CHAPTER 3

Think & Discuss *(p. 127)*

1. 45° **2.** no

Skill Review (p. 128)

1. $47 + x = 180$

$x = 133$

2. $135 = 3x - 6$

$141 = 3x$

$47 = x$

3. $m = \dfrac{5 - 7}{2 - (-6)}$

$m = -\dfrac{2}{8}$

$m = -\dfrac{1}{4}$

4. $\dfrac{1}{2} = -5\left(\dfrac{7}{2}\right) + b$

$\dfrac{1}{2} = -\dfrac{35}{2} + b$

$\dfrac{36}{2} = b$

$18 = b$

5. $5x + 9 = 6x - 11$

$9 = x - 11$

$20 = x$

6. $2(x - 1) + 15 = 90$

$2x - 2 + 15 = 90$

$2x + 13 = 90$

$2x = 77$

$x = \dfrac{77}{2}$

7. Definition of a right angle

8. Vertical angles are congruent.

9. $\angle 2$ and $\angle 3$ form a linear pair.

10. Definition of congruent angles

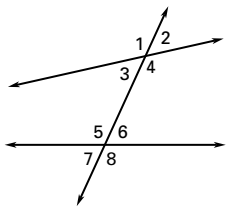
11. Subtraction property of equality

12. Distributive property

Lesson 3.1

3.1 Guided Practice (p. 132)

1. *Sample answer:*



$\angle 3$ and $\angle 6$

$\angle 4$ and $\angle 5$

2. *Sample answer:* Skew lines and parallel lines are alike because they do not intersect. Skew lines and parallel lines are different because skew lines are not coplanar and parallel lines are coplanar.

3. B **4.** C **5.** A

6. $\angle 1$ and $\angle 5$, $\angle 4$ and $\angle 8$, $\angle 2$ and $\angle 6$, or $\angle 3$ and $\angle 7$

7. $\angle 3$ and $\angle 5$ or $\angle 4$ and $\angle 6$

8. $\angle 1$ and $\angle 7$ or $\angle 2$ and $\angle 8$

9. $\angle 3$ and $\angle 6$ or $\angle 4$ and $\angle 5$

3.1 Practice and Applications (p. 132)

10. parallel **11.** perpendicular **12.** skew **13.** parallel

14. $\overleftrightarrow{UV}$, $\overleftrightarrow{TS}$, or $\overleftrightarrow{XW}$ **15.** $\overleftrightarrow{QU}$, $\overleftrightarrow{QT}$, $\overleftrightarrow{RV}$, or $\overleftrightarrow{RS}$

16. $\overleftrightarrow{TX}$, $\overleftrightarrow{SW}$, $\overleftrightarrow{UX}$, or $\overleftrightarrow{VW}$ **17.** UVW **18.** 1 **19.** 1

20. skew **21.** corresponding **22.** alternate exterior

23. consecutive interior **24.** alternate interior

25. alternate exterior **26.** corresponding **27.** III; 3

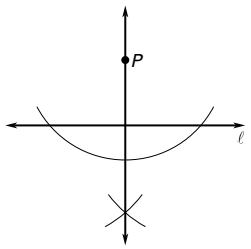
28. L; 50 **29.** V; 5 **30.** X; 10 **31.** M; 1000 **32.** no

33. yes **34.** yes **35.** no **36.** 2

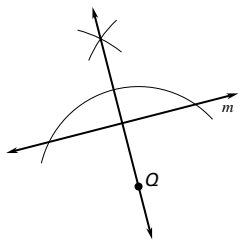
37. *Sample answer:* The two lines of intersection are coplanar, since they are both in the third plane. The two lines do not intersect because they are in parallel planes. Since they are coplanar and do not intersect, they are parallel.

38. *Sample answer:* The lines have a common point.

39.



40.



41. B **42.** C **43.** $\angle DFA$, $\angle DEH$ **44.** $\angle DEB$

45. $\angle BEG$ **46.** $\angle GFJ$

3.1 Mixed Review (p.134)

47. $m\angle ABD = 80°$, $m\angle ABC = 160°$

48. 19°, 109° **49.** 77°, 167° **50.** 34°, 124° **51.** 2°, 92°

52. 63°, 153° **53.** 22°, 112° **54.** 89°, 179° **55.** 30°, 120°

56. 45°, 135°

57. $x + 13 - 13 = 23 - 13$ Subtraction property of equality

$x = 10$ Simplify

58. $x - 8 + 8 = 17 + 8$ Addition property of equality

$x = 25$ Simplify

59. $4x + 11 - 11 = 31 - 11$ Subtraction property of equality

$\frac{4x}{4} = \frac{20}{4}$ Division property of equality

$x = 5$ Simplify

60. $2x + 9 + 29 = 4x - 29 + 29$

Addition property of equality

$2x - 2x + 38 = 4x - 2x$

Subtraction property of equality

$\frac{38}{2} = \frac{2x}{2}$

Division property of equality

$19 = x$

Simplify

61. $2(x - 1) + 3 = 17$ Given

$2x - 2 + 3 = 17$ Distributive Property

$2x + 1 = 17$ Simplify

$2x + 1 - 1 = 17 - 1$ Subtraction property of equality

$\frac{2x}{2} = \frac{16}{2}$ Division property of equality

$x = 8$ Simplify

62. $5x + 7(x - 10) = -94$ Given

$5x + 7x - 70 = -94$ Distributive property

$12x - 70 = -94$ Simplify

$12x - 70 + 70 = -94 + 70$ Addition property of equality

$\frac{12x}{12} = \frac{-24}{12}$ Division property of equality

$x = -2$ Simplify

Developing Concepts Activity (p. 135)

1. $x + y = 60$ → $x = 5$; $5 + y = 60$ → $y = 55$

$x + y = 60$ and $x = 5 \rightarrow 5 + y = 60 \rightarrow y = 55$

2. $\angle 5 \cong \angle 6$, $\angle 5$ and $\angle 6$ are a linear pair.

$m\angle 5 = m\angle 6$

$\angle 5$ and $\angle 6$ are supplementary.

$m\angle 5 + m\angle 6 = 180°$

$m\angle 5 + m\angle 5 = 180°$

$2(m\angle 5) = 180°$

$m\angle 5 = 90°$

$\angle 5$ is a right angle.

$j \perp k$

3. Given

Definition of congruent angles

Linear Pair Postulate

Definition of supplementary angles

Substitution property of equality

Distributive property

Division property of equality

Definition of right angle

Definition of perpendicular lines

Critical Thinking: *Sample answer:* Both have a statement, a reason for each statement, and conclude with the statement that is to be proved.

Lesson 3.2

3.2 Guided Practice (p. 138)

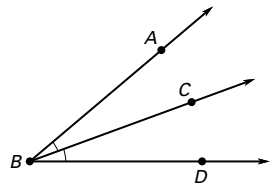
1. Two lines are perpendicular if and only if they meet to form right angles.

2. Postulate 14, Perpendicular Postulate

3. Vertical Angles Theorem **4.** Theorem 3.1

5. Theorem 3.2 **6.** Theorem 3.3 **7.** 90 **8.** 45 **9.** 20

10. *Sample answer:* It does not state that $\angle ABC$ and $\angle CBD$ form a linear pair.



3.2 Practice and Applications (pp. 139–141)

11. 90 **12.** 30 **13.** 35

14. *Sample answer:* $\angle 1$ and $\angle 2$ are complementary.

15. *Sample answer:* $\angle 1$, $\angle 2$, $\angle 3$, and $\angle 4$ are right angles.

16. *Sample answer:* $\angle 3$ is a right angle, $\angle 1$ and $\angle 2$ are complementary.

17. **a.** right angle **b.** 90° **c.** Angle Addition **d.** $m\angle 3$ **e.** $m\angle 4$ **f.** 90°

18. **a.** $\angle 1$ and $\angle 2$ are supplementary.

b. Definition of supplementary angles

c. Definition of right angles

d. Substitution property

e. $m\angle 2 = 90°$

f. Definition of right angles

19.

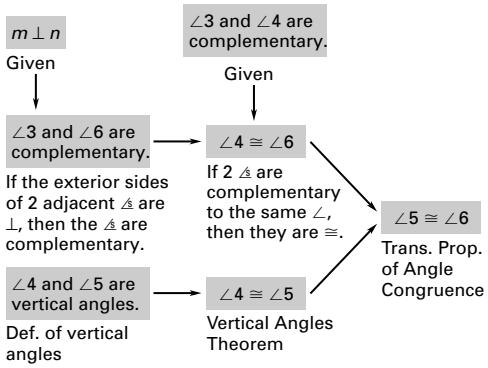
Statements	Reasons
1. $\angle 1$ and $\angle 3$ are vertical angles.	**1.** Definition of vertical angles
2. $\angle 1 \cong \angle 3$	**2.** Vertical Angles Theorem
3. $m\angle 1 = m\angle 3$	**3.** Definition of congruent angles
4. $\angle 1$ is a right angle.	**4.** Given
5. $m\angle 1 = 90°$	**5.** Definition of right angle
6. $90° = m\angle 3$	**6.** Substitution property of equality
7. $\angle 3$ is a right angle.	**7.** Definition of right angle

20. If the exterior sides of two adjacent angles are perpendicular, then the angles are complementary; given; vertical angles are congruent.

21. If $\angle 4 \cong \angle 6$, then $\angle 4 \cong \angle 6$, because $\angle 5 \cong \angle 4$ and because of the Transitive Property of Congruence for angles.

22. Both $\angle 4$ and $\angle 6$ are complementary to $\angle 3$, so $\angle 4 \cong \angle 6$ because if two angles are complementary to the same angle, then they are congruent.

23.



24. **Given:** $\overline{AB} \perp \overline{BC}$, $\overline{BC} \perp \overline{CD}$

Prove: $\angle 7 \cong \angle 8$

Statements	Reasons
1. $\overline{AB} \perp \overline{BC}$, $\overline{BC} \perp \overline{CD}$	**1.** Given
2. $\angle 7$ and $\angle 8$ are right angles	**2.** Definition of perpendicular lines
3. $m\angle 7 = 90°$, $m\angle 8 = 90°$	**3.** Definition of right angle
4. $m\angle 7 = m\angle 8$	**4.** Transitive property of equality
5. $\angle 7 \cong \angle 8$	**5.** Definition of congruent angles

25. No; *Sample answer:* If the crosspieces form one right angle, then all 4 angles must be right angles by definition of perpendicular lines.

26. B **27.** B

28. *Sample answer:* The angles formed by the mirror and the floor and by the mirror and the reflection of the floor are congruent. If the sum of the measures of the two angles is not 180°, then each angle is not 90°, or the mirror is not perpendicular to the floor.

3.2 Mixed Review (p. 141)

29. 38° **30.** 90° **31.** 39° **32.** 48°

33. $\angle 1$ and $\angle 5$, $\angle 3$ and $\angle 7$, $\angle 2$ and $\angle 6$, $\angle 4$ and $\angle 8$

34. $\angle 3$ and $\angle 6$, $\angle 4$ and $\angle 5$

35. $\angle 1$ and $\angle 8$, $\angle 2$ and $\angle 7$

36. $\angle 3$ and $\angle 5$, $\angle 4$ and $\angle 6$

Technology Activity (p. 142)

1. Answers will vary. *Sample answers:* The corresponding angles are congruent. The alternate interior angles are congruent.

2. Answers will vary. *Sample answers:* The corresponding angles are always congruent. The alternate interior angles are always congruent.

3. *Sample answer:* If two parallel lines are cut by a transversal, then the pairs of corresponding angles are congruent.

4. *Sample answers:* If two parallel lines are cut by a transversal, then the pairs of alternate interior angles are congruent.

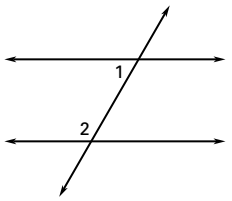
Critical Thinking:

Sample conjecture: If two parallel lines are cut by a transversal, then the sum of two consecutive interior angles is 180°.

Lesson 3.3

3.3 Guided Practice (p. 146)

1. *Sample answer:*



2. one; *Sample answer:* Each angle is either congruent to the given angle or supplementary to it.

3. Alternate Exterior Angles Theorem

4. Alternate Interior Angles Theorem

5. Consecutive Interior Angles Theorem

6. Corresponding Angles Postulate

7. 133

3.3 Practice and Applications (pp. 146–148)

8. $m\angle 1 = 135°$ *Sample answer:* by Corresponding angles postulate; $m\angle 2 = 135°$ *Sample answer:* by the Vertical angles theorem

9. $m\angle 1 = 82°$ *Sample answer:* by Corresponding angles postulate; $m\angle 2 = 98°$ *Sample answer:* by the Linear pair postulate

10. $m\angle 1 = 118°$ *Sample answer:* by Alternate interior angles theorem; $m\angle 2 = 62°$ *Sample answer:* Consecutive interior angles theorem

11. $67 + x = 180$; Linear pair postulate
$x = 113$; Subtraction property of equality
$y = 113$; Alternate exterior angles theorem

12. $y = 109$; Vertical angles theorem
$x + 109 = 180$; Consecutive interior angles theorem
$x = 71$; Subtraction property of equality

13. $x + 90 = 180$; Consecutive interior angles theorem
$x = 90$; Subtraction property of equality
$90 + y = 180$; Linear pair postulate
$y = 90$; Subtraction property of equality

14. $y + 65 = 180$; Linear pair postulate
$y = 115$; Subtraction property of equality
$x + 115 = 180$; Consecutive interior angles theorem
$x = 65$; Subtraction property of equality

15. $x + 80 = 180$; Linear pair postulate
$x = 100$; Subtraction property of equality
$y = 80$; Alternate exterior angles theorem

16. $x = 130$; Corresponding angles postulate
$x = y = 130$; Vertical angles theorem

17. $m\angle 2 = m\angle 3 = m\angle 6 = m\angle 7 = 73°$
$m\angle 4 = m\angle 5 = m\angle 8 = 107°$

18.
$2y = 70$
$y = 35$

19.
$5y = 115$
$y = 23$

20.
$6y + 120 = 180$
$6y = 60$
$y = 10$

21.
$3x - 14 = 70$
$3x = 84$
$x = 28$

22.
$2x + 10 = 90$
$2x = 80$
$x = 40$

23.
$12x - 9 = 135$
$12x = 144$
$x = 12$

24.
$89 + 5x - 24 = 180$
$65 + 5x = 180$
$5x = 115$
$x = 23$

25.
$94 + 13x - 5 = 180$
$13x + 89 = 180$
$13x = 91$
$x = 7$

26.
$7(x - 7) = 126$
$7x - 49 = 126$
$7x = 175$
$x = 25$

27. Statements: $p \parallel q$; $m\angle 1 = m\angle 3$; $\angle 3$ and $\angle 2$ form a linear pair; $m\angle 1 + m\angle 2 = 180°$

Reasons: Alternate interior angles theorem; Linear pair postulate; Definition of supplementary $\measuredangle$

28. *Sample answer:* $\angle 2 \cong \angle 3$ by the Vertical angles theorem. It is given that $j \parallel k$, so $\angle 1 \cong \angle 3$ by the Corresponding angles postulate. Then $\angle 1 \cong \angle 2$ by the Transitive property of angle congruence.

29. *Sample answer:* $m\angle 1 = 90°$ by the Definition of perpendicular lines. It is given that $q \parallel r$, so $\angle 1 \cong \angle 2$ by the corresponding angles postulate. $m\angle 1 = m\angle 2$ by Definition of congruent angles. Then $m\angle 2 = 90°$ by the Transitive property of equality.

30. 42°; Alternate interior angles theorem

31. **a.** 70°, 110°

b. *Sample answer:* $\angle 3$ and $\angle 2$ are supplementary so they form a linear pair, and the exterior sides of a linear pair form a straight angle.

32. $m\angle 2 = 132°$, Linear pair postulate

$m\angle 3 = 48°$, Vertical angle theorem

$m\angle 4 = 48°$, Corresponding angles postulate

$m\angle 5 = 42°$, If the exterior sides of two adjacent angles are perpendicular, then the angles are complementary.

$m\angle 6 = 42°$, Corresponding angles postulate

$m\angle 7 = 138°$, Linear pair postulate

3.3 Mixed Review (p. 149)

33. 130° **34.** 107° **35.** 79° **36.** 73° **37.** 69° **38.** 62°

39. If an angle is acute, then the measure of the angle is 19°.

40. If I go to the park, then you will go with me.

41. If I go fishing, then I do not have to work.

42. 67° **43.** 21° **44.** 70°

Quiz 1 (p. 149)

1. $\angle 6$ **2.** $\angle 5$ **3.** $\angle 6$ **4.** $\angle 7$

5. *Sample answer:* Since $\angle 1$ and $\angle 2$ are congruent angles that form a linear pair this shows that $m\angle 1$ and $m\angle 2$ are both 90°. This shows that the two lines are perpendicular so that $\angle 3$ and $\angle 4$ are right angles.

6.
$2x = 138$
$x = 69$

7.
$2x + 1 = 151$
$2x = 150$
$x = 75$

8.
$7x + 15 + 81 = 180$
$7x + 96 = 180$
$7x = 84$
$x = 12$

9. 35°; The top left corner is assumed to be a right angle; $\angle 3$ and $\angle 2$ are complementary, Definition of complementary angles; $m\angle 3 + m\angle 2 = 90°$, Definition of complementary angles; $m\angle 2 = 90° - 55° = 35°$, substitute; $m\angle 1 = m\angle 2$, Corresponding angles postulate.

Lesson 3.4

3.4 Guided Practice (p. 153)

1. coplanar lines that do not intersect

2. If two parallel lines are cut by a transversal, then the alternate interior angles are congruent; yes

3. yes; alternate exterior angles converse

4. no **5.** no **6.** yes; alternate interior angles converse

7. yes; corresponding angles converse

8. yes; consecutive interior angles converse

9. 45; consecutive interior angles converse

3.4 Practice and Applications (pp. 153–156)

10. yes; alternate interior angles converse

11. yes; alternate exterior angles converse

12. yes; corresponding angles converse

13. no **14.** yes; alternate exterior angles converse

15. no

16. $x + 2x = 180$
$3x = 180$
$x = 60$

17. $x = 90 - x$
$2x = 90$
$x = 45$

18. $2x + 20 = 3x$
$20 = x$

19. yes; corresponding angles converse

20. yes; consecutive interior angles converse

21. no **22.** no

23. yes; angle addition postulate and alternate exterior angles converse

24. yes; angle addition postulate and consecutive interior angles converse

25. no

26. none; *Sample answer:* $m\angle EAB = 115°$ and $m\angle CBA = 66°$, so the consecutive interior angles are not supplementary.

27. $j \parallel n$ because $31° + 69° = 100°$ and $32° + 68° = 100°$

28. **Statement:** $\angle 1$ and $\angle 3$ are supplementary; $\angle 2 \cong \angle 3$.
Reasons: Given; corresponding angles converse

29. 32°

30. *Sample answer:*

1. $\angle 4 \cong \angle 5$ (Given); 2. $\angle 4 \cong \angle 6$ (Vertical angles theorem); 3. $\angle 5 \cong \angle 6$ (Transitive property of angle congruence); 4. $g \parallel h$ (Corresponding angles converse)

31. *Sample answer:*

$\angle 5$ and $\angle 6$ are alternate interior angles. They have the same measure, so they are congruent. Then the lines p and q are parallel because of the Alternate Interior Angles Converse.

32. $\overline{AB} \parallel \overline{CD}$; $\angle B \cong \angle BEA$, $\angle BEA \cong \angle CED$ by the Vertical angles theorem, and $\angle CED \cong \angle C$. So $\angle B \cong \angle C$ by the transitive property of angle congruence, and $\overline{AB} \parallel \overline{CD}$ by the alternate interior angles converse.

33. $\angle 1 \cong \angle 4$ and $\angle 2 \cong \angle 3$. *Sample answer:* The angles marked as congruent are alternate interior angles, so $r \parallel s$ by the Alternate interior angles converse. Then $\angle 1 \cong \angle 4$ by the alternate interior angles theorem and $\angle 2 \cong \angle 3$ by the Vertical angles theorem.

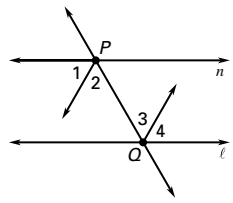
34.

Statements	Reasons
1. $m\angle 7 = 125°$, $m\angle 8 = 55°$	**1.** Given
2. $m\angle 7 + m\angle 8 = 180°$	**2.** Addition property of equality
3. $j \parallel k$	**3.** Consecutive interior angles converse

35.

Statements	Reasons
1. $a \parallel b$; $\angle 1 \cong \angle 2$	**1.** Given
2. $m\angle 1 + m\angle 3 = 180°$	**2.** Consecutive interior angles theorem
3. $m\angle 1 = m\angle 2$	**3.** Definition of congruent angles
4. $m\angle 2 + m\angle 3 = 180°$	**4.** Substitution property of equality
5. $c \parallel d$	**5.** Consecutive interior angles converse

36. *Sample answer:*



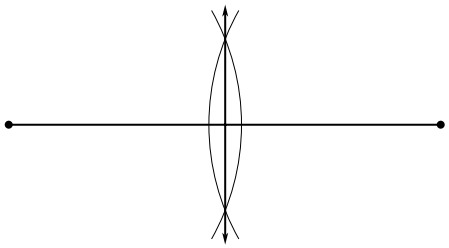
Conjecture: If two parallel lines are cut by a transversal, then the bisectors of the alternate interior angles are parallel. Plan for proof: Show that $m\angle 1 = m\angle 2$, $m\angle 3 = m\angle 4$, and $m\angle 1 + m\angle 2 = m\angle 3 + m\angle 4$. Then show that $2m\angle 2 = 2m\angle 3$ so $m\angle 2 = m\angle 3$. Finally show that the angle bisectors are parallel.

37. C **38.** C

39. *Sample answer:* $l_1 \parallel l_2$ so $m\angle BCA = m\angle A$ by the alternate interior angles theorem. $m\angle BCA = m\angle B$, so $j \parallel k$ by the alternate interior angles converse.

3.4 Mixed Review (p. 156)

40.



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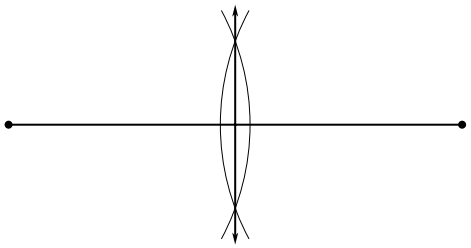

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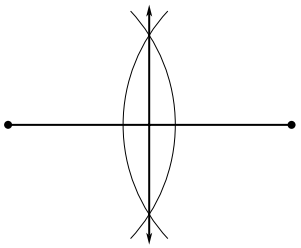

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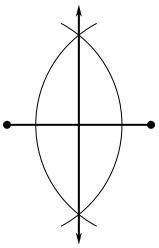


44. 4; $\overline{AB} \cong \overline{AD}$, $\overline{AD} \cong \overline{DC}$ (given), so $\overline{AB} \cong \overline{DC}$ by the Transitive property of segment congruence. Then $9x - 11 = 6x + 1$ by substitution, $3x = 12$ by the addition property of equality (add $-6x$ to each side, add 11 to each side), and $x = 4$ by the multiplication property of equality.

45. $\angle 5$ **46.** $\angle 6$ **47.** $\angle 7$ **48.** $\angle 7$

Lesson 3.5

3.5 Guided Practice (p. 160)

1. Theorem 3.11: If two lines are parallel to the same line, then they are parallel to each other.

Theorem 3.12: In a plane, if two lines are perpendicular to the same line, then they are parallel to each other.

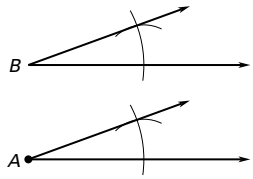
2. Theorem 3.11: If two lines are parallel to the same line, then they are parallel to each other.

3. Theorem 3.12: In a plane, if two lines are perpendicular to the same line, then they are parallel to each other.

4. $m_1 \parallel m_2$, $l_1 \parallel l_2$; *Sample answer:* If two lines are cut by a transversal so that consecutive interior angles are supplementary, then the lines are parallel.

5. $l_1 \parallel l_2$; *Sample answer:* If two lines are cut by a transversal so that alternate interior angles are congruent, then the lines are parallel.

6.



7. *Sample answer:* Given line l and exterior point P, draw any line n though P that intersects l. Label one of the four angles where l and n intersect as $\angle 1$. Copy $\angle 1$ at P. Be sure that $\angle 1$ and the new angle ($\angle 2$) are in corresponding positions. One of the sides of $\angle 2$ will lie on line n. Draw the line m that contains the other side of $\angle 2$. It will be parallel to l.

3.5 Practice and Applications (pp. 160–163)

8. Theorem 3.11 **9.** Theorem 3.12

10. Theorem 3.8: Alternate interior angles converse

11. Postulate 16: Corresponding angles converse

12. Theorem 3.10: Alternate exterior angles converse

13. Theorem 3.8: Alternate interior angles converse

14. *Sample answer:*

1. Show alternate interior angles are congruent.
2. Show alternate exterior angles are congruent.
3. Show corresponding angles are congruent.
4. Show consecutive interior angles are supplementary.
5. Show 2 lines are parallel to a third line.
6. Show two lines are perpendicular to a third line.

15. *Sample answer:* By showing that the two given interior consecutive angles are supplementary

16. *Sample answer:* First, show that the angles with measures 55° and 35° are complementary. Then $n \perp j$, and $k \parallel j$ by Theorem 3.12.

17. *Sample answer:* By showing that corresponding angles 1 and 4 are congruent

18. *Sample answer:*

$x + x = 180$ Linear Pair Postulate

$2x = 180$

$x = 90$

If $x = 90$, g and h are both perpendicular to the transversal; so $g \parallel h$ by Theorem 3.12.

19. *Sample answer:*

Since $180 - x + x = 180$, $g \parallel h$ by the Consecutive interior angles converse.

20. *Sample answer:*

$90 + x + x = 180$ Linear Pair Postulate

$2x = 90$

$x = 45$

If $x = 45$, then $90 - (45) = 45$ and $g \parallel h$ by the Corresponding angles converse.

21. $p \parallel q$; Corresponding angles converse

$q \parallel r$; Consecutive interior angles converse

$p \parallel r$; Theorem 3.11

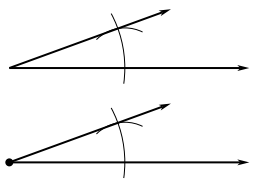
22. $h \parallel j$; Corresponding angles converse

23. $a \parallel b$; Theorem 3.12

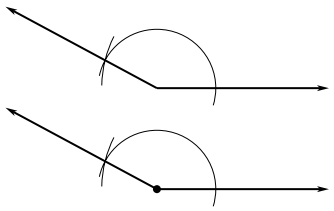
$c \parallel d$; Theorem 3.12

24. none

25.



26.



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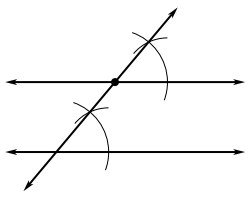

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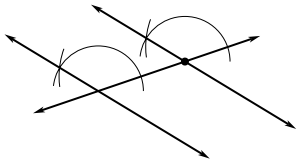


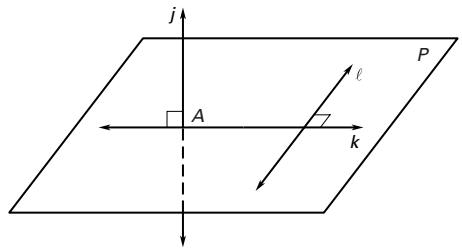
29. *Sample answer:* Through construction, the two angles in Ex. 28 are congruent. Since the angles are corresponding angles, it follows that the lines are parallel by the corresponding angles converse.

30. *Sample answer:* Since each yard line is perpendicular to the same line (sideline), each pair of yard lines are parallel by Theorem 3.12 and all the yard lines are parallel by Theorem 3.11.

31. *Sample answer:* Since you are starting out with two parallel sides, the next strip will have one side parallel to the first strip, thus Theorem 3.11 tells us that if two lines are parallel to the same line, then they are parallel to each other.

32. *Sample answer:* The lines could lie in different planes.

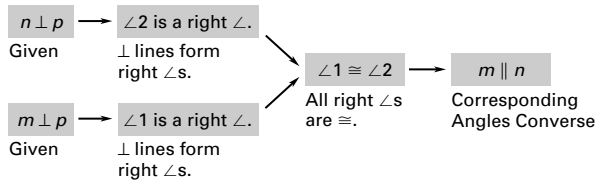
Counterexample: $l \perp k$ and l and k are in Plane P. $j \perp k$ and j intersects Plane P at a point A.



33. always **34.** always **35.** never **36.** always

37. 50°

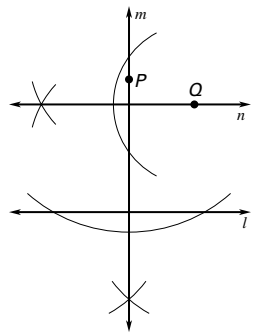
38.



39. **a.** Yes; *sample answer:* Hold the straightedge next to each red line and see if the red lines are straight.

b. Yes; *sample answer:* Measure the angles formed by the red lines and the top horizontal line, and see if corresponding angles are congruent.

40.



Theorem 3.12

41. **a.** *Sample answer:* Corresponding congruent angles converse

b. *Sample answer:* Consecutive interior angles converse

c. 90°; *Sample answer:* Since $\overline{AB} \parallel \overline{CD}$ and $\overline{CD} \parallel \overline{EF}$, it follows that $\overline{AB} \parallel \overline{EF}$. $\angle CAB$ and $\angle CEF$ are consecutive interior angles which are supplementary and $\angle CEF$ is a right angle. Therefore, $\angle 1$ must also be a right angle.

42.

Statements	Reasons
1. $\angle 1 \cong \angle 2$; $j \parallel k$	**1.** Given
2. $\angle 1 \cong \angle 3$	**2.** Alternate Exterior Angles Theorem
3. $\angle 2 \cong \angle 3$	**3.** Transitive Property
4. $r \parallel s$	**4.** Corresponding Angles Converse

3.5 Mixed Review (p. 163)

43. $AB = \sqrt{(0-14)^2 + (-6-0)^2} = \sqrt{232} = 2\sqrt{58}$

44. $AB = \sqrt{(-3-2)^2 + (-8-(-1))^2} = \sqrt{74}$

45. $AB = \sqrt{(0-6)^2 + (-7-3)^2} = \sqrt{136} = 2\sqrt{34}$

46. $AB = \sqrt{(-9-(-1))^2 + (-5-11)^2} = \sqrt{320} = 8\sqrt{5}$

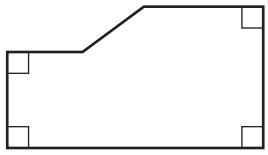
47. $AB = \sqrt{(5-(-11)^2 + (-7-6)^2} = \sqrt{425} = 5\sqrt{17}$

48. $AB = \sqrt{(4-(-3))^2 + (4-(-3))^2} = \sqrt{98} = 7\sqrt{2}$

49. *Sample answer:* If the angle is acute, its measure could also be 82°.

50. *Sample answer:* If the two angles are supplementary, they could both be right angles.

51. *Sample answer:*



52. $m\angle 2 = 147°, m\angle 3 = 147°, m\angle 4 = 33°, m\angle 5 = 33°, m\angle 6 = 147°, m\angle 7 = 147°, m\angle 8 = 33°$

Quiz 2 (p. 164)

1. Yes; consecutive interior angles converse

2. $a \parallel b$ **3.** $a \parallel b$ **4.** $a \parallel b, c \parallel d$

5. *Sample answer:* Since the exterior angles are supplementary the interior angles must also be supplementary. By the consecutive interior angles converse the edges are parallel.

Math & History (p. 164)

1. about 25,000 miles. The value is close to the modern day measurement.

Lesson 3.6

3.6 Guided Practice (p. 168)

1. The y-coordinate of the point where the line crosses the y-axis.

2. 2 **3.** 0; undefined or no slope

4. $m = \frac{4-0}{3-0} = \frac{4}{3}$ **5.** $m = \frac{5-1}{2-4} = -\frac{4}{2} = -2$

6. $m = \frac{4-(-6)}{0-(-8)} = \frac{10}{8} = \frac{5}{4}$

7. parallel; both have slope $\frac{1}{3}$ **8.** not parallel

9. parallel; both have slope $\frac{1}{2}$

10. $-3 = -1(2) + b$

$-3 = -2 + b$

$-1 = b$

$y = -1x - 1$

$y = -x - 1$

3.6 Practice and Applications (pp. 168–171)

11. $\frac{3}{2}$ **12.** -1 **13.** $\frac{1}{2}$ **14.** $m = \frac{6-6}{-6-2} = -\frac{0}{8} = 0$

15. $m = \frac{7-2}{-2-3} = -\frac{5}{5} = -1$

16. $m = \frac{-8-8}{-8-1} = \frac{-16}{-9} = \frac{16}{9}$

17. $m = \frac{9-1}{-5-(-1)} = -\frac{8}{4} = -2$;

$m = \frac{7-1}{0-3} = -\frac{6}{3} = -2$; parallel

18. $m = \frac{4-(-8)}{0-(-3)} = \frac{12}{3} = 4$;

$m = \frac{1-(-7)}{1-(-1)} = \frac{8}{2} = 4$; parallel

19. $m = \frac{4-(-2)}{0-(-2)} = \frac{6}{2} = 3$;

$m = \frac{2-(-6)}{4-2} = \frac{8}{2} = 4$; not parallel

20. $m = \frac{5-3}{-4-(-8)} = \frac{2}{4} = \frac{1}{2}$;

$m = \frac{-1-(-4)}{8-2} = \frac{3}{6} = \frac{1}{2}$; parallel

21. $m = \frac{7-2}{0-(-6)} = \frac{5}{6}$; $m = \frac{1-(-4)}{5-(-2)} = \frac{5}{7}$; not parallel

22. $m = \frac{2-(-4)}{-8-0} = -\frac{6}{8} = -\frac{3}{4}$;

$m = \frac{5-(-2)}{0-8} = -\frac{7}{8}$; not parallel

23. *Sample answer:* Let x be the height and write a proportion. Since we are finding height, we will use a positive slope of $\frac{3}{5}$.

$\frac{3}{5} = \frac{x}{12}$

$5x = 36$

$x = 7.2$ The height is about 7.2 feet.

24. $m = \frac{-6 - (-4)}{0 - 4} = \frac{-2}{-4} = \frac{1}{2}$; slope of $\overleftrightarrow{AB}$ is $\frac{1}{2}$;

$m = \frac{2 - 3}{0 - 2} = \frac{-1}{-2} = \frac{1}{2}$; slope of $\overleftrightarrow{CD}$ is $\frac{1}{2}$;

$m = \frac{-4 - (-7)}{0 - 1} = -\frac{3}{1} = -3$; slope of $\overleftrightarrow{EF}$ is -3;

$\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$

25. $m = \frac{6 - 7}{2 - 4} = \frac{-1}{-2} = \frac{1}{2}$; slope of $\overleftrightarrow{AB}$ is $\frac{1}{2}$;

$m = \frac{-1 - 2}{0 - 6} = \frac{-3}{-6} = \frac{1}{2}$; slope of $\overleftrightarrow{CD}$ is $\frac{1}{2}$;

$m = \frac{-5 - (-2)}{4 - 8} = \frac{-3}{-4} = \frac{3}{4}$; slope of $\overleftrightarrow{EF}$ is $\frac{3}{4}$;

$\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$

26. $m = \frac{10 - 7}{-4 - (-8)} = \frac{3}{4}$; slope of $\overleftrightarrow{AB}$ is $\frac{3}{4}$;

$m = \frac{7 - 4}{-5 - (-2)} = -\frac{3}{3} = -1$; slope of $\overleftrightarrow{CD}$ is -1;

$m = \frac{-3 - (-7)}{2 - 6} = -\frac{4}{4} = -1$; slope of $\overleftrightarrow{EF}$ is -1;

$\overleftrightarrow{CD} \parallel \overleftrightarrow{EF}$

27. $y = 3x + 2$ **28.** $y = \frac{1}{3}x - 4$ **29.** $y = -\frac{2}{9}x$

30. $y = \frac{1}{2}x + 6$ **31.** $y = -3$ **32.** $y = -\frac{2}{9}x - \frac{3}{5}$

33. $y = -6x + 3$ **34.** $y = x + 3$ **35.** $y = -\frac{4}{3}x + 3$

36. $-6 = -2(0) + b$

$-6 = b$

$y = -2x + 6$

37. $9 = -1(-3) + b$

$9 = 3 + b$

$6 = b$

$y = -x + 6$

38. $4 = \frac{1}{2}\left(\frac{3}{2}\right) + b$

$4 = \frac{3}{4} + b$

$\frac{13}{4} = b$

$y = \frac{1}{2}x + \frac{13}{4}$

39. $-4 = 0(2) + b$

$-4 = b$

$y = -4$

40. $-5 = \frac{3}{4}(-7) + b$

$-5 = -\frac{21}{4} + b$

$\frac{1}{4} = b$

$y = \frac{3}{4}x + \frac{1}{4}$

41. $x = 6$

42. $6 = -(-3) + b$

$6 = 3 + b$

$3 = b$

$y = -x + 3$

43. $-2 = \frac{5}{4}(1) + b$

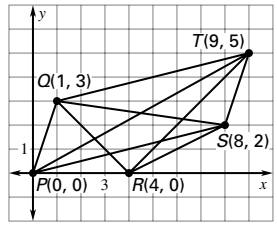
$-2 = \frac{5}{4} + b$

$-\frac{13}{4} = b$

$y = \frac{5}{4}x - \frac{13}{4}$

44. $y = 7$ **45.** *Sample answer:* $y = \frac{1}{3}x$ **46.** $-\frac{3}{20}$

47.



48. $\overline{PQ} \parallel \overline{ST}$, $\overline{PS} \parallel \overline{QT}$. The slopes are $\overline{PQ}$, 3; $\overline{PR}$, 0; $\overline{PT}$, $\frac{5}{9}$; $\overline{PS}$, $\frac{1}{4}$; $\overline{QR}$, -1; $\overline{QS}$, $-\frac{1}{7}$; $\overline{QT}$, $\frac{1}{4}$; $\overline{RS}$, $\frac{1}{2}$; $\overline{RT}$, 1; $\overline{ST}$, 3

49. 5%; no **50.** 6%; yes **51.** 9%; yes **52.** 9%; no

53. $y = x$; 45° **54.** $y = 2x$; no (The angle is about 63°.)

55. C **56.** E

57. $-2 = \frac{k - (-1)}{4 - (-2)}$

$-2 = \frac{k + 1}{6}$

$-12 = k + 1$

$-13 = k$

58. $-\frac{1}{4} = \frac{-10 - (-6)}{k - 5}$

$-\frac{1}{4} = \frac{-4}{k - 5}$

$-k + 5 = -16$

$-k = -21$

$k = 21$

3.6 Mixed Review (p. 171)

59. $\frac{1}{20}$ **60.** $-\frac{1}{3}$ **61.** $-\frac{1}{11}$ **62.** $\frac{1}{340}$ **63.** $\frac{7}{3}$ **64.** $-\frac{3}{13}$

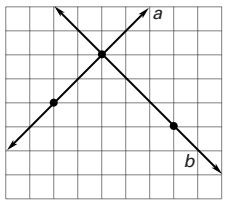
65. -2 **66.** 4 **67.** -9 **68.** 4 **69.** $-\frac{35}{3} = -11\frac{2}{3}$

70. $\frac{22}{3} = 7\frac{1}{3}$ **71.** Yes, Alternate Exterior Angles Converse

72. Yes, Corresponding Angles Converse **73.** no

Activity (p. 172)

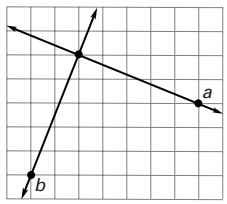
1. *Sample answer:*



2. Slope of $a = 1$ Slope of $b = -1$

3. $1 \times (-1) = -1$

4. *Sample answer:*



Slope of $a = -\frac{2}{5}$

Slope of $b = \frac{5}{2}$

$\left(-\frac{2}{5}\right)\left(\frac{5}{2}\right) = -1$

Lesson 3.7

3.7 Guided Practice (p. 175)

1. $\frac{\text{rise}}{\text{run}}$ **2.** 5

3. yes; *Sample answer:* the slope of $\overleftrightarrow{AC}$ is -2, and the slope of $\overleftrightarrow{BD}$ is $\frac{1}{2}$, and $(-2)\left(\frac{1}{2}\right) = -1$.

4. not perpendicular **5.** perpendicular **6.** $y = -\frac{1}{3}x$

3.7 Practice and Applications (pp. 175–177)

7. yes **8.** no **9.** yes **10.** yes **11.** no **12.** yes

13. $-\frac{1}{2}$; $(2)\left(-\frac{1}{2}\right) = -1$ **14.** $-\frac{1}{5}$; $(5)\left(-\frac{1}{5}\right) = -1$

15. $\frac{1}{3}$; $(-3)\left(\frac{1}{3}\right) = -1$ **16.** $\frac{1}{7}$; $(-7)\left(\frac{1}{7}\right) = -1$

17. $-\frac{3}{2}$; $\left(\frac{2}{3}\right)\left(-\frac{3}{2}\right) = -1$ **18.** -5; $\left(\frac{1}{5}\right)(-5) = -1$

19. 3; $\left(-\frac{1}{3}\right)(3) = -1$ **20.** $\frac{3}{4}$; $\left(-\frac{4}{3}\right)\left(\frac{3}{4}\right) = -1$

21. Slope of $\overleftrightarrow{AC}$: 3 $\quad m = \frac{-2-1}{-1-0} = \frac{-3}{-1} = 3$

Slope of $\overleftrightarrow{BD}$: $-\frac{1}{3}$ $\quad m = \frac{2-0}{-3-3} = -\frac{2}{6} = -\frac{1}{3}$

perpendicular

22. Slope of $\overleftrightarrow{AC}$: $\frac{3}{4}$ $\quad m = \frac{-3-0}{-1-3} = \frac{-3}{-4} = \frac{3}{4}$

Slope of $\overleftrightarrow{BD}$: $-\frac{3}{2}$ $\quad m = \frac{1-(-2)}{-1-1} = \frac{3}{-2} = -\frac{3}{2}$

not perpendicular

23. Slope of $\overleftrightarrow{AC}$: $\frac{1}{3}$ $\quad m = \frac{-1-1}{-2-4} = \frac{-2}{-6} = \frac{1}{3}$

Slope of $\overleftrightarrow{BD}$: $-\frac{5}{2}$ $m = \frac{3-(-2)}{-2-0} = -\frac{5}{2}$

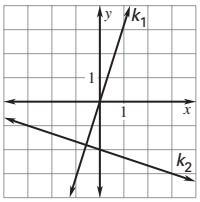
not perpendicular

24. Slope of $\overleftrightarrow{AC}$: -2 $m = \frac{0-(-2)}{-3-(-2)} = -\frac{2}{1} = -2$

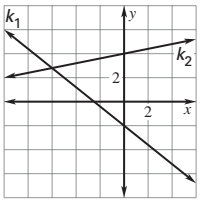
Slope of $\overleftrightarrow{BD}$: $\frac{1}{2}$ $\quad m = \frac{-3-0}{-4-2} = \frac{-3}{-6} = \frac{1}{2}$

perpendicular

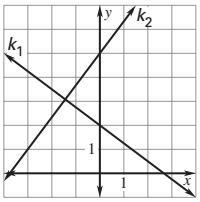
25. perpendicular



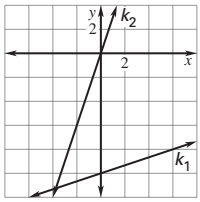
26. not perpendicular



27. perpendicular



28. not perpendicular



29. $3y - 4x = 3$

$3y = 4x + 3$

$y = \frac{4}{3}x + 1$

$4y + 3x = -12$

$4y = -3x - 12$

$y = -\frac{3}{4}x - 3$

perpendicular

30. $y - 6x = 2$

$y = 6x + 2$

$6y - x = 12$

$6y = x + 12$

$y = \frac{1}{6}x + 12$

not perpendicular

31. $3y + 2x = -36$

$3y = -2x - 36$

$y = -\frac{2}{3}x - 12$

$4y - 3x = 16$

$4y = 3x + 16$

$y = \frac{3}{4}x + 4$

not perpendicular

32. $5y + 3x = -15$

$5y = -3x - 15$

$y = -\frac{3}{5}x - 3$

$3y - 5x = -33$

$3y = 5x - 33$

$y = \frac{5}{3}x - 11$

perpendicular

33. Slope of $\overleftrightarrow{AB}$: -1; slope of $\overleftrightarrow{PQ}$: $\frac{6}{7}$; slope of $\overleftrightarrow{WV}$: -1

$\overleftrightarrow{AB} \parallel \overleftrightarrow{WV}$

34. Slope of $\overleftrightarrow{FE}$: $-\frac{1}{3}$; slope of $\overleftrightarrow{GH}$: 4; slope of $\overleftrightarrow{KL}$: $-\frac{2}{5}$

35. Slope of $\overleftrightarrow{AZ}$: $\frac{2}{3}$; slope of $\overleftrightarrow{CD}$: $-\frac{4}{3}$; slope of $\overleftrightarrow{RS}$: $\frac{3}{4}$

$\overleftrightarrow{CD} \perp \overleftrightarrow{RS}$

36. Slope of $\overleftrightarrow{OP}$: $\frac{4}{3}$; slope of $\overleftrightarrow{ST}$: $-\frac{3}{4}$; slope of $\overleftrightarrow{QR}$: $-\frac{6}{7}$

$\overleftrightarrow{OP} \perp \overleftrightarrow{ST}$

37. *Sample answer:* the slopes are 2 and $-\frac{1}{2}$, and the product of the two slopes is -1.

38. $3 = -2(0) + b$

$3 = b$

$y = -2x + 3$

39. $1 = -\frac{3}{5}(5) + b$

$1 = -3 + b$

$4 = b$

$y = -\frac{3}{5}x + 4$

40. $2 = \frac{1}{4}(-2) + b$

$2 = -\frac{2}{4} + b$

$\frac{5}{2} = b$

$y = \frac{1}{4}x + \frac{5}{2}$

41. $3y + 4x = 12$

$3y = -4x + 12$

$y = -\frac{4}{3}x + 4$

$-4 = \frac{3}{4}(-3) + b$

$-4 = -\frac{9}{4} + b$

$-\frac{7}{4} = b$

$y = \frac{3}{4}x - \frac{7}{4}$

42. $0 = \frac{4}{3}(8) + b$

$0 = \frac{32}{3} + b$

$-\frac{32}{3} = b$

$y = \frac{4}{3}x - \frac{32}{3}$

43. $-10 = -7(7) + b$

$-10 = -49 + b$

$39 = b$

$y = -7x + 39$

44. $-4 = -\frac{1}{3}(-3) + b$

$-4 = 1 + b$

$-5 = b$

$y = -\frac{1}{3}x - 5$

45. $-5 = \frac{5}{2}(5) + b$

$-5 = \frac{25}{2} + b$

$-\frac{35}{2} = b$

$y = \frac{5}{2}x - \frac{35}{2}$

46. $-1 = -4(-1) + b$

$-1 = 4 + b$

$-5 = b$

$y = -4x - 5$

47. parallel

48. parallel **49.** perpendicular **50.** neither

51. **a.** yes; both have slope $-\frac{3}{2}$

b. yes; their slopes are $-\frac{3}{2}$ and $\frac{2}{3}$

c. *Sample answer:* Calculate the slopes of l_1 and n and show that their product is -1; use the results of parts (a) and (b) and the result that if a line is perpendicular to one of two parallel lines, it is perpendicular to the other also.

52. $y = \frac{1}{2}x + 1$

53. $y = -2x + 12$

$y = \frac{1}{2}x + 1$

$y = -2x + 12$

$4y = 2x + 4$

$5y = 16$

$y = \frac{16}{5}$

$\frac{16}{5} = -2x + 12$

$16 = -10x + 60$

$10x = 44$

$x = \frac{22}{5}$

$\left(\frac{22}{5}, \frac{16}{5}\right)$

54. $d = \sqrt{\left(\frac{22}{5} - 2\right)^2 + \left(\frac{16}{5} - 2\right)^2}$

$= \sqrt{\frac{144}{25} + \frac{36}{25}}$

$= \frac{\sqrt{180}}{5} = \frac{6\sqrt{5}}{5} \approx 2.68$

3.7 Mixed Review (p. 178)

55. 142° **56.** 144° **57.** 35° **58.** 142° **59.** $\angle 6$

60. $\angle 7$ **61.** $\angle 6$ **62.** $\angle 5$

63. *Sample answer:* A paragraph proof presents statements and reasons in a string of sentences. A two-column proof presents a list of statements with a reason for each one. A flow proof shows a logical arrangement of statements with a reason for each one.

Quiz 3 (p. 178)

1. $m = \frac{8 - 2}{5 - 1} = \frac{6}{4} = \frac{3}{2}$ **2.** $m = \frac{5 - (-3)}{-1 - 2} = -\frac{8}{3}$

3. $2 = 3(0) + b$

$2 = b$

$y = 3x + 2$

4. $-4 = \frac{1}{2}(2) + b$

$-4 = 1 + b$

$-5 = b$

$y = \frac{1}{2}x - 5$

5. yes; slopes have a product of -1

6. $y - 3x = -2$

$y = 3x - 2$

no

$3y - x = 12$

$3y = x + 12$

$y = \frac{1}{3}x + 4$

7. $m = \frac{5}{5} = 1$

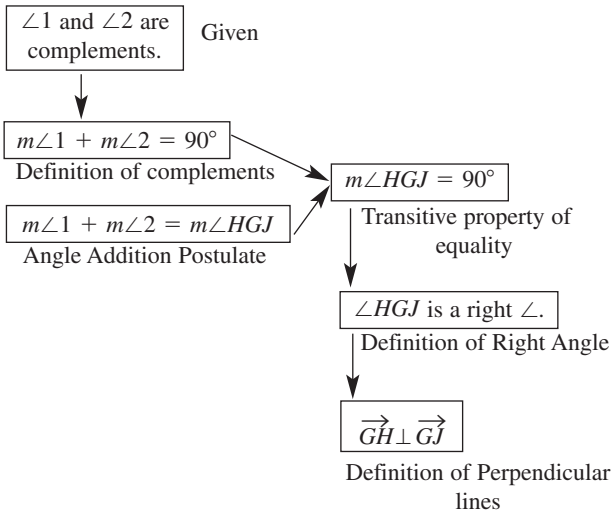
Chapter 3 Review *(pp. 180–182)*

1. alternate exterior **2.** alternate interior

3. *Sample answer:* $\overleftrightarrow{CG}$ **4.** *Sample answer:* $\overleftrightarrow{AC}$

5. *Sample answer:* $\overleftrightarrow{AB}$

6.



7. $m\angle 2 = 105°$; $m\angle 3 = 105°$, $m\angle 4 = 75°$, $m\angle 5 = 75°$
$m\angle 6 = 105°$

8. $(7x - 8) + 62 = 180$ Consecutive interior angles are supplementary.

$7x + 54 = 180$

$7x = 126$

$x = 18$

9. $(4x + 4) = 92$ Alternate interior angles are congruent.

$4x = 88$

$x = 22$

10. By the Vertical Angles Theorem, the angle vertical to the angle labeled $(44 - 3x)°$ also has measure $(44 - 3x)°$.

$(44 - 3x) + 25 = 180$ Consecutive interior angles are supplementary.

$-3x + 69 = 180$

$-3x = 111$

$x = -37$

11.

Statements	Reasons
1. $m\angle 4 = 60°$; $m\angle 7 = 120°$	**1.** Given
2. $m\angle 4 + m\angle 7 = 180°$	**2.** Addition property of equality
3. $\angle 4$ and $\angle 7$ are supplementary.	**3.** Definition of supplementary angles
4. $l \parallel m$	**4.** Consecutive interior angles converse

12.

Statements	Reasons
1. $\angle 1$ and $\angle 7$ are supplementary.	**1.** Given
2. $m\angle 1 + m\angle 7 = 180°$	**2.** Definition of supplementary angles
3. $\angle 1 \cong \angle 4$	**3.** Vertical angles theorem
4. $m\angle 1 = m\angle 4$	**4.** Definition of angle congruence
5. $m\angle 4 + m\angle 7 = 180°$	**5.** Substitution property of equality
6. $\angle 4$ and $\angle 7$ are supplementary.	**6.** Definition of supplementary angles
7. $l \parallel m$	**7.** Consecutive interior angles converse

13. $j \parallel k$; Corresponding Angles Converse

14. $m \parallel n$; Alternate Interior Angles Converse

15. $m \parallel n$; Consecutive Interior Angles Converse

16. $j \parallel k$, $k \parallel l$, $j \parallel l$; Corresponding Angles Converse, Alternate Exterior Angles Converse, Theorem 3.11

17. Slope of $\overleftrightarrow{AB} = \frac{2 - 0}{2 - (-2)} = \frac{2}{4} = \frac{1}{2}$ parallel

Slope of $\overleftrightarrow{CD} = \frac{(1) - (-1)}{1 - (-1)} = \frac{1}{2}$

18. Slope of $\overleftrightarrow{EF} = \frac{-1 - 3}{2 - (-2)} = -\frac{4}{4} = -1$ parallel

Slope of $\overleftrightarrow{GH} = \frac{2 - (-3)}{-3 - 2} = -\frac{5}{5} = -1$

19. Slope of $\overleftrightarrow{JK} = \frac{1 - (-2)}{-2 - (-3)} = \frac{3}{1} = 3$ not parallel

Slope of $\overleftrightarrow{MN} = \frac{3 - (-2)}{4 - 2} = \frac{5}{2}$

20. $-4 = -2(-1) + b$

$-4 = 2 + b$

$-6 = b$

$y = -2x - 6$

21. yes **22.** no **23.** yes

24. $6 = \frac{1}{3}(-3) + b$

$6 = -1 + b$

$7 = b$

$y = \frac{1}{3}x + 7$

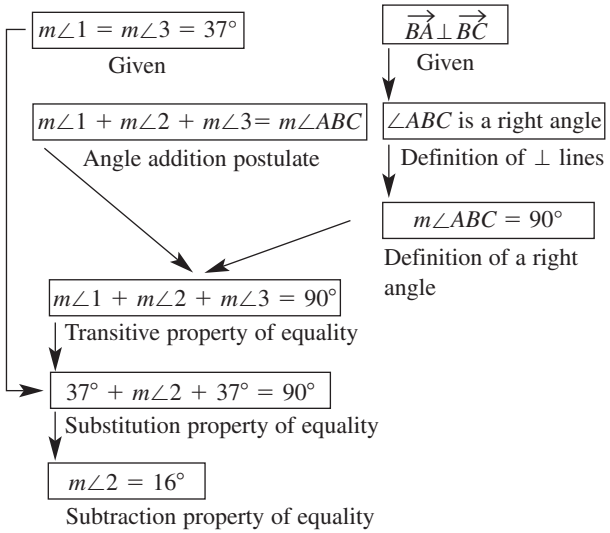
Chapter 3 Test *(p. 183)*

1. alternate interior angles **2.** supplementary angles

3. corresponding angles **4.** alternate exterior angles

5. consecutive interior angles **6.** vertical angles

7.



8. $\angle 2, \angle 4, \angle 6, \angle 8$ **9.** $l \parallel n$ **10.** $m \parallel n$ **11.** $p \parallel q$; $l \parallel m$

12. $1 = -\frac{1}{3}(0) + b$

$1 = b$

$y = -\frac{1}{3}x + 1$

13. $2 = \frac{1}{2}(-1) + b$

$2 = -\frac{1}{2} + b$

$\frac{5}{2} = b$

$y = \frac{1}{2}x + \frac{5}{2}$

14. *Sample answer:* Washington Monument; yes. The lines that form the top are skew to the opposite sides of the base of the monument.

15. Yes; Theorem 3.12: If two coplanar lines are perpendicular to the same line, then they are parallel to each other.

16.

Statements	Reasons
1. $\angle 1 \cong \angle 2, \angle 3 \cong \angle 4$	**1.** Given
2. $l \parallel m$	**2.** Corresponding angles converse
3. $\angle 4 \cong \angle 5$	**3.** Alternate interior angles theorem
4. $\angle 3 \cong \angle 5$	**4.** Transitive property of angle congruence
5. $n \parallel p$	**5.** Corresponding angles converse

Chapter 3 Standardized Test *(pp. 184–185)*

1. B **2.** C **3.** C **4.** D **5.** A **6.** A **7.** D **8.** D

9. A **10.** **a.** always **b.** never **c.** always **d.** sometimes

11. *Sample answers:* Since $m\angle 4 = 65°$ and $m\angle 5 = 115°$, they are supplementary because their measures add up to 180°. $\angle 3$ and $\angle 4$ are supplementary because they form a linear pair. By the Congruent Supplements Thm., it follows that $\angle 3 \cong \angle 5$. Therefore, by the Alternate Interior Angles Converse, $r \parallel s$.

Since $m\angle 4 = 65°$ and $m\angle 5 = 115°$, they are supplementary because their measures add up to 180°. $\angle 5$ and $\angle 6$ are supplementary because they form a linear pair. By the Congruent Supplement Thm., it follows that $\angle 4 \cong \angle 6$. Therefore, by the Alternate Exterior Angle Converse, $r \parallel s$.

12. $1 = -\frac{1}{3}(1) + b$

$1 = -\frac{1}{3} + b$

$\frac{4}{3} = b$

$y = -\frac{1}{3}x + \frac{4}{3}$

13. $0 = 3(4) + b$

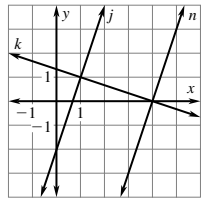
$0 = 12 + b$

$-12 = b$

$y = 3x - 12$

14. *Sample answer:* Check to see if they have the same slope; solve them as a system of equations.

15.



16. The slope of the ramp is $\frac{6}{60} = \frac{1}{10}$ which is greater than $\frac{1}{12}$, the building code requirement. The ramp in the diagram is too steep.

17. Let x = length of base needed to meet slope specification. Then the top of the ramp would be at $(x, 6)$.

$\frac{6 - 0}{x - 0} = \frac{1}{12}$

$x = 72$

$72 - 60 = 12$

12 inches longer; the slanted part will then stop at (72, 6).

Cumulative Practice (pp. 186–187)

1. You add 2, then 3, then 4, and so on; 30

2. B **3.** $\overleftrightarrow{DT}$ **4.** $\overrightarrow{GB}$

5. Exactly one; through any three noncollinear points there is exactly one plane.

6. $d = \sqrt{(-3 - 7)^2 + (-1 - (-5))^2}$

$= \sqrt{100 + 16}$

$= \sqrt{116} \approx 10.8$

7. $\left(\frac{7 + x}{2}, \frac{-5 + y}{2}\right) = (-3, -1)$

$\frac{7 + x}{2} = -3$

$7 + x = -6$

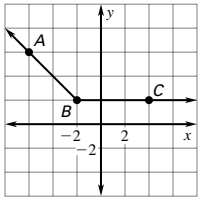
$x = -13$

$\frac{-5 + y}{2} = -1$

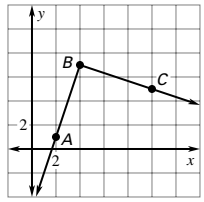
$-5 + y = -2$

$y = 3$

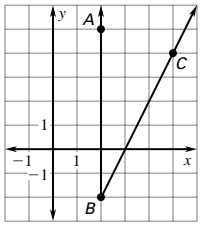
8. obtuse



9. right



10. acute



11. $x + 3 = 9$

$x = 6$

$7y - 2 + (6) + 3 + 9 = 30$

$7y + 16 = 30$

$7y = 14$

$y = 2$

12. $3x + 15x = 180$

$18x = 180$

$x = 10$

$10(10 + y) = 15(10)$

$100 + 10y = 150$

$10y = 50$

$y = 5$

13. $(3x + 6) + (2x + 4) = 90$

$5x + 10 = 90$

$5x = 80$

$x = 16$

$2(16) + 4 = y$

$32 + 4 = y$

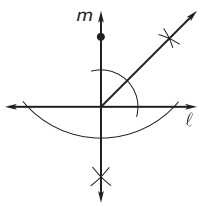
$36 = y$

14. $A = (10)^2 = 100 \text{ cm}^2$

15. $A = \dfrac{(10)(8)}{2} = \dfrac{80}{2}$

$= 40$ square units

16.



17. If-then: If an angle is a straight angle, then its measure is 180°.

Inverse: If an angle is not a straight angle, then its measure is not 180°.

Converse: If the measure of an angle is 180°, then the angle is a straight angle.

Contrapositive: If the measure of an angle is not 180°, then the angle is not a straight angle.

18. For example, consider the three lines at a corner of a room.

19. Two lines can intersect to form acute and obtuse angles.

20. *Sample answer:* If $AB = 2$, $BC = 6$, and $AC = 8$, then $AB + BC = AC$ but B is not the midpoint of $\overline{AC}$.

21. *Sample answer:* If $\angle 1$ and $\angle 2$ are vertical angles, and $\angle 1$ and $\angle 2$ are right angles, then the angles are supplementary but do not form a linear pair.

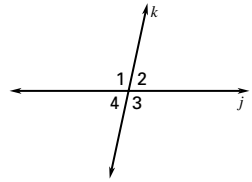
22. $3(s - 2) = 15$ Given

$3s - 6 = 15$ Distributive property

$3s = 21$ Addition property of equality

$s = 7$ Division property of equality

23.



Sample answer: $\angle 1$ and $\angle 2$ are a linear pair because their noncommon sides are opposite rays.

Sample answer: $\angle 1$ and $\angle 3$ are vertical angles because both of the noncommon sides are opposite rays.

24. $x = 0$ if and only if $x + x = x$; true

25. Yes, by the law of Detachment

26. $\angle 1$ and $\angle 7$, $\angle 4$ and $\angle 9$, $\angle 2$ and $\angle 4$, $\angle 5$ and $\angle 10$.

27. 55° **28.** 40°

29. $\overleftrightarrow{BC} \parallel \overleftrightarrow{DE}$ by the Consecutive interior angles converse

30.

Statements	Reasons
1. $\angle 6 \cong \angle 9$	**1.** Given
2. $\overline{CE} \parallel \overline{BD}$	**2.** Alternate interior angles converse
3. $\angle 3$ and $\angle 4$ are supplementary	**3.** Consecutive interior angles theorem

31. the slope of $\overleftrightarrow{AD}$ is $\dfrac{-11}{23}$, the slope of $\overleftrightarrow{BC}$ is $\dfrac{-11}{23}$.

$$m = \frac{-1 - 10}{25 - 2} = \frac{-11}{23} = -\frac{11}{23}$$

$$m = \frac{6 - (-5)}{-1 - 22} = \frac{11}{-23} = -\frac{11}{23}$$

32. the slope of $\overleftrightarrow{BA}$ is $\dfrac{-3}{4}$, the slope of $\overleftrightarrow{AC}$ is $\dfrac{4}{3}$.

$$m = \frac{-5 - 10}{22 - 2} = -\frac{15}{20} = -\frac{3}{4}$$

$$m = \frac{10 - 6}{2 - (-1)} = \frac{4}{3}$$

The product of the slopes is -1.

33. $6 = -\dfrac{3}{4}(-1) + b$

$6 = \dfrac{3}{4} + b$

$\dfrac{21}{4} = b$

$y = -\dfrac{3}{4}x + \dfrac{21}{4}$

34. distance around track: $2(110) + 50(3.14) \approx 377$ yd
enclosed area: $3.14(25)^2 + 50 \cdot 110 \approx 7462.5$ yd^2

35. **a.** $6 \cdot 1.5 = 9$ in.

$4 \cdot 1.5 = 6$ in.,

6 in. by 9 in.

b. $\angle 1$ and $\angle 3$ are complementary.

c. $\angle 1$ and $\angle 2$ are supplementary.

36. **a.** 145°

b. $\angle 1$

c. By Theorem 3.12, in a plane, if two lines are perpendicular to the same line, then they are parallel to each other.