-Solving With Impossible Constructions	118-119

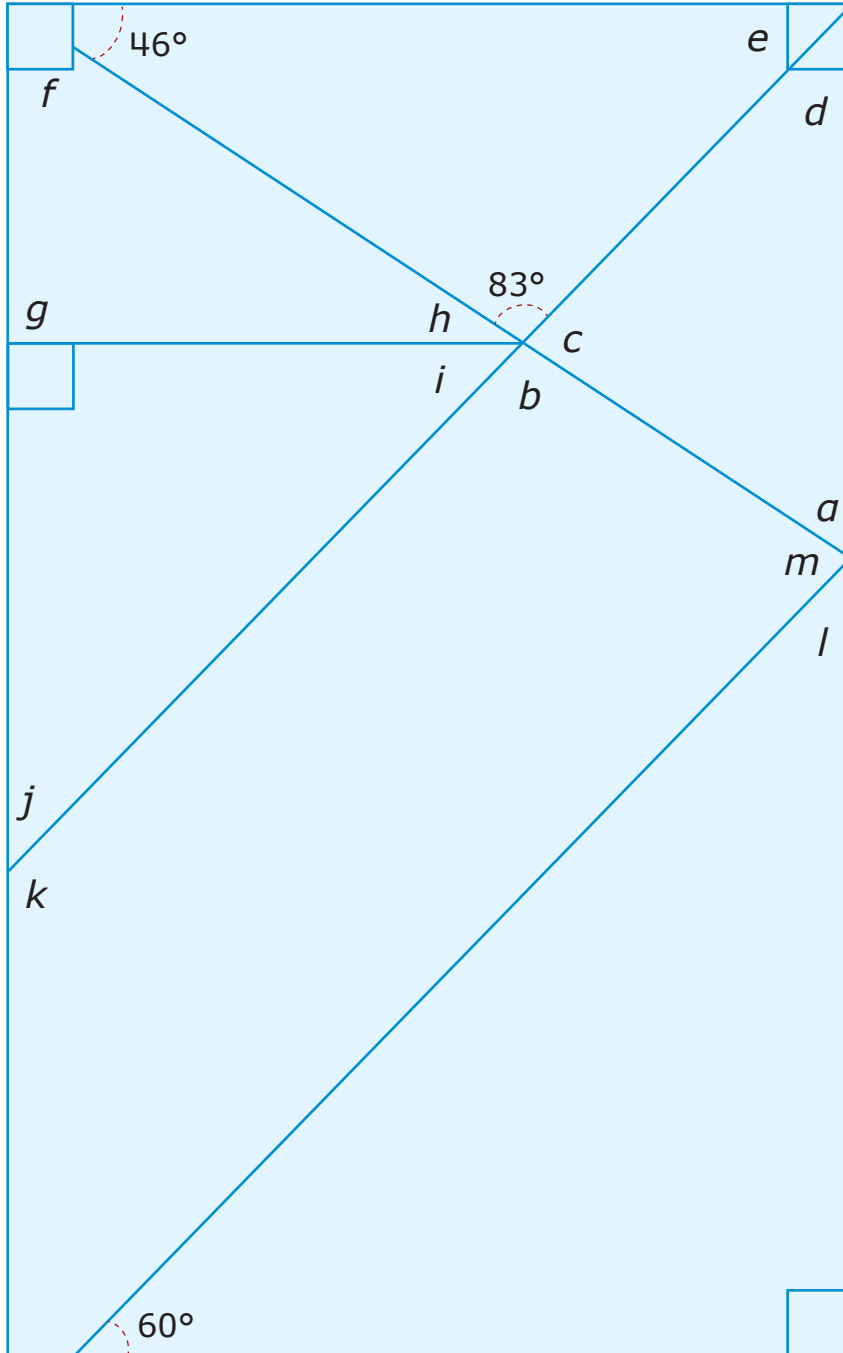
Free resource from www.criticalthinking.com. Commercial redistribution prohibited

Chapter 9	The Geometry of Three Dimensional Shapes	Pages 120-134
	3D Shapes - Prisms	120-122
	The Volume of Cylinders	123-124
	Volumes of Pyramids and Cones	125-126
	Turn Up the Volume!	127-128
	Volume of a Sphere.....	129-130
	Surface Area of Prisms	131
	Surface Area of a Cylinder Activity	132
	Finding Surface Area.....	133
	Euler’s Formula.....	134
Chapter 10	Symmetry and Transformations	Pages 135-167
	What is Vertical, Horizontal, and Point Symmetry?.....	135-137
	Transformations - Reflections	138-143
	Transformations - Translations.....	144-147
	Transformations - Rotations.....	148-153
	Transformations - Dilations	154-157
	Glide Reflections and Compositions	158-164
	Tessellations.....	165-167
Chapter 11	Proving Triangles Congruent	Pages 168-190
	Introduction to Proofs - Congruency	168-169
	SSS Activity.....	170
	SAS Activity.....	171
	ASA and AAS Activities	172
	SSA Activity.....	173
	The Essence of a Good Geometric Proof	174-176
	Picture, Statement, and Reason	177-178
	Finding Congruent Triangles.....	179
	Two Column Proofs.....	180-183
	Investigate Hypotenuse - Leg Theorem.....	183-184
	Similar Figures and Introduction to Similarity Proofs	185-187
	Proving Triangles Similar	188-189
	Test Your Reasoning Skills.....	190
Chapter 12	Coordinate Geometry	Pages 191-222
	What is the Slope of a Line	191
	Slope Formula.....	192-196
	How to Write an Equation of a Line.....	197-201
	The Midpoint Formula	202-205
	The Distance Formula.....	206-210
	Review Your Formulas	211-212
	Introduction to Coordinate Proofs	213-222
Glossary	Pages 223-228
Answers	Pages 229-263

Free resource from www.criticalthinking.com. Commercial redistribution prohibited

Angles Puzzle 1

Use your *thinking skills* to find the missing angles and record in degrees below. Figures are **not** to scale, so do not measure.



a _____ *b* _____ *c* _____ *d* _____ *e* _____ *f* _____ *g* _____

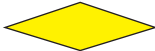
h _____ *i* _____ *j* _____ *k* _____ *l* _____ *m* _____

Free resource from www.criticalthinking.com. Commercial redistribution prohibited

Quadrilateral Matching


Match the quadrilateral with its properties. You may use an answer more than once.

1 Rectangle 

2 Rhombus 

3 Parallelogram 

4 Kite 

5 Trapezoid 

6 Isosceles Trapezoid 

7 Square 

- a Diagonals are congruent.
- b Opposite sides are congruent.
- c Opposite angles are congruent.
- d Consecutive angles are supplementary.
- e Diagonals are perpendicular.
- f All sides are congruent.
- g All angles are congruent.
- h Sum of the angle measures equals 360° .

Chapter 8 - Geometric Constructions

A Geometric Construction

A **geometric construction** is a construction done with only a compass and a straightedge. Of course, a good pencil is important. In a classic geometric construction, you are **not** allowed to measure or erase. If you make a mistake, it's best you start over.

Before we problem solve and do some *fun thinking* problems with constructions, it is a good idea to review how to do these constructions.

- Bisecting an angle.
- Copying an angle.
- Constructing a perpendicular bisector to a line.
- Constructing a perpendicular bisector to a line from a point on the not on the line.
- Constructing a line parallel to another line through a given point.
- Constructing some popular polygons.

Note

My constructions are actual drawings since they were done on the computer, but if you follow the directions for each of these, you will make *perfect* constructions.

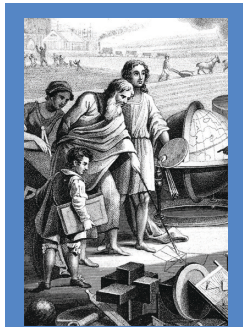


Geometric constructions are used by engineers and designers. They will help you see the beauty of geometry.

For fun, create your own design with a compass and a straightedge. Try to fill up a page of paper with your own design.

Problem-Solving With Geometric Constructions (Cont.)

Plato (428-347 BC), a famous Greek philosopher and mathematician, discovered that many constructions can be made with only a compass and no straightedge. Those constructions are now called Mascheroni constructions in honor of Italian mathematician Lorenzo Mascheroni (1750-1800) who wrote a book called *The Geometry of Compasses*.



Ancient Greek philosopher drawing his theorem in the sand.

- 7 Using *only* a compass, given segment \overline{AB} , construct segments that are 2, 3, and 4 times bigger than \overline{AB} .



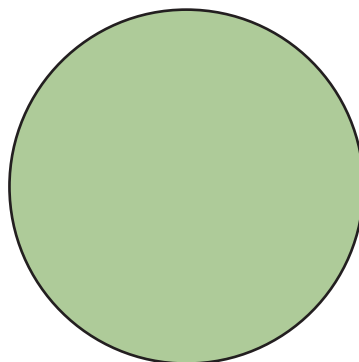
Remember

You **cannot** use a straightedge so you can only show the points that mark such distances.

- 8 I lost the center of *My Circle* construction below. If you draw a circle and forget where the center is, draw two non-parallel chords. Construct the perpendicular bisectors of each chord and where the perpendicular bisectors meet is your missing center. Try it!

Hint

Once you find the center, make two triangles. Use the center as one point, and the points where the chord and the circle intersect to help you see what is happening.



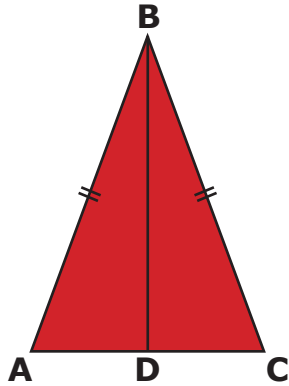
Why does this work? Explain your thinking. _____

Free resource from www.criticalthinking.com. Commercial redistribution prohibited

Picture, Statement, and Reason

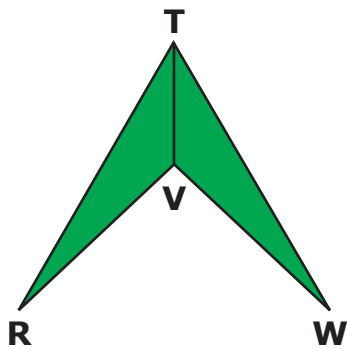
Refer to the picture and write a reason for each statement.

1



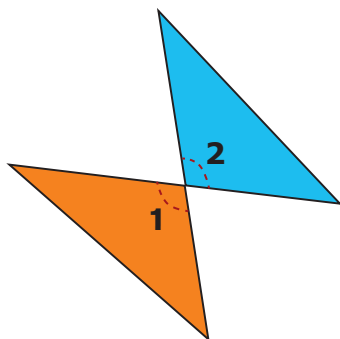
Statement	Reason
<p>a $\overline{AB} \cong \overline{CB}$</p>	<p>a Given (The fact is stated in the picture or in the information.)</p>
<p>b $\angle A \cong \angle C$</p>	<p>b _____</p> <p>_____</p> <p>_____</p>

2



<p>a $\overline{TV} \cong \overline{TV}$</p>	<p>a _____</p> <p>_____</p> <p>_____</p>
---	--

3



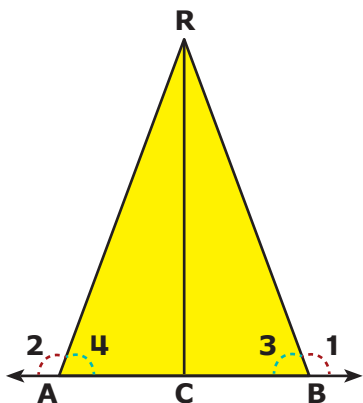
<p>a $\angle 1 \cong \angle 2$</p>	<p>a _____</p> <p>_____</p> <p>_____</p>
---	--

Free resource from www.criticalthinking.com. Commercial redistribution prohibited

Two Column Proofs (Cont.)

Refer to the picture and fill in the missing reasons or statements for each proof.

Proof 3

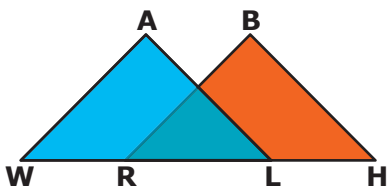


Given: $\overline{RC} \perp \overline{AB}$ and $\overline{AC} \cong \overline{BC}$

Prove: $\angle 1 \cong \angle 2$

Statement	Reason
1 _____	1 Given
2 _____	2 Given
3 $\angle ACR$ and $\angle BCR$ are right angles.	3 _____
4 _____	4 All right angles are congruent
5 $\overline{RC} \cong \overline{RC}$	5 _____
6 $\triangle ACR \cong \triangle BCR$	6 _____
7 $\angle 3 \cong \angle 4$	7 _____
8 $\angle 1 \cong \angle 2$	8 _____

Proof 4



Given: $\overline{WR} \cong \overline{HL}$,
 $\angle W \cong \angle H$,
 $\angle ALW \cong \angle BRH$

Prove: $\triangle AWL \cong \triangle BHR$
 and $\angle A \cong \angle B$

1 _____	1 Given
2 _____	2 Given
3 _____	3 Given
4 $\overline{RL} \cong \overline{RL}$	4 _____
5 $\overline{WL} \cong \overline{HR}$	5 _____
6 $\triangle AWL \cong \triangle BHR$	6 _____
7 $\angle A \cong \angle B$	7 _____