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Contents at a Glance

INTRODUCTION 1

PART 1: THE QUESTIONS 3

CHAPTER 1: Diving into Geometry 5
CHAPTER 2: Constructions 13
CHAPTER 3: Geometric Proofs with Triangles 17
CHAPTER 4: Classifying Triangles 31
CHAPTER 5: Investigating the Centers of a Triangle 41
CHAPTER 6: Similar Triangles 49
CHAPTER 7: The Right Triangle 59
CHAPTER 8: Triangle Inequalities 67
CHAPTER 9: Polygons 75
CHAPTER 10: Properties of Parallel Lines 81
CHAPTER 11: Properties of Quadrilaterals 89
CHAPTER 12: Coordinate Geometry 97
CHAPTER 13: Transformational Geometry 105
CHAPTER 14: Exploring Circles 121
CHAPTER 15: Circle Theorems 127
CHAPTER 16: Three-Dimensional Geometry 141
CHAPTER 17: Locus Problems 149

PART 2: THE ANSWERS 155

CHAPTER 18: Answers and Explanations 157

INDEX 439

Table of Contents

INTRODUCTION 1
What You'll Find 1
Beyond the Book 1
Where to Go for Additional Help 2

PART 1: THE QUESTIONS 3

CHAPTER 1: Diving into Geometry 5
The Problems You'll Work On 5
What to Watch Out For 5
Understanding Basic Geometric Definitions 6
Applying Algebra to Basic Geometric Definitions 7
Recognizing Geometric Terms 8
Properties and Postulates 8
Adjacent Angles, Vertical Angles, and Angles That Form Linear Pairs 10
Complementary and Supplementary Angles 10
Angles in a Triangle 11

CHAPTER 2: Constructions 13
The Problems You'll Work On 13
What to Watch Out For 13
Creating Congruent Constructions 14
Constructions Involving Angles and Segments 14
Parallel and Perpendicular Lines 15
Creative Constructions 16

CHAPTER 3: Geometric Proofs with Triangles 17
The Problems You'll Work On 17
What to Watch Out For 17
Triangle Congruence Theorems 18
Completing Geometric Proofs Using Triangle Congruence Theorems 21
Overlapping Triangle Proofs 24
Indirect Proofs 28

CHAPTER 4: Classifying Triangles 31
The Problems You'll Work On 31
What to Watch Out For 31
Classifying Triangles by Their Sides 32
Properties of Isosceles, Equilateral, and Right Triangles 33
Classifying Triangles by Their Angles 34
Understanding the Classification of Triangles 35
Geometric Proofs Involving Isosceles Triangles 36

CHAPTER 5: Investigating the Centers of a Triangle 41
The Problems You'll Work On 41
What to Watch Out For 41
The Incenter of a Triangle 42
Understanding the Orthocenter 42
Understanding Centroids 43
Finding the Centroid of a Triangle 44
The Circumcenter of a Triangle 45
Recognizing Triangle Centers 45
Constructing the Centers of a Triangle 47
The Euler Line 48

CHAPTER 6: Similar Triangles 49
The Problems You'll Work On 49
What to Watch Out For 49
Understanding Similar Triangles 50
Midsegments 50
Creating Similar Triangles 51
Similar-Triangle Word Problems 52
Proving That Two Triangles Are Similar to Each Other 53
Proving That Corresponding Sides Are in Proportion 54
Proving with the Means and Extremes 55

CHAPTER 7: The Right Triangle 59
The Problems You'll Work On 59
What to Watch Out For 59
Pythagorean Theorem 60
Right Triangle Proportions 60
Word Problems Involving Right-Triangle Proportions 62
Working with Special Right Triangles 63
Application of Special Right Triangles 63
Trigonometric Ratios 65
Applying the Trigonometric Ratios to Word Problems 66

CHAPTER 8: Triangle Inequalities 67
The Problems You'll Work On 67
What to Watch Out For 67
Relationships between the Sides and Angles of a Triangle 68
Triangle Inequality Theorem 69
Finding the Missing Side Length 69
Isosceles Triangles 70
Using the Exterior Angle Theorem of a Triangle 70
Geometric Proofs Involving Triangle Inequality Theorems 72

CHAPTER 9: Polygons 75
The Problems You'll Work On 75
What to Watch Out For 75
Naming Polygons 76
Understanding Angles of a Polygon 76

The Sum of the Interior and Exterior Angles of a Polygon . . . 77
Finding the Area of Regular Polygons . . . 79

CHAPTER 10: Properties of Parallel Lines . . . 81
The Problems You'll Work On . . . 81
What to Watch Out For . . . 81
Alternate Interior and Alternate Exterior Angles . . . 82
Classifying Triangles by Their Angle Measurements . . . 83
Finding Angle Measures Involving Parallel Lines . . . 83
Reviewing Corresponding, Adjacent, and Vertical Angles . . . 84
More Practice with Angles Involving Parallel Lines . . . 85
Geometric Proof Incorporating Parallel Lines . . . 86
Geometric Proof Incorporating Parallel Lines . . . 87

CHAPTER 11: Properties of Quadrilaterals . . . 89
The Problems You'll Work On . . . 89
What to Watch Out For . . . 89
Properties of Parallelograms . . . 90
Word Problems with Parallelograms . . . 91
Properties of Rectangles . . . 91
Finding the Diagonal of a Rectangle . . . 92
Reviewing the Properties of a Rhombus . . . 93
Diagonal Properties of a Rhombus . . . 93
Properties of a Square . . . 94
Properties of a Trapezoid . . . 96

CHAPTER 12: Coordinate Geometry . . . 97
The Problems You'll Work On . . . 97
What to Watch Out For . . . 97
Determining Distance . . . 98
Using the Midpoint Formula . . . 98
Using the Slope Formula . . . 99
Parallel and Perpendicular Lines . . . 100
Writing the Equation of a Line in Slope-Intercept Form . . . 101
Coordinate Geometry Proofs . . . 102

CHAPTER 13: Transformational Geometry . . . 105
The Problems You'll Work On . . . 105
What to Watch Out For . . . 105
Rigid Motion . . . 106
Reflecting Points over the x- and y-axes . . . 109
Writing Equations for Lines of Reflection . . . 110
Understanding Point Symmetry . . . 110
Triangle Translations . . . 111
Translating Points . . . 112
Finding Translation Rules . . . 113
Doing Dilations . . . 113
Practicing with Rotations . . . 114
Understanding the Rules for Rotations . . . 115
Rigid Motion of Triangles . . . 115
Compositions of Transformations . . . 116

Glide Reflections and Direct and Indirect Isometries . . . 117
Transformations of a Segment . . . 118
Trying Rigid Motion Constructions . . . 118

CHAPTER 14: Exploring Circles . . . 121
The Problems You'll Work On . . . 121
What to Watch Out For . . . 121
Working with the Circumference of a Circle . . . 122
Understanding the Area of a Circle . . . 122
Working with Sectors . . . 123
Arc Length . . . 124
The Equation of a Circle in Standard Form . . . 124

CHAPTER 15: Circle Theorems . . . 127
The Problems You'll Work On . . . 127
What to Watch Out For . . . 127
Central Angles and Arcs . . . 128
Inscribed Angles and Arcs . . . 128
Angles Formed by Intersecting Chords of a Circle . . . 129
Angles Formed by Secants and Tangents . . . 131
The Intersecting Chord Theorem . . . 132
Lengths of Tangents and Secants . . . 135
Tangent and Radius . . . 137
"BIG" Circle Problems . . . 137
Circle Proofs . . . 138

CHAPTER 16: Three-Dimensional Geometry . . . 141
The Problems You'll Work On . . . 141
What to Watch Out For . . . 141
Understanding Points, Lines, and Planes . . . 142
Surface Area of Solid Figures . . . 143
Calculating the Volume of Solid Figures . . . 145
Rotations of Two-Dimensional Figures . . . 146

CHAPTER 17: Locus Problems . . . 149
The Problems You'll Work On . . . 149
What to Watch Out For . . . 149
Basic Locus Theorems . . . 150
Loci Using Coordinate Geometry . . . 150
The Locus of Points Equidistant from One or Two Lines . . . 151
The Locus of Points Equidistant from Two Points . . . 151
Writing the Equation of a Circle . . . 152
Compound Locus in Coordinate Geometry . . . 152
Compound and Challenging Locus Problems . . . 153

PART 2: THE ANSWERS . . . 155

CHAPTER 18: Answers and Explanations . . . 157

INDEX . . . 439

Introduction

This book is intended for anyone who needs to brush up on geometry. You may use this book as a supplement to material you're learning in an undergraduate geometry course. The book provides a basic level of geometric knowledge. As soon as you understand these concepts, you can move on to more complex geometry problems.

What You'll Find

The 1,001 geometry problems are grouped into 17 chapters. You'll find calculation questions, construction questions, and geometric proofs, all with detailed answer explanations. If you miss a question, take a close look at the answer explanation. Understanding where you went wrong will help you learn the concepts.

Beyond the Book

In addition to what you're reading right now, this book comes with a free, access-anywhere Cheat Sheet that includes tips and other goodies you may want to have at your fingertips. To get this Cheat Sheet, simply go to `www.dummies.com` and type **Geometry 1001 Dummies Cheat Sheet** into the Search box.

The online practice that comes free with this book offers 500 geometry questions and answers presented in a multiple-choice format. The beauty of the online problems is that you can customize your online practice to focus on the topic areas that give you trouble. If you're short on time and want to maximize your study, you can specify the quantity of problems you want to practice, pick your topics, and go. You can practice a few hundred problems in one sitting or just a couple dozen, and whether you can focus on a few types of problems or a mix of several types. Regardless of the combination you create, the online program keeps track of the questions you get right and wrong so you can monitor your progress and spend time studying exactly what you need.

To gain access to the online practice, you simply have to register. Just follow these steps:

1. **Register your book or ebook at Dummies.com to get your PIN. Go to** `www.dummies.com/go/getaccess`.
2. **Select your product from the dropdown list on that page.**
3. **Follow the prompts to validate your product, and then check your email for a confirmation message that includes your PIN and instructions for logging in.**

If you don't receive this email within two hours, please check your spam folder before contacting us through our Technical Support website at http://support.wiley.com or by phone at 877-762-2974.

Now you're ready to go! You can come back to the practice material as often as you want — simply log in with the username and password you created during your initial login. No need to enter the access code a second time.

Your registration is good for one year from the day you activate your PIN.

Where to Go for Additional Help

This book covers a great deal of geometry material. Because there are so many topics, you may struggle in some areas. If you get stuck, consider getting some additional help.

In addition to getting help from your friends, teachers, or coworkers, you can find a variety of great materials online. If you have Internet access, a simple search often turns up a treasure trove of information. You can also head to www.dummies.com to see the many articles and books that can help you in your studies.

1,001 Geometry Questions For Dummies gives you just that — 1,001 practice questions and answers to improve your understanding and application of geometry concepts. If you need more in-depth study and direction for your geometry courses, you may want to try out the following *For Dummies* products:

- ***Geometry For Dummies,* by Mark Ryan:** This book provides an introduction into the most important geometry concepts. You'll learn all the principles and formulas you need to analyze two- and three-dimensional shapes. You'll also learn the skills and strategies needed to write a geometric proof.
- ***Geometry Workbook For Dummies,* by Mark Ryan:** This workbook guides you through geometric proofs using a step-by-step process. It also provides tips, shortcuts, and mnemonic devices to help you commit some important geometry concepts to memory.

1 The Questions

IN THIS PART . . .

The best way to become proficient in geometry is through a lot of practice. Fortunately, you now have 1,001 practice opportunities right in front of you. These questions cover a variety of geometric concepts and range in difficulty from easy to hard. Master these problems, and you'll be well on your way to a solid foundation in geometry.

Here are the types of problems that you can expect to see:

- Geometric definitions (Chapter 1)
- Constructions (Chapter 2)
- Geometric proofs with triangles (Chapter 3)
- Classifying triangles (Chapter 4)
- Centers of a triangle (Chapter 5)
- Similar triangles (Chapter 6)
- The Pythagorean theorem and trigonometric ratios (Chapter 7)
- Triangle inequality theorems (Chapter 8)
- Polygons (Chapter 9)
- Parallel lines cut by a transversal (Chapter 10)
- Quadrilaterals (Chapter 11)
- Coordinate geometry (Chapter 12)
- Transformations (Chapter 13)
- Circles (Chapters 14 and 15)
- Surface area and volume of solid figures (Chapter 16)
- Loci (Chapter 17)

Chapter 1

Diving into Geometry

Geometry requires you to know and understand many definitions, properties, and postulates. If you don't understand these important concepts, geometry will seem extremely difficult. This chapter provides practice with the most important geometric properties, postulates, and definitions you need in order to get started.

The Problems You'll Work On

In this chapter, you see a variety of geometry problems. Here's what they cover:

- Understanding midpoint, segment bisectors, angle bisectors, median, and altitude
- Working with the properties of perpendicular lines, right angles, vertical angles, adjacent angles, and angles that form linear pairs
- Noting the differences between complementary and supplementary angles
- Using the addition and subtraction postulates
- Understanding the reflexive, transitive, and substitution properties

What to Watch Out For

The following tips may help you avoid common mistakes:

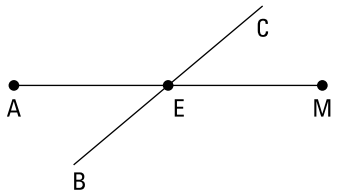
- Be on the lookout for when something is being done to a segment or an angle. Bisecting a segment creates two congruent segments, whereas bisecting an angle creates two congruent angles.
- The transitive property and the substitution property look extremely similar in proofs, making them very confusing. Check whether you're just switching the congruent segments/angles or whether you're getting a third set of congruent segments/angles after already being given two pairs of congruent segments/angles.
- Make sure you understand what the question is asking you to solve for. Sometimes a question asks only for a particular variable, so as soon as you find the variable, you're done. However, sometimes a question asks for the measure of the segment or angle; after you find the value of the variable, you have to plug it in to find the measure of the segment or angle.

Understanding Basic Geometric Definitions

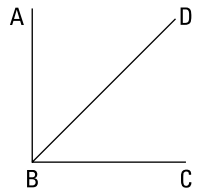
1–3 *Fill in the blank to create an appropriate conclusion to the given statement.*

1. If M is the midpoint of $\overline{AB}$, then $\overline{AM} \cong$ ___.

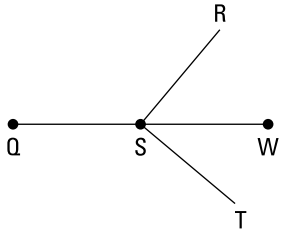
2. If $\overline{BC}$ bisects $\overline{AM}$ at E, then $\overline{AE} \cong$ ___.



3. If $\overline{AB} \perp \overline{BC}$, then _____ is a right angle.



4–9 *In the following figure, $\overline{QW}$ bisects $\angle RST$ and $\overline{RS} \perp \overline{TS}$. Determine whether each statement is true or false.*



4. $\angle RST$ is a right angle.

5. $\angle RSQ \cong \angle RSW$.

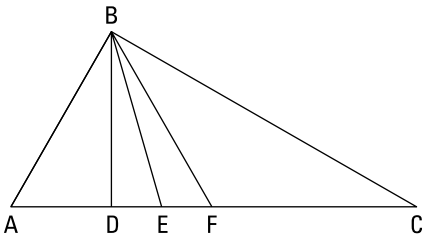
6. $\angle QSR$ and $\angle WSR$ form a linear pair.

7. $\angle WST \cong \angle WSR$.

8. $\angle RSQ$ is an obtuse angle.

9. If Point S is the midpoint of $\overline{QW}$, then it's always true that $\overline{RS} \cong \overline{TS}$.

10–14 *Use the following figure and the given information to draw a valid conclusion.*



10. $\overline{BF}$ is the median of $\triangle ABC$.

11. $\overline{BD}$ is the altitude of $\triangle ABC$.

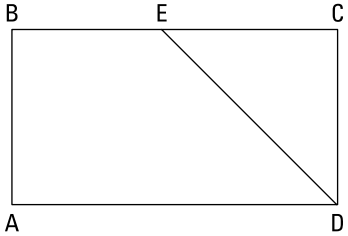
12. $\overline{BE}$ bisects $\angle ABC$.

13. F is the midpoint of $\overline{AC}$.

14. F is the midpoint of $\overline{AC}$. What type of angle does $\angle BFC$ have to be in order for $\overline{BF}$ to be called a perpendicular bisector?

Applying Algebra to Basic Geometric Definitions

15–18 *Use the figure and the given information to answer each question.*



15. E is the midpoint of $\overline{BC}$. If $BE = 50$ and $CE = 2x + 25$, find the value of x.

16. $\overline{ED}$ bisects $\angle ADC$. If $m\angle ADE$ is represented by $3x - 5$ and $m\angle CDE$ is represented by $x + 25$, find $m\angle ADC$.

17. If $\overline{BA} \perp \overline{DA}$ and $m\angle BAD$ is represented by $5x - 20$, find the value of x.

18. $\overline{DE}$ bisects $\overline{BC}$. If $BC = 5x - 3$ and $CE = x + 12$, find the length of $\overline{BE}$.

Recognizing Geometric Terms

19–26 Write the geometric term that fits the definition.

19. Two adjacent angles whose sum is a straight angle: _____

20. Two lines that intersect to form right angles: _____

21. An angle whose measure is between 0° and 90°: _____

22. A type of triangle that has two sides congruent and the angles opposite them also congruent: _____

23. Divides a line segment or an angle into two congruent parts: _____

24. An angle greater than 90° but less than 180°: _____

25. A line segment connecting the vertex of a triangle to the midpoint of the opposite side: _____

26. The height of a triangle: _____

Properties and Postulates

27–34 Refer to segment $\overline{DREW}$ to fill in the blank.

27. $\overline{DR} + \overline{RE} =$ ___

28. $\overline{DR} + \overline{RW} =$ ___

29. $\overline{DW} - \overline{EW} =$ ___

30. $\overline{DE} - \overline{RE} =$ ___

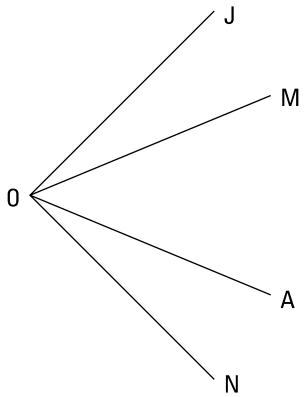
31. The _____ would be the reason used to prove that $\overline{RE} \cong \overline{RE}$.

32. If $\overline{DR} \cong \overline{WE}$, then $\overline{DR} + \overline{RE} \cong \overline{WE} +$ ___.

33. If $\overline{DE} \cong \overline{RW}$, then $\overline{RW} - \overline{RE} \cong$ ___ $\overline{RE}$.

34. Assuming the figure is not drawn to scale, if $\overline{DR} \cong \overline{RE}$ and $\overline{EW} \cong \overline{RE}$, then you can prove that $\overline{DR} \cong \overline{EW}$. The _____ postulate can be used to draw this conclusion.

35–40 *In the given diagram,* $\angle JOM \cong \angle NOA$. *Use the basic geometric postulates to answer each question.*



35. Which property or postulate is used to show that $\angle MOA \cong \angle MOA$?

36. $\angle JOM + \angle MOA \cong \angle MOA +$ ___

37. $m\angle JON - m\angle JOA =$ ___

38. What information must be given in order for the following to be true?

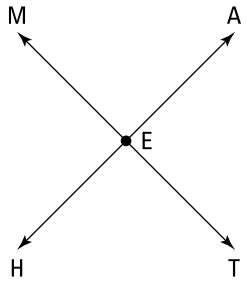
$\angle JOA - \angle MOA \cong \angle NOM - \angle MOA$

39. If $\overline{OM}$ bisects $\angle JON$, you can conclude that $2(\angle JOM) \cong$ ___.

40. If $\overline{OM}$ bisects $\angle JON$, you can conclude that $\frac{1}{2}(\angle JON) \cong$ ___.

Adjacent Angles, Vertical Angles, and Angles That Form Linear Pairs

41–47 In the following figure, $\overline{MET}$ intersects $\overline{AEH}$ at E. Fill in the blank to make the statement true.



41. $\angle AET \cong$ ___ because they're vertical angles.

42. $\angle MEA$ and $\angle HET$ are _____ angles.

43. $\angle MEH$ and $\angle TEH$ form a linear pair; therefore, the two angles add up to _____.

44. $m\angle AET$ is represented by $\frac{1}{2}x + 10$, and $m\angle MEH$ is represented by $x - 2$. $m\angle MEA =$ ___?

45. $m\angle MEA$, $m\angle AET$, and $m\angle MEH$ are represented by $2a$, $2a + b$, and $3a - 20$, respectively. $b =$ ___?

46. $\angle MEA$ and $\angle MEH$ are angles that share the same vertex and are next to each other. These are called _____ angles.

47. $\angle HET$ and $\angle TEA$ form a linear pair. If $m\angle HET$ is represented by $2x$ and $m\angle TEA$ is represented by $5x - 16$, then what does $m\angle TEA$ equal?

Complementary and Supplementary Angles

48–57 Practice understanding angle relationships by solving the problem algebraically.

48. $\angle A$ and $\angle C$ are complementary. If $m\angle A = 50^\circ$, find $m\angle C$.

49. $\angle B$ and $\angle D$ are supplementary. If $m\angle B = 120^\circ$, find $m\angle D$.

50. If two angles are complementary and congruent to each other, what is the measure of the angles?

51. Two angles are supplementary and congruent. What type of angles must they be?

52. The ratio of two angles that are supplements is 2:3. Find the larger angle.

53. If two angles are supplementary and one angle is 40° more than the other angle, find the smaller angle.

54. If two angles are complementary and one angle is twice the measure of the other, find the measure of the smaller angle.

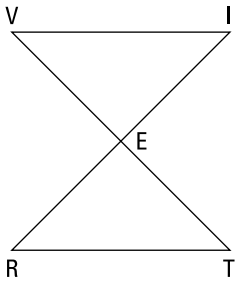
55. If two angles are complementary and one angle is 6 less than twice the measure of the other angle, find the larger angle.

56. If two angles form a linear pair, what is their sum?

57. The ratio of two angles that are complements of each other is 5:4. Find the measure of the smaller angle.

Angles in a Triangle

58–60 *Use the following figure and the given information to solve each problem.* $\overline{TV}$ *and* $\overline{RI}$ *intersect at E.*



58. If $m\angle IVE = 50^\circ$, $m\angle VIE = 70^\circ$, and $m\angle RET = 2x - 10$, find the value of *x.*

59. If $m\angle IVE = 50^\circ$ and $m\angle VIE = 70^\circ$, find the degree measure of $\angle TEI$.

60. If $m\angle VEI$ is represented by $2a + b$, $m\angle RET$ is represented by $a - b$, and $m\angle REV$ is represented by $4a + 2b$, find the value of *a.*

Chapter 2

Constructions

One of the most visual topics in geometry is constructions. In this chapter, you get to demonstrate some of the most important geometric properties and definitions using a pencil, straight edge, and compass.

The Problems You'll Work On

In this chapter, you see a variety of construction problems:

- Constructing congruent segments and angles
- Drawing segment, angle, and perpendicular bisectors
- Creating constructions involving parallel and perpendicular lines
- Constructing 30°-60°-90° and 45°-45°-90° triangles

What to Watch Out For

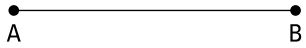
The following tips may help you avoid common mistakes:

- If you're drawing two arcs for a construction, make sure you keep the width of the compass (or radii of the circles) consistent.
- Make your arcs large enough so that they intersect.
- Sometimes you need to do more than one construction to create what the problem is asking for. This idea is extremely helpful when you need to construct special triangles.

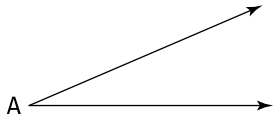
Creating Congruent Constructions

61–65 Use your knowledge of constructions (as well as a compass and straight edge) to create congruent segments, angles, or triangles.

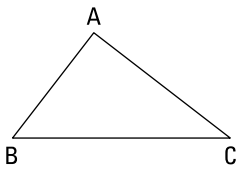
61. Construct $\overline{CD}$, a line segment congruent to $\overline{AB}$.



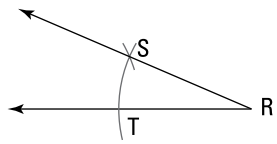
62. Construct $\angle D$, an angle congruent to $\angle A$.



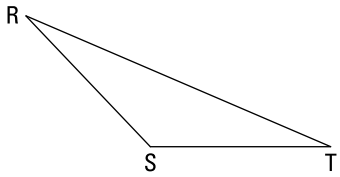
63. Construct $\triangle DEF$, a triangle congruent to $\triangle BCA$.



64. Is the following construction an angle bisector or a copy of an angle?



65. Construct $\triangle ABC$, a triangle congruent to $\triangle STR$.

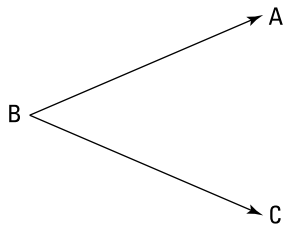


Constructions Involving Angles and Segments

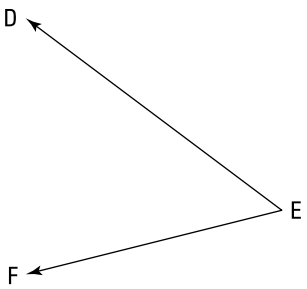
66–70 Apply your knowledge of constructions to angles and segments.

66. Construct segment $\overline{CD}$, whose measure is twice the measure of $\overline{AB}$.

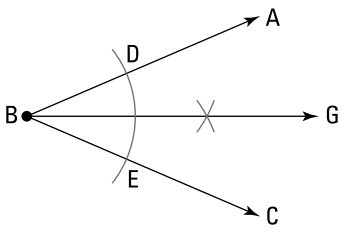
67. Given $\angle B$, construct $\overline{BG}$, the bisector of $\angle B$.



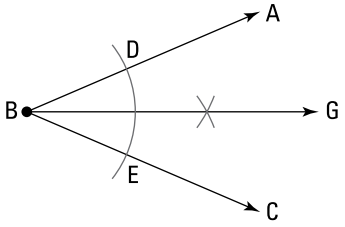
68. Construct the angle bisector of $\angle DEF$.



69. What type of construction is represented by the following figure?



70. True or False? The construction in the following diagram proves that $\angle ABG \cong \angle GBC$.

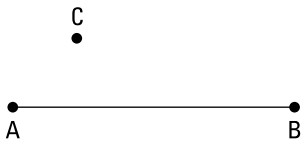


Parallel and Perpendicular Lines

71–77 Apply your knowledge of constructions to problems involving parallel and perpendicular lines.

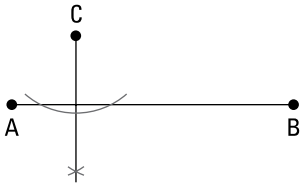
71. Place Point E anywhere on $\overline{AB}$. Construct $\overline{DE}$ perpendicular to $\overline{AB}$ through Point E.

72. Use the following diagram to construct a line perpendicular to $\overline{AB}$ through Point C.

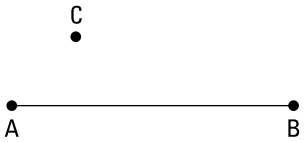


73. Construct the perpendicular bisector of $\overline{AB}$.

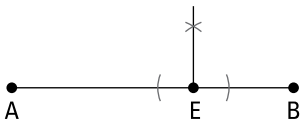
74. Which construction is represented in the following figure?



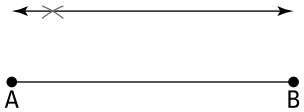
75. Construct a line parallel to $\overline{AB}$ that passes through Point C.



76. True or False? The construction in the following diagram proves that $\overline{AE} \cong \overline{EB}$.



77. True or False? The following diagram is the correct illustration of the construction of a line parallel to $\overline{AB}$.

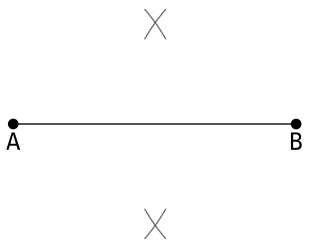


Creative Constructions

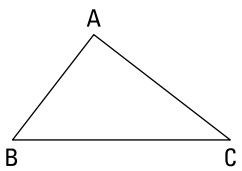
78–85 Apply your knowledge of constructions to some more creative problems.

78. Construct a 30° angle.

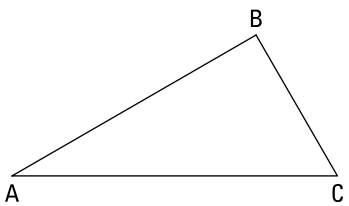
79. True or False? The following diagram shows the first step in constructing a 45° angle.



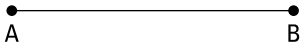
80. Construct an altitude from vertex A to side $\overline{BC}$ in $\triangle ABC$.



81. Construct the median to $\overline{AB}$ in $\triangle ABC$.



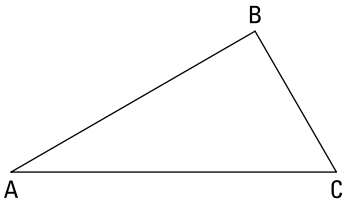
82. Construct an equilateral triangle whose side length is $\overline{AB}$.



83. Construct a 45° angle.

84. Construct a $30^\circ = 60^\circ = 90^\circ$ triangle.

85. Construct the median to $\overline{BC}$ in $\triangle ABC$.



Chapter 3

Geometric Proofs with Triangles

In geometry, you're frequently asked to prove something. In this chapter, you're given specific information and asked to prove specific information about triangles. You do this by using various geometric properties, postulates, and definitions to generate new statements that will lead you toward the information you're looking to prove true.

The Problems You'll Work On

In this chapter, you see a variety of problems involving geometric proofs:

- Using SAS, SSS, ASA, and AAS to prove triangles congruent
- Showing that corresponding parts of congruent triangles are congruent
- Formulating a geometric proof with overlapping triangles
- Using your knowledge of quadrilaterals to complete a geometric proof
- Completing indirect proofs

What to Watch Out For

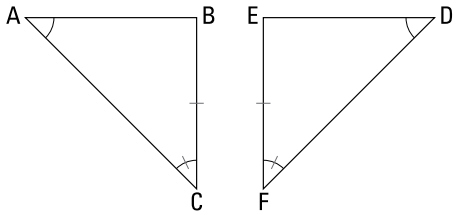
Remember the following tips as you work through this chapter:

- The statement that needs to be proven has to be the last statement of the proof. It can't be used as a given statement.
- You must use all given information to formulate the proof. Each given should be used separately to draw its own conclusion.
- If you've used all your given information and still require more to prove the triangles congruent, look for the reflexive property or a pair of vertical angles.
- After you find angles or segments congruent, mark them in your diagram. The markings make it easier for you to see what other information you need to complete the proof.
- To prove parts of a triangle congruent, you'll first need to prove that the triangles are congruent to each other using the proper triangle congruence theorems.

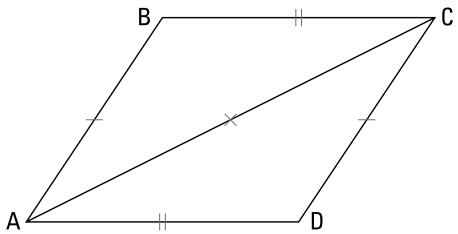
Triangle Congruence Theorems

86–102 *Use your knowledge of SAS, ASA, SSS, and AAS to solve the problem.*

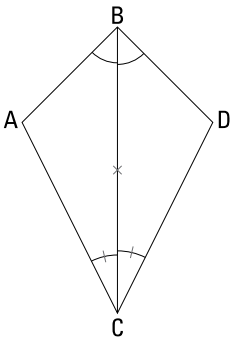
86. What method can you use to prove these two triangles congruent?



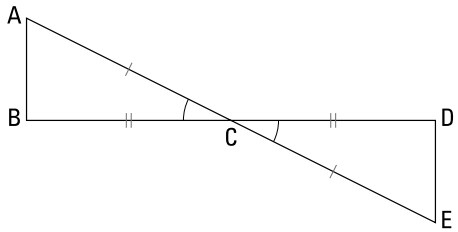
87. What method can you use to prove these two triangles congruent?



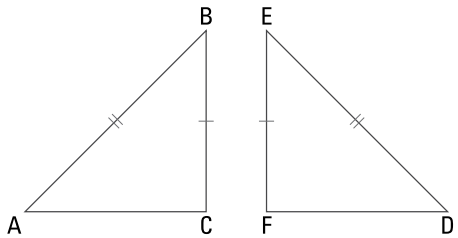
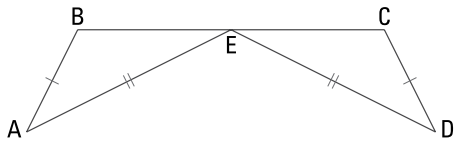
88. What method can you use to prove these two triangles congruent?



89. What method can you use to prove $\triangle ABC \cong \triangle EDC$?



90. Which pair of segments or angles would need to be proved congruent in order to prove these triangles congruent using the SSS method?



91. Which pair of segments or angles would need to be proved congruent in order to prove these triangles congruent using the SAS method?