In the photograph of the tennis court, the angle the sideline makes with the service line is the same as the angle it makes with the base line.

This photograph illustrates a postulate about angles and parallel lines.

**POSTULATE 8**

**Corresponding Angles Postulate**

**Words** If two parallel lines are cut by a transversal, then corresponding angles are congruent.

**Symbols** If \( j \parallel k \), then the following are true:

\[
\angle 1 \cong \angle 5 \quad \angle 2 \cong \angle 6 \\
\angle 3 \cong \angle 7 \quad \angle 4 \cong \angle 8
\]

**EXAMPLE 1** Find Measures of Corresponding Angles

Find the measure of the numbered angle.

**Solution**

a. \( m\angle 6 = 60^\circ \)

b. \( m\angle 5 = 135^\circ \)

c. \( m\angle 2 = 90^\circ \)
Find the measure of the numbered angle.

1. $120^\circ$

2. $145^\circ$

3. $45^\circ$

THEOREM 3.5

Alternate Interior Angles Theorem

Words If two parallel lines are cut by a transversal, then alternate interior angles are congruent.

Symbols If $j \parallel k$, then the following are true:

\[
\angle 3 \equiv \angle 6 \\
\angle 4 \equiv \angle 5
\]

EXAMPLE 2 Find Measures of Alternate Interior Angles

Find the measure of $\angle PQR$.

a. $m\angle PQR = 35^\circ$

b. $m\angle PQR = 120^\circ$

c. $m\angle PQR = 70^\circ$

Find the measure of the numbered angle.

4. $4$

5. $5 \ 65^\circ$

6. $6 \ 100^\circ$
THEOREM 3.6

Alternate Exterior Angles Theorem

**Words** If two parallel lines are cut by a transversal, then alternate exterior angles are congruent.

**Symbols** If \( j \parallel k \), then the following are true:

\[
\angle 1 \cong \angle 8 \\
\angle 2 \cong \angle 7
\]

EXAMPLE 3 Find Measures of Alternate Exterior Angles

Find the measures of \( \angle 1 \) and \( \angle 2 \).

**Solution**

The measure of \( \angle 2 \) is 75° because alternate exterior angles are congruent. The measure of \( \angle 2 \) can be used to find the measure of \( \angle 1 \).

\[
m\angle 1 + m\angle 2 = 180^\circ \\
m\angle 1 + 75^\circ = 180^\circ \\
m\angle 1 + 75^\circ - 75^\circ = 180^\circ - 75^\circ \\
m\angle 1 = 105^\circ
\]

**Student Help**

**Look Back**
To review linear pairs, see p. 75.

**Checkpoint** Use Angle Relationships

Find the measure of the numbered angle.

7. \( 130^\circ \)

8. \( 92^\circ \)

9.

Use the diagram below. Tell whether the angles are congruent or not congruent. Explain.

10. \( \angle 1 \) and \( \angle 8 \)
11. \( \angle 3 \) and \( \angle 4 \)
12. \( \angle 4 \) and \( \angle 2 \)
13. \( \angle 2 \) and \( \angle 7 \)
14. \( \angle 3 \) and \( \angle 7 \)
15. \( \angle 3 \) and \( \angle 8 \)
**THEOREM 3.7**

**Same-Side Interior Angles Theorem**

**Words** If two parallel lines are cut by a transversal, then same-side interior angles are supplementary.

**Symbols** If $j \parallel k$, then the following are true:

\[ \angle 3 + \angle 5 = 180^\circ \]
\[ \angle 4 + \angle 6 = 180^\circ \]

---

**EXAMPLE 4** Find Measures of Same-Side Interior Angles

Find the measure of the numbered angle.

**a.**

\[ \angle 5 = 80^\circ \]
\[ \angle 6 = 6^\circ \]

**Solution**

\[ \angle 5 + 80^\circ = 180^\circ \]
\[ \angle 5 = 100^\circ \]

**b.**

\[ \angle 6 = 130^\circ \]
\[ \angle 5 = 50^\circ \]

**EXAMPLE 5** Use Algebra with Angle Relationships

Find the value of $x$.

\[ (x + 15)^\circ = 125^\circ \]

**Solution**

\[ x + 15 = 125 \]
\[ x = 110 \]

---

**Checkpoint Use Algebra with Angle Relationships**

Find the value of $x$.

16. \[ (x + 35)^\circ \]
17. \[ (x - 2)^\circ \]
18. \[ (2x + 10)^\circ \]
### 3.4 Exercises

#### Guided Practice

**Vocabulary Check**

Tell whether the angles are corresponding angles, alternate interior angles, alternate exterior angles, same-side interior angles, or none of these.

1. \( \angle 1 \) and \( \angle 5 \)  
2. \( \angle 5 \) and \( \angle 4 \)  
3. \( \angle 2 \) and \( \angle 8 \)  
4. \( \angle 6 \) and \( \angle 2 \)  
5. \( \angle 3 \) and \( \angle 6 \)  
6. \( \angle 7 \) and \( \angle 3 \)  
7. \( \angle 4 \) and \( \angle 7 \)  
8. \( \angle 8 \) and \( \angle 3 \)

**Skill Check**

What postulate or theorem justifies the statement?

9. \( \angle 10 \cong \angle 15 \)  
10. \( \angle 12 \cong \angle 13 \)  
11. \( m \angle 11 + m \angle 13 = 180^\circ \)  
12. \( \angle 9 \cong \angle 13 \)

13. **Logical Reasoning** Two parallel lines are cut by a transversal so that one of the angles formed is a right angle. What can you say about the measures of all the other angles? Explain.

#### Practice and Applications

**Extra Practice**

See p. 679.

**Visualize It!** Draw two parallel lines. Use a protractor to draw a transversal so that one of the angles has the given measure. Measure all the angles and write the angle measures on your drawing.

14. \( 135^\circ \)  
15. \( 60^\circ \)

**Homework Help**

Example 1: Exs. 16–18  
Example 2: Exs. 19–21, 25  
Example 3: Exs. 22–24  
Example 4: Exs. 29–31  
Example 5: Exs. 32–37

**Corresponding Angles** Find the measure of the numbered angle.

16. \( \angle 110^\circ \)  
17. \( \angle 2 \)  
18. \( \angle 50^\circ \)
Alternate Interior Angles Find the measure of the numbered angle.

19. \[ \text{Angle 1} \] 37°

20. \[ 127° \]

21. \[ 94° \]

Alternate Exterior Angles Find the measure of \( \angle ABC \).

22. \[ \text{Angle } A \]

23. \[ \text{Angle } B \]

24. \[ \text{Angle } C \]

25. Rainbows When sunlight enters a drop of rain, different colors leave the drop at different angles. For red light, \( m\angle 2 = 42° \). What is \( m\angle 1 \)? Explain.

Logical Reasoning Find \( m\angle 1 \) and \( m\angle 2 \). Explain your reasoning.

26. \[ \text{Angle 1} \] 135°

27. \[ \text{Angle 2} \] 82°

28. \[ \text{Angle 1} \] 118°

Same-Side Interior Angles Find the measure of the numbered angle.

29. \[ \text{Angle 1} \] 49°

30. \[ \text{Angle 2} \] 77°

31. \[ \text{Angle 3} \] 104°

Using Algebra Find the value of \( y \).

32. \[ 70° + 2\gamma \]

33. \[ 115° + 5\gamma \]

34. \[ 120° + 6\gamma \]
Using Algebra  Find the value of \( x \). 

35. \( (5x - 24)° \)  
36. \( (13x - 5)° \)  
37. \( 7(x - 7)° \)

38. **Physical Therapy**  Sports physicians and physical therapists use a tool called a *goniometer* to measure range of motion.

In the diagram, \( \overline{BA} \parallel \overline{ED} \) and \( \overline{BC} \parallel \overline{EF} \). Use the blue transversal to explain why \( \angle ABC \equiv \angle DEF \).

**Error Analysis**  A student has written some angle measures incorrectly. Copy the diagram and correct the errors.

39. 

40.

**Standardized Test Practice**

41. **Multiple Choice**  Which statement is false?
   - \( A \) \( m\angle 2 + m\angle 5 = 180° \)
   - \( B \) \( m\angle 5 + m\angle 6 = 180° \)
   - \( C \) \( m\angle 6 + m\angle 7 = 180° \)
   - \( D \) \( m\angle 3 + m\angle 8 = 180° \)

42. **Multiple Choice**  Which statement about the diagram above is true?
   - \( E \) \( \angle 2 \equiv \angle 4 \)
   - \( G \) \( \angle 5 \equiv \angle 7 \)
   - \( H \) \( \angle 3 \equiv \angle 8 \)
   - \( J \) \( \angle 6 \equiv \angle 3 \)
Mixed Review

Identifying Line Relationships Fill in the blank with parallel, perpendicular, or skew. (Lesson 3.1)

43. Line \( j \) and line \( k \) are __ ? __.
44. Line \( j \) and line \( m \) are __ ? __.
45. Line \( k \) and line \( m \) are __ ? __.
46. Line \( m \) appears __ ? __ to plane \( B \).

Studying Angles List all pairs of angles that fit the description. (Lesson 3.3)

47. corresponding
48. alternate interior
49. alternate exterior
50. same-side interior

Algebra Skills

Solving Equations Solve the equation. (Skills Review, p. 673)

51. \( 3y - 4 = 20 \)
52. \( 4 - 6p = 2p - 3 \)
53. \( 75 + 7x = 2x \)
54. \( 14r + 81 = -r \)
55. \( 12s - 5 = 7s \)
56. \( 5(z + 3) = 12 \)

Quiz 2

Use the diagram to describe the relationship between the pair of angles. (Lesson 3.3)

1. \( \angle 1 \) and \( \angle 8 \)
2. \( \angle 4 \) and \( \angle 6 \)
3. \( \angle 6 \) and \( \angle 2 \)
4. \( \angle 2 \) and \( \angle 7 \)
5. \( \angle 4 \) and \( \angle 5 \)
6. \( \angle 3 \) and \( \angle 6 \)

Find the measures of \( \angle 1 \) and \( \angle 2 \). (Lesson 3.4)

7. \( \angle 1 \) \( 104^\circ \)
8. \( \angle 1 \) \( 78^\circ \)
9. \( \angle 1 \) \( 107^\circ \)

Find the value of \( x \). (Lesson 3.4)

10. \( 87^\circ \) \( (4x + 3)^\circ \)
11. \( 115^\circ \) \( 5(x - 3)^\circ \)
12. \( 53^\circ \) \( (5x - 2)^\circ \)