CHAPTER 4

Vocabulary

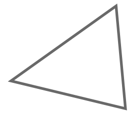
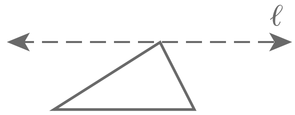
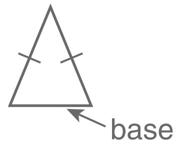
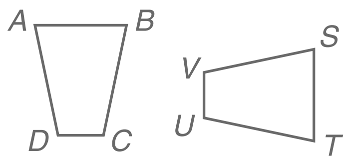
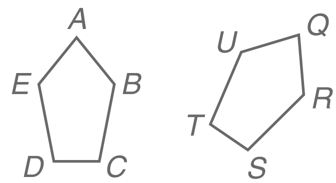
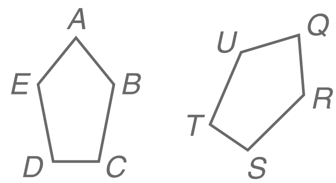
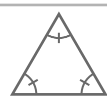
The table contains important vocabulary terms from Chapter 4. As you work through the chapter, fill in the page number, definition, and a clarifying example.

Term	Page	Definition	Clarifying Example
acute triangle			
auxiliary line			
base of an isosceles triangle			
congruent polygons			
corresponding angles of polygons			
corresponding sides of polygons			
equiangular triangle			

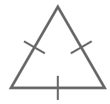
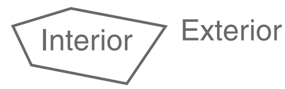
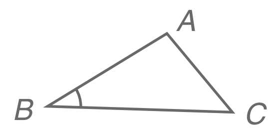
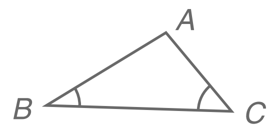
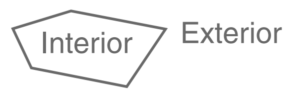
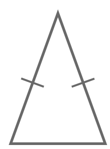
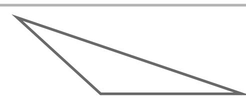
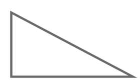
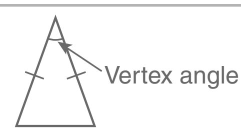
CHAPTER 4

Vocabulary

The table contains important vocabulary terms from Chapter 4. As you work through the chapter, fill in the page number, definition, and a clarifying example.

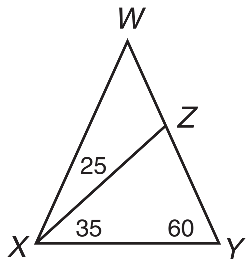
Term	Page	Definition	Clarifying Example
acute triangle	**216**	**A triangle with three acute angles.**	
auxiliary line	**223**	**A line drawn in a figure to aid in a proof.**	
base of an isosceles triangle	**273**	**The side opposite the vertex angle.**	
congruent polygons	**231**	**Two polygons whose corresponding sides and angles are congruent.**	
corresponding angles of polygons	**231**	**Angles in the same position in two different polygons that have the same number of angles.**	 $\angle A$ and $\angle Q$ are corresponding angles
corresponding sides of polygons	**231**	**Sides in the same position in two different polygons that have the same number of sides.**	 $\overline{DC}$ and $\overline{TS}$ are corresponding sides
equiangular triangle	**216**	**A triangle with three congruent angles.**	

Term	Page	Definition	Clarifying Example
equilateral triangle			
exterior of a polygon			
included angle			
included side			
interior of a polygon			
isosceles triangle			
obtuse triangle			
right triangle			
vertex angle of an isosceles triangle			

Term	Page	Definition	Clarifying Example
equilateral triangle	217	**A triangle with three congruent sides.**	
exterior of a polygon	225	**The set of all points outside a polygon.**	
included angle	242	**The angle formed by two adjacent sides of a polygon.**	 $\angle B$ is the included angle between sides $\overline{AB}$ and $\overline{BC}$
included side	252	**The common side of two consecutive angles of a polygon.**	 $\overline{BC}$ is the included side of $\angle B$ and $\angle C$
interior of a polygon	225	**The set of all points inside a polygon.**	
isosceles triangle	217	**A triangle with at least two congruent sides.**	
obtuse triangle	216	**A triangle with one obtuse angle.**	
right triangle	216	**A triangle with one right angle.**	
vertex angle of an isosceles triangle	273	**The angle formed by the legs of an isosceles triangle.**	

Chapter Review

4-1 Classifying Triangles

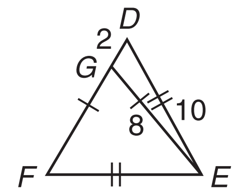


Classify each triangle by its angle measure.

1. $\triangle XYZ$

2. $\triangle XYW$

3. $\triangle XZW$



Classify each triangle by its side lengths.

4. $\triangle DEF$

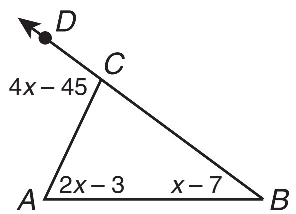
5. $\triangle DEG$

6. $\triangle EFG$

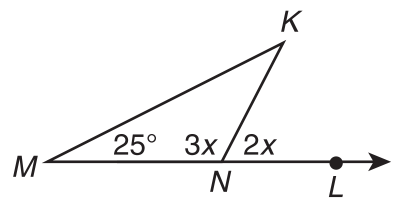
4-2 Angle Relationships in Triangles

Find each angle measure.

7. $m\angle ACB$



8. $m\angle K$



9. A carpenter built a triangular support structure for a roof. Two of the angles of the structure measure 32.5° and 47.5°. Find the measure of the third angle.

4-3 Congruent Triangles

Given $\triangle ABC \cong \triangle XYZ$. Identify the congruent corresponding parts.

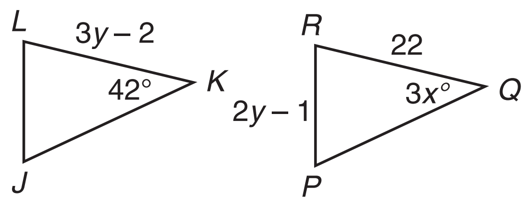
10. $\overline{BC} \cong$

11. $\overline{ZX} \cong$

12. $\angle A \cong$

13. $\angle Y \cong$

Given $\triangle JKL \cong \triangle PQR$. Find each value.

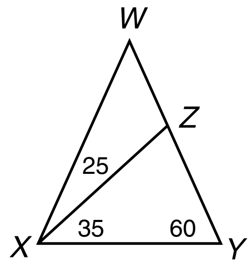


14. x

15. RP

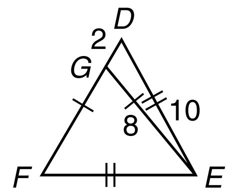
Chapter Review

4-1 Classifying Triangles



Classify each triangle by its angle measure.

1. △*XYZ* — Acute
2. △*XYW* — Equiangular
3. △*XZW* — Obtuse



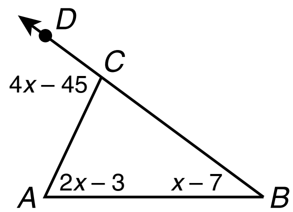
Classify each triangle by its side lengths.

4. △*DEF* — Equilateral
5. △*DEG* — Scalene
6. △*EFG* — Isosceles

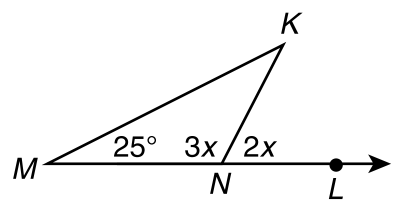
4-2 Angle Relationships in Triangles

Find each angle measure.

7. $m\angle ACB$ — 85°



8. $m\angle K$ — 47°



9. A carpenter built a triangular support structure for a roof. Two of the angles of the structure measure 32.5° and 47.5°. Find the measure of the third angle.

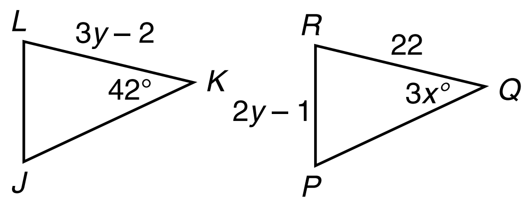
100°

4-3 Congruent Triangles

Given △*ABC* ≅ △*XYZ*. Identify the congruent corresponding parts.

10. $\overline{BC} \cong$ $\overline{YZ}$
11. $\overline{ZX} \cong$ $\overline{CA}$
12. $\angle A \cong$ $\angle X$
13. $\angle Y \cong$ $\angle B$

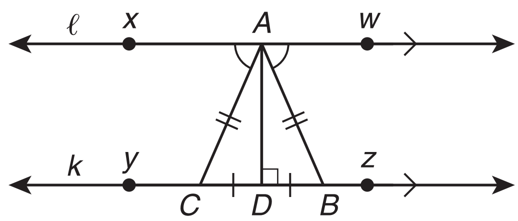
Given △*JKL* ≅ △*PQR*. Find each value.



14. *x* — 14
15. *RP* — 15

16. Given: $\ell \parallel k$; $\overline{BD} \cong \overline{CD}$; $\overline{AB} \cong \overline{AC}$; $\overline{AD} \perp \overline{CB}$; $\overline{AD} \perp \overline{XW}$; $\angle XAC \cong WAB$

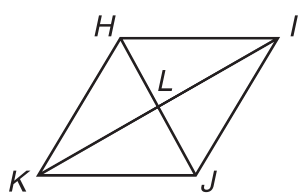
Prove: $\triangle ABD \cong \triangle ACD$



Statements	Reasons
1. $\overline{BD} \cong \overline{CD}$; $\overline{AB} \cong \overline{AC}$;	1.
2. $\overline{AD} \cong \overline{AD}$	2.
3. $\ell \parallel k$; $\overline{AD} \perp \overline{CB}$; $\overline{AD} \perp \overline{XW}$	3.
4.	4. Def. of $\perp$ lines
5. $\angle ADB \cong \angle ADC$	5.
6.	6. Given
7. $\angle XAC \cong \angle ACD$; $\angle WAB \cong \angle ABD$	7.
8.	8. Transitive Property of Congruence
9. $\angle CAD \cong \angle BAD$	9.
10.	10. Def of Congruent Triangles

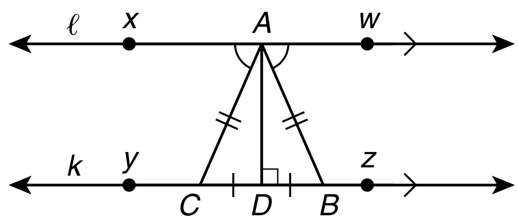
4-4 Triangle Congruence: SSS and SAS

17. Given that *HIJK* is a rhombus, use SSS to explain why $\triangle HIL \cong \triangle JKL$.



16. Given: $\ell \parallel k$; $\overline{BD} \cong \overline{CD}$; $\overline{AB} \cong \overline{AC}$; $\overline{AD} \perp \overline{CB}$; $\overline{AD} \perp \overline{XW}$; $\angle XAC \cong WAB$

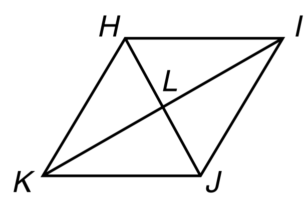
Prove: $\triangle ABD \cong \triangle ACD$



Statements	Reasons
1. $\overline{BD} \cong \overline{CD}$; $\overline{AB} \cong \overline{AC}$;	1. **Given**
2. $\overline{AD} \cong \overline{AD}$	2. **Reflexive Property of Congruence**
3. $\ell \parallel k$; $\overline{AD} \perp \overline{CB}$; $\overline{AD} \perp \overline{XW}$	3. **Given**
4. **$\angle ADB$ and $\angle ADC$ are right angles.**	4. Def. of $\perp$ lines
5. $\angle ADB \cong \angle ADC$	5. **Rt. $\angle \cong$ Thm**
6. **$\angle XAC \cong \angle WAB$**	6. Given
7. $\angle XAC \cong \angle ACD$; $\angle WAB \cong \angle ABD$	7. **Parallel lines cut by a transversal, alternate interior angles are congruent.**
8. **$\angle ACD \cong \angle ABD$**	8. Transitive Property of Congruence
9. $\angle CAD \cong \angle BAD$	9. **Third Angles Theorem**
10. **$\triangle ABD \cong \triangle ACD$**	10. Def of Congruent Triangles

4-4 Triangle Congruence: SSS and SAS

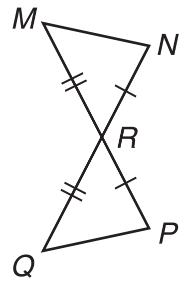
17. Given that *HIJK* is a rhombus, use SSS to explain why $\triangle HIL \cong \triangle JKL$.



$\overline{HI} \cong \overline{JK}$ by the definition of a rhombus. $\overline{HL} \cong \overline{JL}$ and $\overline{LI} \cong \overline{LK}$ because diagonals of a rhombus bisect each other. Therefore, $\triangle HIL \cong \triangle JKL$ by SSS.

18. Given: $\overline{NR} \cong \overline{PR}$; $\overline{MR} \cong \overline{QR}$

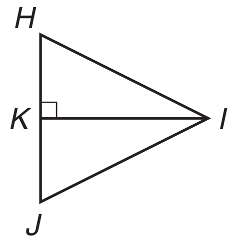
Prove: $\triangle MNR \cong \triangle QPR$



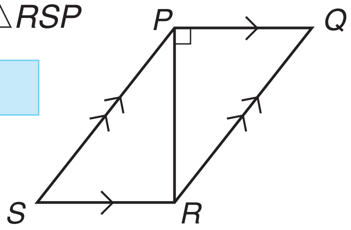
4-5 Triangle Congruence: ASA, AAS, and HL

Determine if you can use the HL Congruence Theorem to prove the triangles congruent. If not, tell what else you need to know.

19. $\triangle HIK \cong \triangle JIK$



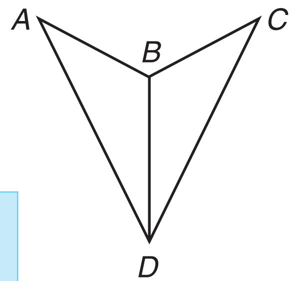
20. $\triangle PQR \cong \triangle RSP$



21. Use ASA to prove the triangles congruent.

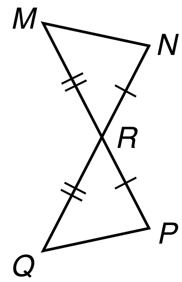
Given: $\overline{BD}$ bisects $\angle ABC$ and $\angle ADC$

Prove: $\triangle ABD \cong \triangle CBD$



18. Given: $\overline{NR} \cong \overline{PR}$; $\overline{MR} \cong \overline{QR}$

Prove: $\triangle MNR \cong \triangle QPR$



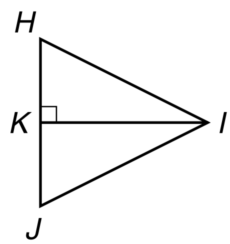
Statements	Reasons
1. $\overline{NR} \cong \overline{PR}$; $\overline{MR} \cong \overline{QR}$	1. Given
2. $\angle MRN \cong \angle QRP$	2. Vertical angles are congruent
3. $\triangle MNR \cong \triangle QPR$	3. SAS

4-5 Triangle Congruence: ASA, AAS, and HL

Determine if you can use the HL Congruence Theorem to prove the triangles congruent. If not, tell what else you need to know.

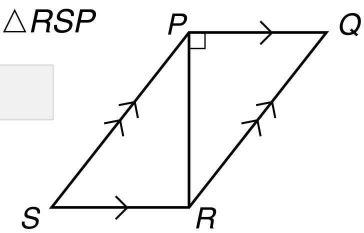
19. $\triangle HIK \cong \triangle JIK$

No; $\overline{HI} \cong \overline{JI}$



20. $\triangle PQR \cong \triangle RSP$

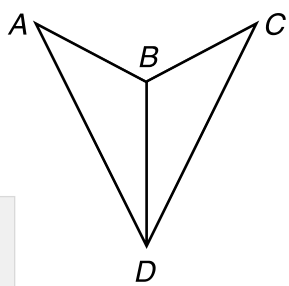
Yes



21. Use ASA to prove the triangles congruent.

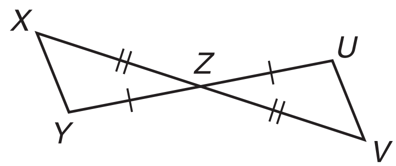
Given: $\overline{BD}$ bisects $\angle ABC$ and $\angle ADC$

Prove: $\triangle ABD \cong \triangle CBD$



Statements	Reasons
1. $\overline{BD}$ bisects $\angle ABC$ and $\angle ADC$	1. Given
2. $\angle ABD \cong \angle CBD$, $\angle ADB \cong \angle CDB$	2. Definition of angle bisector
3. $\overline{BD} \cong \overline{BD}$	3. Reflexive property of congruent angles
4. $\triangle ABD \cong \triangle CBD$	4. ASA

4-6 Triangle Congruence: CPCTC



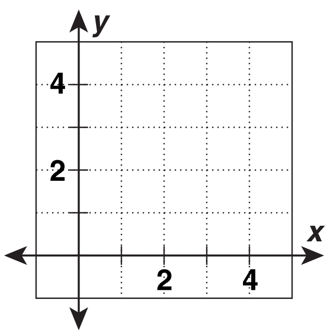
22. Given: $\overline{UZ} \cong \overline{YZ}$, $\overline{VZ} \cong \overline{XZ}$

Prove: $\overline{XY} \cong \overline{VU}$

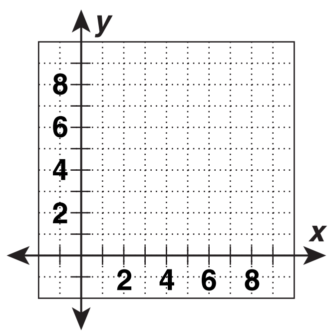
4-7 Introduction to Coordinate Proof

Position each figure in the coordinate plane.

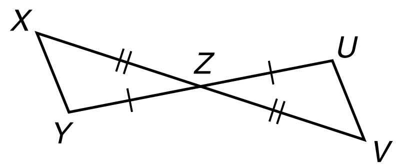
23. a right triangle with legs 3 and 4 units in length



24. a rectangle with sides 6 and 8 units in length



4-6 Triangle Congruence: CPCTC



22. Given: $\overline{UZ} \cong \overline{YZ}$, $\overline{VZ} \cong \overline{XZ}$

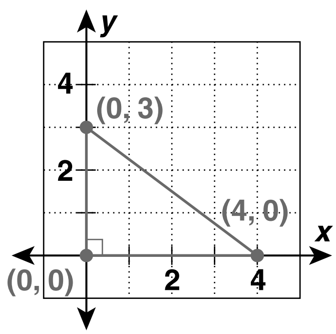
Prove: $\overline{XY} \cong \overline{VU}$

Statements	Reasons
1. $\overline{UZ} \cong \overline{YZ}$, $\overline{VZ} \cong \overline{XZ}$	1. Given
2. $\angle UZV \cong \angle YZX$	2. Vertical angles are congruent
3. $\triangle UZV \cong \triangle YZX$	3. SAS
4. $\overline{XY} \cong \overline{VU}$	4. CPCTC

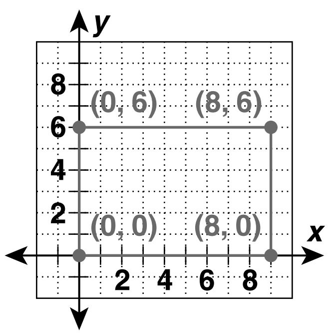
4-7 Introduction to Coordinate Proof

Position each figure in the coordinate plane. Answers will vary. Sample answers shown.

23. a right triangle with legs 3 and 4 units in length



24. a rectangle with sides 6 and 8 units in length

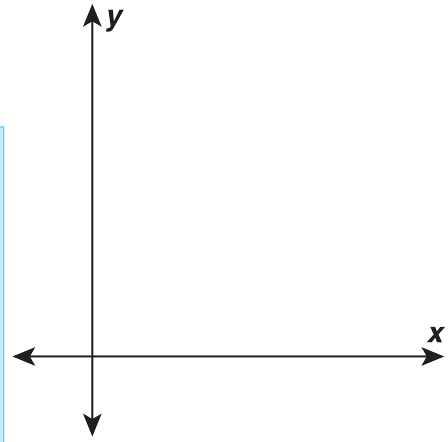


4-8 Isosceles and Equilateral Triangles

25. Assign coordinates to each vertex and write a coordinate proof.

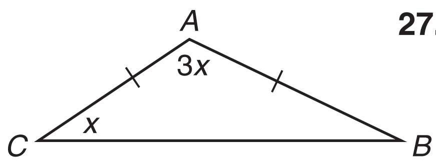
Given: rectangle *ABCD* with diagonals intersecting at *z*

Prove: $\overline{CZ} \cong \overline{DZ}$

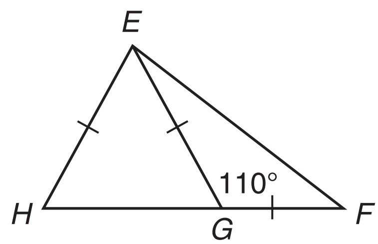


Find each angle measure.

26. $m\angle B$

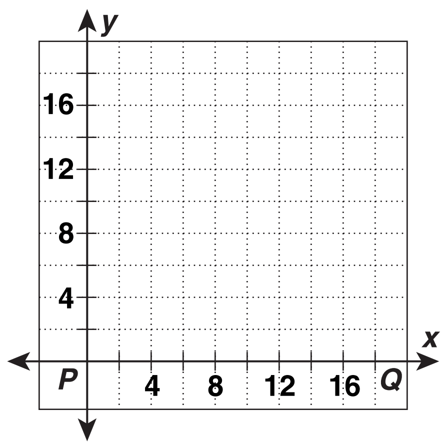


27. $m\angle HEF$



28. Given: $\triangle PQR$ **has coordinates** $P(0, 0)$, $Q(2a, 0)$, **and** $R(a, a\sqrt{3})$

Prove: $\triangle PQR$ is equilateral.



4-8 Isosceles and Equilateral Triangles

25. Assign coordinates to each vertex and write a coordinate proof.

Given: rectangle *ABCD* with diagonals intersecting at *z*

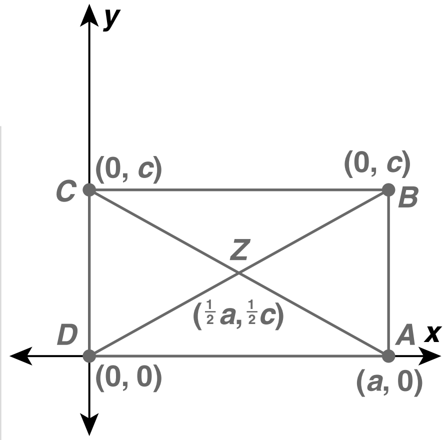
Prove: $\overline{CZ} \cong \overline{DZ}$

The coordinates of *z* are $\left(\frac{1}{2}a, \frac{1}{2}c\right)$ because diagonals of rectangles bisect each other, meaning they intersect at each other's midpoints. By the midpoint formula the coordinates of *z* are $\left(\frac{0+a}{2}, \frac{0+c}{2}\right)$.

$CZ = \sqrt{(0 - \frac{1}{2}a)^2 + (c - \frac{1}{2}c)^2} = \sqrt{\frac{1}{4}a^2 + \frac{1}{4}c^2}$

$DZ = \sqrt{(0 - \frac{1}{2}a)^2 + (0 - \frac{1}{2}c)^2} = \sqrt{\frac{1}{4}a^2 + \frac{1}{4}c^2}$ Therefore,

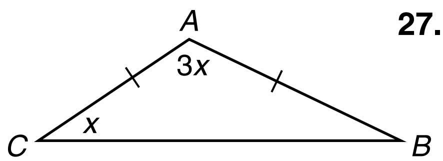
$CZ = DZ$, which means $\overline{CZ} \cong \overline{DZ}$.



Find each angle measure.

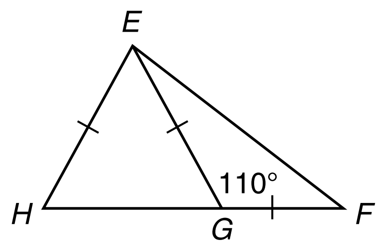
26. $m\angle B$

36°



27. $m\angle HEF$

75°



28. Given: $\triangle PQR$ **has coordinates** $P(0, 0)$, $Q(2a, 0)$, **and** $R(a, a\sqrt{3})$

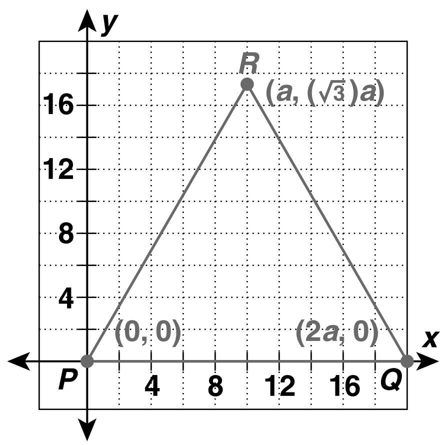
Prove: $\triangle PQR$ is equilateral.

$PQ = \sqrt{(0 - 2a)^2 + (0 - 0)^2} = 2a$

$QR = \sqrt{(2a - a)^2 + (0 - a\sqrt{3})^2} = 2a$

$RP = \sqrt{(a - 0)^2 + (a\sqrt{3} - 0)^2} = 2a$

Since $PQ = QR = RP$, $\triangle PQR$ is equilateral.



Postulates and Theorems

Theorem 4-2-1	(Triangle Sum Theorem) The sum of the angle measures of a triangle is 180°. $m\angle A + m\angle B + m\angle C = 180°$
Corollary 4-2-2	The acute angles of a right triangle are complementary.
Corollary 4-2-3	The measure of each angle of an equilateral triangle is 60°.
Theorem 4-2-4	(Exterior Angle Theorem) The measure on an exterior angle of a triangle is equal to the sum of the measures of its remote interior angles.
Theorem 4-2-5	(Third Angles Theorem) If two angles of one triangle are congruent to two angles of another triangle, then the third pair of angles are congruent.
Postulate 4-4-1	(Side-Side-Side (SSS) Congruence) If three sides of one triangle are congruent to three sides of another triangle, then the triangles are congruent.
Postulate 4-4-2	(Side-Angle-Side (SAS) Congruence) If two sides and the included angle of one triangle are congruent to two sides and the included angle of another triangle, then the triangles are congruent.
Postulate 4-5-1	(Angle-Side-Angle (ASA) Congruence) If two angles and the included side of one triangle are congruent to two angles and the included side of another triangle, then the triangles are congruent.
Theorem 4-5-2	(Angle-Angle-Side (AAS) Congruence) If two angles and the nonincluded side of one triangle are congruent to two angles and the nonincluded side of another triangle, then the triangles are congruent.
Theorem 4-5-3	(Hypotenuse-Leg (HL) Congruence) If the hypotenuse and a leg of a right triangle are congruent to the hypotenuse and a leg of another right triangle, then the triangles are congruent.
Theorem 4-8-1	(Isosceles Triangle Theorem) If two sides of a triangle are congruent, then the angles opposite the sides are congruent.
Converse 4-8-2	(Converse of Isosceles Triangle Theorem) If two sides of a triangle are congruent, then the angles opposite the sides are congruent.
Corollary 4-8-3	(Equilateral Triangle) If a triangle is equilateral, then it is equiangular.
Corollary 4-8-4	(Equiangular Triangle) If a triangle is equiangular, then it is equilateral.

CHAPTER 4

Postulates and Theorems

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CHAPTER 4

Big Ideas

Answer these questions to summarize the important concepts from Chapter 4 in your own words.

1. Name 5 ways to prove triangles congruent.

2. What do the letters CPCTC stand for?

3. Explain the relationship between the lengths of the sides of a triangle and the angles opposite of the sides of a triangle.

4. What two formulas are most useful in coordinate proofs?

For more review of Chapter 4:

- Complete the Chapter 4 Study Guide and Review on pages 284–287 of your textbook.
- Complete the Ready to Go On quizzes on pages 239 and 281 of your textbook.

Big Ideas

Answer these questions to summarize the important concepts from Chapter 4 in your own words.

1. Name 5 ways to prove triangles congruent.

Answers will vary. Possible answer: SSS, SAS, ASA, AAS and HL.

2. What do the letters CPCTC stand for?

Possible answer: Corresponding parts of congruent triangles are congruent.

3. Explain the relationship between the lengths of the sides of a triangle and the angles opposite of the sides of a triangle.

Answers will vary. Possible answer: The angle opposite the longest side is the largest angle, the angle opposite the shortest side is the smallest angle, etc.

4. What two formulas are most useful in coordinate proofs?

Answers will vary. Possible answer: The midpoint and distance formulas.

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