CHAPTER 2

Think & Discuss *(p. 69)*

1. First, you must convert feet to inches.

$$700 \text{ ft} \times \frac{12 \text{ in.}}{1 \text{ ft}} = 8400 \text{ in.}$$

Dante II has an average stride of 45 inches, so divide 8400 inches by 45 inches.

$$\frac{8400}{45} \approx 187 \text{ steps}$$

2. "If the distance to the bottom of the crater is x feet and your stride is y inches, then convert x feet into $12x$ inches and divide by y inches."

Skill Review *(p. 70)*

1. D **2.** B **3.** F **4.** E **5.** 142° **6.** 142° **7.** 38°

Lesson 2.1

2.1 Guided Practice (p. 75)

1. converse

2. **a.** Postulate 7: If two lines intersect, then their intersection is exactly one point.

b. Postulate 10: If two points lie in a plane, then the line containing them lies in the plane.

3. Hypothesis: The dew point equals the air temperature.

Conclusion: It will rain.

4. If the African ball python is threatened, then it will protect itself by coiling into a ball with its head in the middle.

5. If an angle is a right angle, then its measure is 90°.

6. Inverse: If a cactus is not of the *cereus* variety, then its flowers do not open at night.

Converse: If a cactus' flowers open at night, then it is of the *cereus* variety.

Contrapositive: If a cactus' flowers do not open at night, then it is not of the *cereus* variety.

7. false **8.** true

2.1 Practice and Applications (pp. 75-78)

9. If an object weighs 2000 pounds, then it weighs one ton.

10. If an object weighs one pound, then it weighs 16 ounces.

11. If three points lie on the same line, then the points are collinear.

12. If a fish is a blue trunkfish, then it lives in the waters of a coral reef.

13. If a fish is a hagfish, then it lives in salt water.

14. true

15. False; let $x = -3$. The hypothesis is true because $(-3)^4 = 81$. However, the conclusion is false, so the conditional statement is false.

16. true **17.** true

18. If $\angle 1$ is obtuse, then $\angle 1$ measures 123°.

19. If $\angle 2$ is acute, then $\angle 2$ measures 38°.

20. If I go to the mall, then it is not raining.

21. If I go the movies, then it is raining.

22. If-then: If a line exists, then it contains at least two points.

Inverse: If a line does not exist, then it is not true that it contains at least two points.

Converse: If a line contains at least two points, then the line exists.

Contrapositive: If it is not true that a line contains at least two points, then the line does not exist.

23. If-then: If three noncollinear points are distinct, then there is exactly one plane that they lie in.

Inverse: If three noncollinear points are not distinct, then it is not true that there is exactly one plane that they lie in.

Converse: If exactly one plane contains three noncollinear points, then the three points are distinct.

Contrapositive: If it is not true that there is exactly one plane that contains three noncollinear points, then the three points are not distinct.

24. If-then: If a plane exists, then it contains at least three non-collinear points.

Inverse: If a plane does not exist, then it is not true that it contains at least three noncollinear points.

Converse: If a plane contains at least three noncollinear points, then the plane exists.

Contrapositive: If it is not true that a plane contains at least three non-collinear points, then the plane does not exist.

25. one **26.** two **27.** line **28.** a line

29. Postulate 5: Through any two points there exists exactly one line.

30. Postulate 6: A line contains at least two points.

31. Postulate 8: Through any three noncollinear points there exists exactly one plane.

32. Postulate 10: If two points lie in a plane, then the line containing them lies in the plane.

33. Postulate 11: If two planes intersect, then their intersection is a line.

34. Postulate 7: If two lines intersect, then their intersection is exactly one point.

35. Postulate 6: A line contains at least two points.

36. Postulate 11: If two planes intersect, then their intersection is a line.

37. Postulate 8: Through any three noncollinear points there exists exactly one plane.

38. Postulate 5: Through any two points there exists exactly one line.

39. *Sample answer*: If you are at least eighteen years old, then you may register to vote.

40. No; through any two points there exists exactly one line.

41. Yes; points A and B could lie on the line intersecting two planes.

42. Yes; take point A and any two points on line k and you can form a plane through those three points that contains all of line k.

43. Yes; the plane that runs from the front of the room to the back of the room through points A and B, contains both points and a point on the front wall.

44. Inverse: If $x \neq y$, then $5x \neq 5y$.

Converse: If $5x = 5y$, the $x = y$.

Contrapositive: If $5x \neq 5y$, then $x \neq y$.

45. Inverse: If $x \neq 4$, then $6x - 6 \neq x + 14$.

Converse: If $6x - 6 = x + 14$, then $x = 4$.

Contrapositive: If $6x - 6 \neq x + 14$, then $x \neq 4$.

46. If-then: If you tell the truth, then you don't have to remember anything.

a. Hypothesis: You tell the truth.

Conclusion: You don't have to remember anything.

b. Inverse: If you don't tell the truth, then you have to remember something.

47. If-then: If one feels the impulse to soar, then one can never consent to creep.

a. Hypothesis: One feels the impulse to soar.

Conclusion: One can never consent to creep.

b. Inverse: If one does not feel the impulse to soar, then one can consent to creep.

48. If-then: If freedom does not include the freedom to make mistakes, then freedom is not worth having.

a. Hypothesis: Freedom does not include the freedom to make mistakes.

Conclusion: Freedom is not worth having.

b. Inverse: If freedom does include the freedom to make mistakes, then it is worth having.

49. If-then: If a man is early to bed and early to rise, then the man will be healthy, wealthy, and wise.

a. Hypothesis: A man is early to bed and early to rise

Conclusion: The man is healthy, wealthy, and wise

b. Inverse: If a man is not early to bed and early to rise, then the man is not healthy, wealthy, and wise.

50. If-then: If you want a great selection of used cars, then come and see Bargain Bob's Used Cars.

Hypothesis: You want a great selection of used cars.

Conclusion: Come and see Bargain Bob's Used Cars.

51. Inverse: If you do not want a great selection of used cars, then don't come and see Bargain Bob's Used Cars.

Converse: If you come and see Bargain Bob's used cars, then you want a great selection of used cars.

Contrapositive: If you don't come and see Bargain Bob's Used Cars, then you don't want a great selection of used cars.

52. *Sample answer:* If you eat an apple a day, then you will keep the doctor away.

Inverse: If you do not eat an apple a day, then you will not keep the doctor away.

Converse: If you keep the doctor away, then you will eat an apple a day.

Contrapositive: If you will not keep the doctor away, then you will not eat an apple a day.

53. Check work.

54. *Sample answer:* By Postulate 9, a plane contains at least three noncollinear points. Because the CRAB has three legs, its bottom surface can be considered a plane. As the ocean floor is comprised of many intersecting planes, a planar surface moving above the ocean floor can map where the planes are parallel and where they would intersect.

55. D **56.** D

57. Postulate 6: A line contains at least two points.

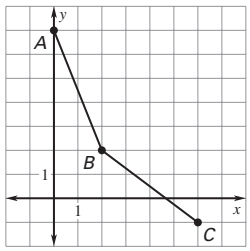
58. Postulate 8: Through any three noncollinear points there exists exactly one plane.

59. Postulate 10: If two points lie in a plane, then the line containing them lies in the plane.

60. Answers will vary.

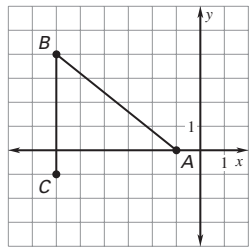
2.1 Mixed Review (p. 78)

61.



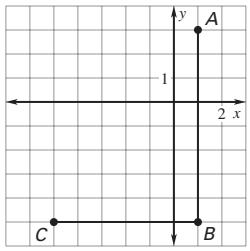
obtuse

62.



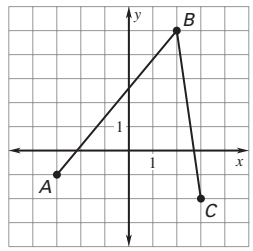
acute

63.



right

64.



acute

65. $M = \left(\frac{-2 + 4}{2}, \frac{8 - 12}{2}\right)$
$= (1, -2)$

66. $M = \left(\frac{8 - 6}{2}, \frac{8 + 1}{2}\right)$
$= (1, 4.5)$

67. $M = \left(\frac{-7 + 4}{2}, \frac{-4 + 7}{2}\right)$
$= (-1.5, 1.5)$

68. $M = \left(\frac{0 - 8}{2}, \frac{-9 + 5}{2}\right)$
$= (-4, -2)$

69. $M = \left(\frac{1 + 11}{2}, \frac{4 - 6}{2}\right)$
$= (6, -1)$

70. $M = \left(\frac{-10 + 2}{2}, \frac{-10 + 12}{2}\right)$
$= (-4, 1)$

71. $A = (6)^2\pi \approx 113.04 \text{ m}^2$
$C = 2(6)\pi \approx 37.68 \text{ m}$

72. $A = (11)^2 = 121 \text{ cm}^2$
$P = 4(11) = 44 \text{ cm}$

73. $A = (38.75)^2 = 1501.5625 \text{ mm}^2$
$P = 4(38.75) = 155 \text{ mm}$

74. $A = \left(\frac{23}{2}\right)^2\pi \approx 415.265 \text{ ft}^2$
$C = 2\left(\frac{23}{2}\right)\pi \approx 72.22 \text{ ft}$

Lesson 2.2

2.2 Guided Practice (p. 82)

1. *Sample answer:* A true biconditional statement is one that is true when read both forwards and backwards.

2. The statements are equivalent. If the first statement used the phrase "if and only if," rather than "only if," then they would not be equivalent.

3. No. For a statement to be a biconditional statement it must contain the phrase "if and only if."

4. yes **5.** yes

6. Conditional statement: If the ceiling fan runs, then the light switch is on.

Converse: If the light switch is on, then the ceiling fan runs.

7. Conditional statement: If you scored a touchdown, then the football crossed the goal line.

Converse: If the football crossed the goal line, then you scored a touchdown.

8. Conditional statement: If the expression $3x + 4$ is equal to 10, then x is 2.

Converse: If x is 2, then the expression $3x + 4$ is equal to 10.

9. False; the points do not lie on the same line.

10. False; $\angle CBA$ is a straight angle, so its measure is 180°.

11. True; $\angle DBA$ and $\angle EBC$ each are supplementary to right angle $\angle DBC$, so each measures 90°.

12. True; $\overline{DE}$ and $\overline{AC}$ intersect at a right angle.

2.2 Practice and Applications (pp. 82–85)

13. false **14.** true **15.** false **16.** true **17.** false

18. true **19.** true

20. Conditional statement: If two angles are congruent, then they have the same measure.

Converse: If two angles have the same measure, then they are congruent.

21. Conditional statement: If a ray bisects an angle, then it divides the angle into two congruent angles.

Converse: If a ray divides an angle into two congruent angles, then the ray bisects the angle.

22. Conditional statement: If two lines are perpendicular, then they intersect to form right angles.

Converse: If two lines intersect to form right angles, then the lines are perpendicular.

23. Conditional statement: If a point is a midpoint of a segment, then it divides the segment into two congruent segments.

Converse: If a point divides a segment into two congruent segments, then it is the midpoint of the segment.

24. A 100° angle is obtuse, but does not measure 94°.

25. Two angles measuring 30° and 60° are complementary, but they do not measure 42° and 48°.

26. Terry could live in Orlando, Florida, not in Tampa, Florida.

27. A rectangle that is 2 m wide and 3 m long has four sides, but is not a square.

28. true

29. False; PQ and PS are equal if they are both 5 cm.

30. False; $\angle PQR$ and $\angle QRS$ are supplementary if $m\angle PQR = 85°$ and $m\angle QRS = 95°$.

31. true

32. Conditional statement: If two angles are adjacent, then they share a common side.

Converse: If two angles share a common side, then they are adjacent angles.

Biconditional statement: Two angles are adjacent if and only if they share a common side.

33. Conditional statement: If two circles have the same diameter, then they have the same circumference.

Converse: If two circles have the same circumference, then they have the same diameter.

Biconditional statement: Two circles have the same circumference if and only if they have the same diameter.

34. Conditional statement: If a number is the perimeter of a triangle, then it is the sum of the lengths of the triangle's sides.

Converse: If a number is the sum of the lengths of the sides of a triangle, then it is the perimeter of the triangle.

Biconditional statement: A number is the perimeter of a triangle if and only if it is the sum of the lengths of the triangle's sides.

35. Conditional statement: If an animal is a leopard, then it has spots.

Converse: If an animal has spots, then it is a leopard.

Counterexample: A Dalmatian dog has spots, but is not a leopard.

36. Conditional statement: If an animal is a panther, then it lives in the forest.

Converse: If an animal lives in the forest, then it is a panther.

Counterexample: A bear lives in the forest, but is not a panther.

37. Conditional statement: If a leopard has pale gray fur, then it is a snow leopard.

Converse: If a leopard is a snow leopard, then it has pale gray fur.

Biconditional statement: A leopard is a snow leopard if and only if it has pale gray fur.

38. Yes; $3u + 2 = u + 12$ if and only if $u = 5$.

39. No; v can be any number if $9v - 4v = 2v + 3v$.

40. No; if $w = -3$, $(-3)^2 - 10 = -1 = (-3) + 2$, so the statement is not true (although the converse is true). If $w^2 - 10 = w + 2$, then w equals *either* 4 or -3.

41. Yes; $x^3 - 27 = 0$ if and only if $x = 3$.

42. No; if $y = 3$, then $(3)^2 = 9$.

43. No; z can be any number if $7 + 18z = 5z + 7 + 13z$.

44. Converse: If $m\angle ABC + m\angle CBD = m\angle ABD$, then C is in the interior of $\angle ABD$.

Biconditional statement: C is in the interior of $\angle ABD$ if and only if $m\angle ABC + m\angle CBD = m\angle ABD$.

45. *Sample answer:* You received an A or B in all of your classes if and only if you made the honor roll.

46. A musical group is a *piano trio* if and only if it contains exactly 1 pianist, 1 violinist, and 1 cellist; If a musical group is a *piano trio*, then it contains exactly 1 pianist, 1 violinist, and 1 cellist; If a musical group contains exactly 1 pianist, 1 violinist, and 1 cellist, then the musical group is a *piano trio*.

A musical group is a *string quartet* if and only if it contains exactly 2 violinists, 1 cellist, and 1 violist; If a musical group is a *string quartet*, then it contains exactly 2 violinists, 1 cellist, and 1 violist; If a musical group contains exactly 2 violinists, 1 cellist, and 1 violist, then the musical group is a *string quartet*.

A musical group is a *string quintet* if and only if it contains exactly 2 violinists, 1 cellist, and 2 violists; If a musical group is a *string quintet*, then it contains exactly 2 violinists, 1 cellist, and 2 violists; If a musical group contains exactly 2 violinists, 1 cellist, and 2 violists, then the musical group is a *string quintet*.

A musical group is a *piano quintet* if and only if it contains exactly 1 pianist, 2 violinists, 1 cellist, and 1 violist; If a musical group is a *piano quintet*, then it contains exactly 1 pianist, 2 violinists, 1 cellist, and 1 violist; If a musical group contains exactly 1 pianist, 2 violinists, 1 cellist, and 1 violist, then the musical group is a *piano quintet*.

47. quadrupled **48.** doubled

49. The statements from Exercises 47 and 48 can both be written as true biconditionals. The sides of the square are doubled if and only if the area is quadrupled, and the sides of a square are doubled if and only if the perimeter is doubled, are both true.

50. Yes. **51.** true

52. False; winds of 34–40 knots are classified as gale winds.

53. False; winds are classified as 9 if the winds measure 41–47 knots.

54. D **55.** B

56. **a.** Contrapositive: If I am not in the capital of Iowa, then I am not in Des Moines; true.

b. Biconditional statement: I am in Des Moines if and only if I am in the capital of Iowa.

57. **a.** Contrapositive: If two angles are not complementary, then the angles do not measure 10° and 80°; true.

b. Biconditional statement: Two angles measure 10° and 80° if and only if they are complementary; false; Two angles can measure 30° and 60° and be complementary.

58. *Sample answer:* No. The contrapositive of a true conditional statement will always be true, but for a biconditional statement to be true, the original conditional statement and the converse need to be true.

59. 3°; 93° **60.** 17°; 107° **61.** 76°; 166° **62.** 61°; 151°

63. $A = 3 \cdot 12 = 36 \text{ ft}^2$

$P = 2(3 + 12) = 2(15) = 30 \text{ ft}$

64. $A = 7 \cdot 10 = 70 \text{ cm}^2$

$P = 2(7 + 10) = 2(17) = 34 \text{ cm}$

65. $A = \pi(8)^2 = 64\,\pi \approx 200.96 \text{ in.}^2$

$P = 2(8)\pi = 16\pi \approx 50.24 \text{ in.}$

66. $A = 6^2 = 36 \text{ m}^2$

$P = 4(6) = 24 \text{ m}$

67. If a rectangle is a square, then its sides are congruent.

68. If $x = 3$, then $8x + 1 = 3x + 16$.

Lesson 2.3

Developing Concepts Activity 2.3 (p. 86)

1. If-then form: If Marie exists, then she does not live in Hart's Location.

Contrapositive: If Marie lives in Hart's Location, then Marie does not exist.

Sample answer: The contrapositive is a helpful clue because it is clear that Marie exists, therefore she cannot live in Hart's Location.

2. Maynard lives in Ravenna.

3. From Clue 5 we know that the favorite hobby of the person living in Grand Rapids is in-line skating. From Clue 1 we know that Brad lives in Grand Rapids. Therefore, Brad's favorite hobby is in-line skating.

2.3 Guided Practice (p. 91)

1. Syllogism; Detachment **2.** deductive reasoning

3. converse **4.** $\sim p \rightarrow \sim q$

5. If you like this movie, then you enjoy scary movies.

6. Yes; $\overrightarrow{BD}$ bisects $\angle ABC$ and forms $\angle ABD$ and $\angle CBD$. Therefore $\angle ABD$ and $\angle CBD$ are complementary.

7. Yes; if f is true, then by the Law of Detachment, g is true. If g is true, then by the Law of Detachment, h is true. Therefore, if f is true, then h is true.

2.3 Practice and Applications (pp. 91–94)

8. If points X, Y, and Z lie on the same line, then points X, Y, and Z are collinear.

9. Points X, Y, and Z do not lie on the same line.

10. Points X, Y, and Z are not collinear.

11. If points X, Y, and Z are not collinear, then points X, Y, and Z do not lie on the same line.

12. Points X, Y, and Z are collinear if and only if they lie on the same line.

13. If points X, Y, and Z do not lie on the same line, then points X, Y, and Z are not collinear.

14. p: Jed gets a C on the exam.

q: He will get an A for the quarter.

Inverse: $\sim p \rightarrow \sim q$; If Jed does not get a C on the exam, then he will not get an A for the quarter.

Contrapositive: $\sim q \rightarrow \sim p$; If Jed does not get an A for the quarter, then he did not get a C on the exam.

15. p: Alberto finds a summer job.

q: He will buy a car.

Inverse: $\sim p \rightarrow \sim q$; If Alberto does not find a summer job, then he will not buy a car.

Contrapositive: $\sim q \rightarrow \sim p$; If Alberto does not buy a car, then he did not find a summer job.

16. p: The fuse has blown.

q: The light will not go on.

Inverse: $\sim p \rightarrow \sim q$; If the fuse has not blown, then the light will go on.

Contrapositive: $\sim q \rightarrow \sim p$; If the light goes on, then the fuse has not blown.

17. p: The car is running.

q: The key is in the ignition.

Inverse: $\sim p \rightarrow \sim q$; If the car is not running, then the key is not in the ignition.

Contrapositive: $\sim q \rightarrow \sim p$; If the key is not in the ignition, then the car is not running.

18. p: You dial 911.

q: There is an emergency.

Inverse: $\sim p \rightarrow \sim q$; If you do not dial 911, then there is not an emergency.

Contrapositive: $\sim q \rightarrow \sim p$; If there is not emergency, then you do not dial 911.

19. p: Gina walks to the store.

q: She will buy a newspaper.

Inverse: $\sim p \rightarrow \sim q$; If Gina does not walk to the store, then she will not buy a newspaper.

Contrapositive: $\sim q \rightarrow \sim p$; If Gina does not buy a newspaper, then she did not walk to the store.

20. p: It is not raining.

q: Petra will ride her bike to school.

Inverse: $\sim p \rightarrow \sim q$; If it is raining, then Petra will not ride her bike to school.

Contrapositive: $\sim q \rightarrow \sim p$; If Petra does not ride her bike to school, then it is raining.

21. Inductive reasoning; inductive reasoning depends on previous examples and patterns to form a conjecture. Dana came to her conclusion based on previous examples.

22. Deductive reasoning; deductive reasoning is based on logic and order. If Marcus is a 16–18 year old with a driver's license in Nevada, then Marcus must have taken the required driver education.

23. valid; *p:* The sum of the measures of $\angle A$ and $\angle C$ is 90°. *q:* $\angle A$ and $\angle C$ are complementary. $p \rightarrow q$ is true and p is true, so q is true.

24. not valid; $\angle A$ and $\angle C$ are complementary, but they are not adjacent.

25. valid; it can be concluded that $\angle B$ is acute, since the measure of $\angle B$ is between the measures of $\angle A$ and $\angle C$.

26. Given $x = 3$
$x > 2x - 10 \rightarrow x = y$
$3 > 6 - 10$
$3 > -4 \rightarrow y = 3$

27. Given $x = 3$
$2x + 3 < 4x < 5x \rightarrow y \leq x$
$9 < 12 < 15 \rightarrow y \leq 3$

28. Given $x = 3$
$4x \geq 12 \rightarrow y = 6x$
$12 \geq 12 \rightarrow y = 18$

28. Given $x = 3$
$x + 3 = 10 \rightarrow y = x$
$6 = 10$; No conclusion; the hypothesis is not true for $x = 3$.

30. If the sun is shining, then we will have a picnic.

31. If the stereo is on, then the neighbors will complain.

32. If Yumi goes to the movies, then Marta will go to the movies.

33. may not **34.** is **35.** may have **36.** given

37. $\angle 1$ and $\angle 2$ are supplementary angles, therefore their measures add up to 180°.

38. $\angle 1$ and $\angle 4$ are congruent angles, therefore their measures are equal.

39. $\angle 4$ and $\angle 3$ are vertical angles, therefore their measures are equal.

40. $\angle 3$ and $\angle 5$ are congruent angles, therefore their measures are equal.

41. $\angle 5$ and $\angle 6$ are supplementary angles, therefore their measures add up to 180°.

42. $p_1 \rightarrow p_3$ by the Law of Syllogism, from Exs. 36–38; then $p_1 \rightarrow p_4$ (with Ex. 39), then $p_1 \rightarrow p_5$ (with Ex. 40), then $p_1 \rightarrow p_6$ (with Ex. 41) by applying the Law of Syllogism each time.

43. Answers will vary.

44. Answers will vary. *Sample answer:* A baseball pitcher throws five strikes in a row. Therefore, the next pitch will be a strike.

45. True; the mall is open; therefore Angela and Diego went shopping, and therefore Diego bought a pretzel.

46. True; the mall is open; therefore Angela and Diego went shopping.

47. False; the mall is open; therefore Angela and Diego went shopping, and therefore Angela bought a pizza. We cannot conclude that she also bought a pretzel.

48. False; the mall is open, therefore Angela and Diego went shopping, and therefore Diego bought a pretzel and Angela bought a pizza. We cannot conclude whether or not Diego had some of Angela's pizza.

49. D, B, A, E, C; the robot extinguishes the fire.

50. *Sample answers:* If a dog is a greyhound, then it hunts by sight; if a dog is a coonhound, then it is a scent hound.

51. **a.** If Jana wins the contest, then Jana gets two free tickets to the concert.

b. $q \rightarrow p$; if Jana gets two free tickets to the concert, then Jana won the contest.

c. $\sim q \rightarrow \sim p$; if Jana does not get two free tickets to the concert, then Jana did not win the contest.

d. converse

e. To conclude that Jana gets two free tickets to the concert, it is necessary to know whether p, Jana wins the contest, is true.

f. *Sample answer:* If Jana gets two free tickets to the concert, then she will bring Greg to the concert.

52. $p \rightarrow q$; $q \rightarrow r$

53. $p \rightarrow r$; if a creature is a fly, then it is an insect.

54. $\sim q \rightarrow \sim p$: If a creature does not have six legs, then it is not a fly; $\sim r \rightarrow \sim q$: If a creature is not an insect, then it does not have six legs.

55. If a creature is not an insect, then it is not a fly; the statement is true; the Law of Syllogism works for contrapositives.

2.3 Mixed Review (p. 94)

56. K **57.** *Sample answer:* F **58.** *Sample answer:* G

59. *Sample answer:* B **60.** $20° + 10° = 30°$

61. $13° + 28° = 41°$ **62.** $3y + 1 + (12 - y) = 2y + 13$

63. $11 + 2f - g + (5g - 4 + f) = 3f + 4g + 7$

Quiz 1 (p. 95)

1. The statement is already in if-then form.

Converse: If tomorrow is June 5, then today is June 4.

Can be combined to form a biconditional statement.

2. If-then form: If a time period is a century, then it is a period of 100 years.

Converse: If a time period is 100 years, then it is a century.

Both the statement and its converse are true so they can be combined to form a biconditional statement: A time period is a century if and only if it is a period of 100 years.

3. If-then form: If two circles have the same diameter, then they are congruent.

Converse: If two circles are congruent, then they have the same diameter.

Can be combined to form a biconditional statement.

4. Yes; John backs the car out, therefore he drives into the fence.

5. Yes; John backs the car out, therefore he drives into the fence, and therefore his father is angry.

Math & History (p. 95)

1. If A is telling the truth, then B is lying. Therefore, B's statement that C is lying is itself a lie, so C must be telling the truth.

2. Begin by assuming that A is telling the truth. Then B must be lying. If B is lying, then C must be telling the truth. But C says that A and B are both lying, which contradicts the original assumption that A is telling the truth. So the original assumption is false and A is lying.

3. From Exercise 2, you know that A is lying. So B must be telling the truth. C says that both A and B are lying, but C's statement cannot be true because B is telling the truth. So B is telling the truth and A and C are both lying.

Lesson 2.4

2.4 Guided Practice (p. 99)

1. Symmetric property of angle measure

2. *Sample answer:*

$$m\angle JNK = m\angle LNM$$
$$m\angle JNK + m\angle KNL = m\angle LNM + m\angle KNL$$
$$m\angle JNL = m\angle KNM$$

3. *Sample answer:*

$$m\angle JNL = m\angle KNM$$
$$m\angle JNL - m\angle KNL = m\angle KNM - m\angle KNL$$
$$m\angle JNK = m\angle LNM$$

4. C **5.** A **6.** B **7.** E **8.** D

9.

$W = 1.42T - 38.5$	Given
$W + 38.5 = 1.42T$	Addition property of equality
$\frac{W + 38.5}{1.42} = T$	Division property of equality
$\frac{(-24.3) + 38.5}{1.42} = T$	
$10 = T$; 10°F	

2.4 Practice and Applications (pp. 99–101)

10. $m\angle B = m\angle A$ **11.** $BC = EF$

12. $2 + JM = 12$, $JM = 10$ **13.** $PQ = RS$ **14.** 30°

15.

$2(3x + 1) = 5x + 14$	Given
$6x + 2 = 5x + 14$	Distributive property
$x + 2 = 14$	Subtraction property of equality
$x = 12$	Subtraction property of equality

16.

$p - 1 = 6$	Given
$p = 7$	Addition property of equality

17.

$q + 9 = 13$	Given
$q = 4$	Subtraction property of equality

18.

$2r - 7 = 9$	Given
$2r = 16$	Addition property of equality
$r = 8$	Division property of equality

19.

$7s + 20 = 4s - 13$	Given
$3s + 20 = -13$	Subtraction property of equality
$3s = -33$	Subtraction property of equality
$s = -11$	Division property of equality

20.

$3(2t + 9) = 30$	Given
$6t + 27 = 30$	Distributive property
$6t = 3$	Subtraction property of equality
$t = \frac{1}{2}$	Division property of equality

21.

$-2(-w + 3) = 15$	Given
$2w - 6 = 15$	Distributive property
$2w = 21$	Addition property of equality
$w = \frac{21}{2}$	Division property of equality

22.

$26u + 4(12u - 5) = 128$	Given
$26u + 48u - 20 = 128$	Distributive property
$74u - 20 = 128$	Simplify.
$74u = 148$	Addition property of equality
$u = 2$	Division property of equality

23.

$3(4v - 1) - 8v = 17$	Given
$12v - 3 - 8v = 17$	Distributive property
$4v - 3 = 17$	Simplify.
$4v = 20$	Addition property of equality
$v = 5$	Division property of equality

24. Given; Angle Addition Postulate; Substitution property of equality; Distributive property

25. Given; Given; Transitive property of equality; Definition of a right angle; Definition of perpendicular lines

26. $\angle 1$ and $\angle 2$ are right angles (Given)

$m\angle 1 = 90°$, $m\angle 2 = 90°$ (Definition of right angles)

$\angle 1$ and $\angle 2$ are supplementary angles (Definition of supplementary angles)

27. B lies between A and C (Given)

$AB + BC = AC$ (Segment Addition Post.)

$AB = 3, BC = 8$ (Given)

$3 + 8 = AC$ (Substitution prop. of equality)

$AC = 11$ (Simplify.)

28.

$m\angle 2 + m\angle 4 = 62°$	Given
$m\angle 1 = m\angle 2$	Given
$m\angle 1 + m\angle 4 = 62°$	Subst. prop. of eq.
$m\angle 1 + m\angle 3 + m\angle 4 = 93°$	Given
$m\angle 3 + 62° = 93°$	Subst. prop. of eq.
$m\angle 3 = 31°$	Subtr. prop. of eq.

29.

$c(r + 1) = n$	Given
$cr + c = n$	Distributive property
$cr = n - c$	Subtraction property of equality
$r = \frac{n - c}{c}$	Division property of equality

30. $r = \frac{10.80 - 10.00}{10.00}$

$r = 0.08$ or 8%

31. $c(r + 1) = n$

$c = \frac{n}{r + 1}$ Division property of equality

$c = \frac{12.72}{0.06 + 1} = \$12.00$

32. **a.** Distributive property

b. Simplify.

c. Subtraction property of equality

d. Addition property of equality

e. Division property of equality

f. *Sample answer:* Given that $4(x - 5 + 2x) = 0.5(12x - 16)$, the equation can be solved using the distributive property, simplying, and using the subtraction, addition, and division properties of equality to show that $x = 2$.

33. symmetric **34.** transitive

2.4 Mixed Review (p. 101)

35. $D = \sqrt{(-2 - 5)^2 + (-3 - 4)^2}$

$= \sqrt{49 + 49}$

$= \sqrt{98} \approx 9.90$

36. $D = \sqrt{(0 - 6)^2 + (2 - (-7))}$

$= \sqrt{36 + 81}$

$= \sqrt{117} \approx 10.82$

37. $D = \sqrt{(11 - 1)^2 + (-1 - 1)^2}$

$= \sqrt{100 + 4}$

$= \sqrt{104} \approx 10.20$

38. $D = \sqrt{(-4 - (-4))^2 + (1 - 8)^2}$

$= \sqrt{0 + 49}$

$= \sqrt{49} = 7$

39. $D = \sqrt{(-6 - (-1))^2 + (2 - 9)^2}$

$= \sqrt{25 + 49}$

$= \sqrt{74} \approx 8.60$

40. $D = \sqrt{(5 - 10)^2 + (1 - 7)^2}$

$= \sqrt{25 + 36}$

$= \sqrt{61} \approx 7.81$

41. $\frac{5 + x}{2} = -1$ $\frac{7 + y}{2} = 0$

$5 + x = -2$ $7 + y = 0$

$x = -7$ $y = -7$

$(-7, -7)$

42. $\frac{-4 + x}{2} = 3$

$-4 + x = 6$

$x = 10$

$\frac{-5 + y}{2} = -6$

$-5 + y = -12$

$y = -7$

$(10, -7)$

43. $\frac{0 + x}{2} = 6$

$x = 12$

$\frac{9 + y}{2} = -2$

$9 + y = -4$

$y = -13$

$(12, -13)$

44. $\frac{-1 + x}{2} = 2$

$-1 + x = 4$

$x = 5$

$\frac{14 + y}{2} = 7$

$14 + y = 14$

$y = 0$

$(5, 0)$

45. 42°, 132°

46. false **47.** false **48.** true **49.** false **50.** true

Lesson 2.5

2.5 Guided Practice (p. 104)

1. $\overline{CD}$; $\overline{AB}$

2. Using the Transitive Property of Segment Congruence, we can only assume that $\overline{SR} \cong \overline{QR}$.

3. By the definition of midpoint, point D is halfway between B and F. Therefore, $\overline{BD} \cong \overline{FD}$.

4. Yes; because $\overline{BF} \perp \overline{CD}$, $\angle CDF$ is a right angle by the def. of perpendicular lines. $m\angle CDE + m\angle FDE = m\angle CDF$ by the Angle Addition Postulate, so the angles are complementary by the definition of complementary angles.

5. By the Transitive Property of Segment Congruence, if $\overline{CE} \cong \overline{BD}$ and $\overline{BD} \cong \overline{FD}$, then $\overline{CE} \cong \overline{FD}$.

2.5 Practice and Applications (pp. 105–107)

6.

Statements	Reasons
1. $EF = EF$	**1.** Reflexive property of equality
2. $\overline{EF} \cong \overline{EF}$	**2.** Definition of congruent segments

7. Given; Definition of congruent segments; Transitive property of equality; Definition of congruent segments.

8.

$\overline{AB} \cong \overline{BC}$, $\overline{CD} \cong \overline{BC}$	Given
$\overline{AB} \cong \overline{CD}$	Trans. Prop. of Seg. Cong.
$AB = CD$	Def. of congruent segments
$2x + 1 = 4x - 11$	Substitution property of equality
$1 = 2x - 11$	Subtraction property of equality
$12 = 2x$	Addition property of equality
$6 = x$	Division property of equality

9.

$PR = 46$	Given
$PQ + QR = PR$	Segment Addition Postulate
$2x + 5 + 6x - 15 = 46$	Subst. property of eq.
$8x - 10 = 46$	Simplify.
$8x = 56$	Addition property of equality
$x = 7$	Division property of equality

10.

$\overline{ST} \cong \overline{SR}$, $\overline{QR} \cong \overline{SR}$	Given
$\overline{QR} \cong \overline{ST}$	Trans. Prop. of Seg. Cong.
$QR = ST$	Def. of congruent segments
$x + 4 = 5(3x - 2)$	Substitution property of equality
$x + 4 = 15x - 10$	Distributive property
$4 = 14x - 10$	Subtraction property of equality
$14 = 14x$	Addition property of equality
$1 = x$	Division property of equality

11.

$\overline{XY} \cong \overline{WX}$, $\overline{YZ} \cong \overline{WX}$	Given
$\overline{XY} \cong \overline{YZ}$	Trans. Prop. of Seg. Cong.
$XY = YZ$	Def. of congruent segments

—CONTINUED—

$4x + 3 = 9x - 12$	Substitution property of equality
$3 = 5x - 12$	Subtraction property of equality
$15 = 5x$	Addition property of equality
$3 = x$	Division property of equality

12–15. Check students' work.

12. $x + y = AB + CD$ **13.** $y - z = CD - EF$

14. $3x - z = 3(AB) - EF$ **15.** $z + y - 2x = EF + CD - 2AB$

16. Given; Transitive Property of Segment Congruence; Definition of congruent segments; Addition property of equality; Segment Addition Postulate; Substitution property of equality; Definition of congruent segments

17.

Statements	Reasons
1. $XY = 8$, $XZ = 8$, $\overline{XY} \cong \overline{ZY}$	**1.** Given
2. $XY = ZY$	**2.** Def. of cong. segments
3. $XY = XZ$	**3.** Trans. prop. of eq.
4. $XZ = ZY$	**4.** Trans. prop. of eq.
5. $\overline{XZ} \cong \overline{ZY}$	**5.** Def. of cong. segments

18.

Statements	Reasons
1. $\overline{NK} \cong \overline{NL}$, $NK = 13$	**1.** Given
2. $NK = NL$	**2.** Def. of cong. segments
3. $NL = 13$	**3.** Trans. prop. of eq.

19. Yes, by the Transitive Property of Segment Congruence

20.

$\overline{UV} \cong \overline{ZY}$, $\overline{UW} \cong \overline{ZX}$	Given
$UV = ZY$, $UW = ZX$	Def. of congruence
$VW = UW - UV$	Segment Addition Post.
$YX = ZX - ZY$	Segment Addition Post.
$YX = UW - UV$	Substitution prop. of equality
$VW = YX$	Transitive prop. of equality
$\overline{VW} \cong \overline{YX}$	Def. of congruence

21. $\frac{1}{2}(14x + 8) = 6x + 8$

$7x + 4 = 6x + 8$

$x + 4 = 8$

$x = 4$

B

22. $3x - 8 = 2x + 3$

$x - 8 = 3$

$x = 11$

$XZ = XY + YZ$

$= 4x + 15 + 2x + 3$

$= 6x + 18$

$= 6(11) + 18$

$= 66 + 18 = 84$

E

23. $RT = z$ **24.** $XY = z$ **25.** $RW = \frac{1}{2}z$ **26.** $WT = \frac{1}{2}z$

27. $P = a + \frac{1}{4}(b - a)$; $Q = a + \frac{3}{8}(b - a)$

2.5 Mixed Review (p. 107)

28. *Sample answer*: If $n = 0$, then $2^n = 1$ and $n + 1 = 1$, so $2^n \not> n + 1$. **29.** *Sample answer:* $2 + 3 = 5$

30. *Sample answer:* 25 is divisible by 5, but not 10.

31. $m\angle 7 = 180° - 64° = 116°$ **32.** 70°

33. $m\angle 8 = 180° - 115° = 65°$ **34.** $m\angle 8 = 180° - 108° = 72°$

35. If Matthew does not win first place, than Matthew did not win the wrestling match.

36. No. Consider the true conditional statement "If $x = 5$, then $x^2 = 25$." The statement is true when read forwards. However, reading it backwards, or reading the converse, "If $x^2 = 25$, then $x = 5$" is false. $x^2 = 25$ does not necessarily mean that $x = 5$. x could also equal -5.

37. $p \rightarrow q$; If the car is in the garage, then Mark is home.

38. $q \rightarrow p$; If Mark is home, then the car is in the garage.

39. $\sim p \rightarrow \sim q$: If the car is not in the garage, then Mark is not home.

40. $\sim q \rightarrow \sim p$; If Mark is not home, then the car is not in the garage.

Lesson 2.6

Developing Concepts Activity 2.6 (p. 108)

1. a. *Sample answer*: The edge of the paper and the crease made at the first fold form a right angle which is made up of $\angle 1$ and $\angle 2$.

b. *Sample answer:* The edge of the paper and the crease made at the first fold form a right angle which is made up of $\angle 3$ and $\angle 4$.

c. *Sample answer:* The angles make up the right angle formed by the corner of the page, so they are complementary.

2. Yes, $m\angle 1 = 90° - m\angle 2$, and $m\angle 3 = 90° - m\angle 2$, so by substitution, $m\angle 1 = m\angle 3$, so $\angle 1 \cong \angle 3$. $m\angle 4 = 90° - m\angle 3$ and $m\angle 2 = 90° - m\angle 3$, so by substitution, $m\angle 2 = m\angle 4$, so $\angle 2 \cong 4$.

3. Yes; same reasons as Exercise 2.

4. Two angles that are complementary to the same angle are congruent.

Extension (p. 108)

Yes; if $m\angle 1 = 180° - m\angle 2$ and $m\angle 3 = 180° - m\angle 2$, by substitution $m\angle 1 = m\angle 3$, so $\angle 1 \cong \angle 3$.

Activity (p. 110)

1. supplementary; supplementary; equal **2.** yes

3. They are congruent.

2.6 Guided Practice (p. 112)

1. $\angle QRS$; Transitive

2. Yes; the angle formed by the blades and the angle formed by the handles are an example of vertical angles, which are congruent.

3. $\angle A$ **4.** no **5.** yes **6.** no **7.** no **8.** yes **9.** yes

2.6 Practice and Applications (pp. 113–115)

10.

Statements	Reasons
1. $\angle A \cong \angle B$	**1.** Given
2. $m\angle A = m\angle B$	**2.** Definition of congruent angles
3. $m\angle B = m\angle A$	**3.** Symmetric property of equality
4. $\angle B \cong \angle A$	**4.** Definition of congruent angles

11. **Given:** $\angle A$

Prove: $\angle A \cong \angle A$

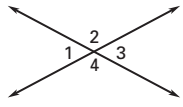
Statements	Reasons
1. $\angle A$	**1.** Given
2. $m\angle A = m\angle A$	**2.** Reflexive property of equality
3. $\angle A \cong \angle A$	**3.** Definition of congruent angles

12. 28° **13.** 31° **14.** 34° **15.** 158° **16.** 59° **17.** 61°

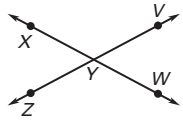
18.

Statements	Reasons
1. $\angle 1$ and $\angle 2$ are complements. $\angle 3$ and $\angle 4$ are complements. $\angle 2 \cong \angle 4$	**1.** Given
2. $m\angle 1 + m\angle 2 = 90°$ $m\angle 3 + m\angle 4 = 90°$	**2.** Definition of complementary angles
3. $m\angle 1 + m\angle 2 = m\angle 3 + m\angle 4$	**3.** Transitive property of equality
4. $m\angle 2 = m\angle 4$	**4.** Definition of congruent angles
5. $m\angle 1 + m\angle 2 = m\angle 3 + m\angle 2$	**5.** Substitution property of equality
6. $m\angle 1 = m\angle 3$	**6.** Subtraction property of equality
7. $\angle 1 \cong \angle 3$	**7.** Definition of congruent angles

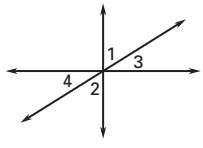
19. $\angle 1 \cong \angle 3$, $\angle 2 \cong \angle 4$



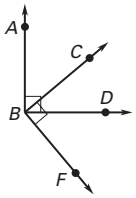
20. $\angle XYZ \cong \angle VYW$, $\angle XYV \cong \angle ZYW$



21. $\angle 1 \cong \angle 2$, $\angle 3 \cong \angle 4$



22. $\angle ABC \cong \angle DBF$, $\angle ABD \cong \angle CBF$



23.

Statements	Reasons
1. $m\angle 3 = 120°$, $\angle 1 \cong \angle 4$ $\angle 3 \cong \angle 4$	**1.** Given
2. $\angle 1 \cong \angle 3$	**2.** Transitive property of angle congruence
3. $m\angle 1 = m\angle 3$	**3.** Definition of congruent angles
4. $m\angle 1 = 120°$	**4.** Substitution prop. of equality

24.

Statements	Reasons
1. $\angle 3$ and $\angle 2$ are complementary. $m\angle 1 + m\angle 2 = 90°$	**1.** Given
2. $m\angle 3 + m\angle 2 = 90°$	**2.** Definition of complementary angles
3. $m\angle 1 + m\angle 2 = m\angle 3 + m\angle 2$	**3.** Transitive property of equality
4. $m\angle 1 = m\angle 3$	**4.** Subtraction property of equality
5. $\angle 3 \cong \angle 1$	**5.** Definition of congruent angles

25.

Statements	Reasons
1. $\angle QVW$ and $\angle RWV$ are supplementary.	**1.** Given
2. $\angle QVW$ and $\angle QVP$ are a linear pair.	**2.** Definition of a linear pair
3. $\angle QVW$ and $\angle QVP$ are supplementary.	**3.** Linear Pair Postulate
4. $\angle QVP \cong \angle RWV$	**4.** Congruent Supplements Theorem

26.

Statements	Reasons
1. $\angle 5 \cong \angle 6$	**1.** Given
2. $\angle 5 \cong \angle 4$, $\angle 6 \cong \angle 7$	**2.** Vertical Angles Theorem
3. $\angle 4 \cong \angle 7$	**3.** Transitive property of angle congruence

27. $4w + 10 + 13w = 180$ Linear Pair Postulate

$17w + 10 = 180$

$17w = 170$

$w = 10$

—CONTINUED—

$2(x + 25) + 2x - 30 = 180$ Linear Pair Postulate

$2x + 50 + 2x - 30 = 180$

$4x + 20 = 180$

$4x = 160$

$x = 40$

28. $3y = 4y - 35$ Vertical angles are congruent.

$-y = -35$

$y = 35$

$3(6z + 7) = 10z + 45$ Vertical angles are congruent.

$18z + 21 = 10z + 45$

$8z + 21 = 45$

$8z = 24$

$z = 3$

29. Yes; $\angle 2 \cong \angle 3$ and $\angle 1$ and $\angle 4$ are supplementary to congruent angles. $\angle 1 \cong \angle 4$ by the Congruent Supplements Theorem.

30. Yes; $m\angle 4 = 90° - 52° = 38°$. $m\angle 3 = 90° - 52° = 38°$. $\angle 4 \cong \angle 3$ by the definition of congruent angles.

31. *Sample answers*: the walls of a room, a shoebox, a window frame, CD case

32. Congruent Complements Theorem

33. C **34.** B **35.** A **36.** C

37.

Statements	Reasons
1. $m\angle ZYQ = 45°$ $m\angle ZQP = 45°$	**1.** Given
2. $\angle XYQ$ and $\angle ZYQ$ are supplementary. $\angle ZQR$ and $\angle ZQP$ are supplementary.	**2.** Linear Pair Postulate
3. $m\angle XYQ + m\angle ZYQ = 180°$ $m\angle ZQR + m\angle ZQP = 180°$	**3.** Definition of supplementary angles
4. $m\angle XYQ + m\angle ZYQ = m\angle ZQR + m\angle ZQP$	**4.** Transitive Property of equality
5. $m\angle XYQ + 45° = m\angle ZQR + 45°$	**5.** Substitution property of equality
6. $m\angle XYQ = m\angle ZQR$	**6.** Subtraction property of equality
7. $\angle ZQR \cong \angle XYQ$	**7.** Definition of congruent angles

2.6 Mixed Review (p. 116)

38. $m\angle 2 = 90° - 62°$
$= 28°$

39. $m\angle 2 = 180° - 8°$
$= 172°$

40. $m\angle 2 = 90° - 47°$
$= 43°$

41. All definitions are true biconditionals. So the conditionals If two lines are perpendicular, then they intersect to form a right angle and If two lines intersect to form a right angle, then the lines are perpendicular are both true.

42.
$w + 2 = 3w - 4$
$-2w + 2 = -4$
$-2w = -6$
$w = 3$

43.
$16x - 5 = 28x - 11$
$-12x - 5 = -11$
$-12x = -6$
$x = \frac{1}{2}$

44.
$5y - 7 = 1.5y$
$3.5y - 7 = 0$
$3.5y = 7$
$y = 2$

45.
$9z = 3z + 2$
$6z = 2$
$z = \frac{1}{3}$

Quiz 2 (p. 116)

1.
$x - 3 = 7$	Given
$x = 10$	Addition property of equality

2.
$x + 8 = 27$	Given
$x = 19$	Subtraction property of equality

3.
$2x - 5 = 13$	Given
$2x = 18$	Addition property of equality
$x = 9$	Division property of equality

4.
$2x + 20 = 4x - 12$	Given
$20 = 2x - 12$	Subtraction property of equality
$32 = 2x$	Addition property of equality
$16 = x$	Division property of equality

5.
$3(3x - 7) = 6$	Given
$9x - 21 = 6$	Distributive property
$9x = 27$	Addition property of equality
$x = 3$	Division property of equality

6.
$-2(-2x + 4) = 16$	Given
$4x - 8 = 16$	Distributive property
$4x = 24$	Addition property of equality
$x = 6$	Division property of equality

7.
Statements	Reasons
1. $\overline{BA} \cong \overline{BC}$, $\overline{BC} \cong \overline{CD}$, $\overline{AE} \cong \overline{DF}$	**1.** Given
2. $\overline{BA} \cong \overline{CD}$	**2.** Transitive Property of Congruence
3. $BA = CD$, $AE = DF$	**3.** Definition of congruent segments
4. $BA + AE = CD + DF$	**4.** Addition property of equality
5. $BA + AE = BE$ $CD + DF = CF$	**5.** Segment Addition Postulate
6. $BE = CF$	**6.** Substitution property of equality
7. $\overline{BE} \cong \overline{CF}$	**7.** Definition of congruent segments

8.
Statements	Reasons
1. $\overline{EH} \cong \overline{GH}$, $\overline{FG} \cong \overline{GH}$	**1.** Given
2. $\overline{EH} \cong \overline{FG}$	**2.** Transitive property of congruence

9. $180° - 142° = 38°$

Chapter 2 Review *(pp. 118–120)*

1. If-then: If there is a teacher's meeting, then we are dismissed early.

Hypothesis: There is a teacher's meeting.

Conclusion: We are dismissed early.

Inverse: If there is not a teacher's meeting, then we are not dismissed early.

Converse: If we are dismissed early, then there is a teacher's meeting.

Contrapositive: If we are not dismissed early, then there is not a teacher's meeting.

2. If-then: If it is Wednesday night, then I prepare dinner.

Hypothesis: It is Wednesday night.

Conclusion: I prepare dinner.

Inverse: If it is not Wednesday night, then I do not prepare dinner.

Converse: If I prepare dinner, then it is Wednesday night.

Contrapositive: If I do not prepare dinner, then it is not Wednesday night.

3. exactly one **4.** two

5. No; $x^2 = 25$ does not necessarily mean that $x = 5$; x could also $= -5$.

6. Yes; if a figure is a square, then it is a rectangle with four congruent sides.

7. If the measure of $\angle A$ is 90°, then $\angle A$ is a right angle.

8. If the measure of $\angle A$ is not 90°, then $\angle A$ is not a right angle.

9. $\angle A$ is not a right angle.

10. If $\angle A$ is not a right angle, then the measure of $\angle A$ is not 90°.

11. If there is a nice breeze, then we will sail to Dunkirk.

12. If the Chess Club meets today, then the garbage needs to be taken out.

13. C **14.** A **15.** D **16.** B

17.

$5(3y + 2) = 25$	Given
$15y + 10 = 25$	Distributive property
$15y = 15$	Subtraction property of equality
$y = 1$	Division property of equality

18.

$8t - 4 = 5t + 8$	Given
$3t - 4 = 8$	Subtraction property of equality
$3t = 12$	Addition property of equality
$t = 4$	Division property of equality

19.

$23 + 11d - 2c = 12 - 2c$	Given
$23 + 11d = 12$	Addition property of equality
$11d = -11$	Subtraction property of equality
$d = -1$	Division property of equality

20.

Statements	Reasons
1. $\overline{AE} \cong \overline{BD}$	**1.** Given
2. $AE = BD$	**2.** Definition of congruent segments
3. $AC + CE = AE$ $BC + CD = BD$	**3.** Segment Addition Postulate
4. $AC + CE = BC + CD$	**4.** Transitive property of equality
5. $\overline{CD} \cong \overline{CE}$	**5.** Given
6. $CD = CE$	**6.** Definition of congruent segments
7. $AC + CD = BC + CD$	**7.** Substitution property of equality
8. $AC = BC$	**8.** Subtraction property of equality
9. $\overline{AC} \cong \overline{BC}$	**9.** Definition of congruent segments

21.

Statements	Reasons
1. $\angle 1$ and $\angle 2$ are complementary. $\angle 3$ and $\angle 4$ are complementary. $\angle 1 \cong \angle 3$	**1.** Given
2. $\angle 2 \cong \angle 4$	**2.** Congruent Complements Theorem

Chapter 2 Test *(p. 121)*

1. Postulate 9: A plane contains at least three noncollinear points.

2. Postulate 11: If two planes intersect, then their intersection is a line.

3. Postulate 8: Through any three noncollinear points there exists exactly one plane.

4. Postulate 10: If two points lie in a plane, then the line containing them lies in the plane.

5.–8. Sample answers are given

5. A 60° angle is acute, but it does not measure 34°.

6. Two segments of length 10 feet each are congruent, but their lengths do not measure 17 feet.

7. Two angles of measure 130° and 50° are supplementary, but their measures do not equal 32° and 148°.

8. You can choose the prime number 7, which is not equal to 13.

9. $y = 70$ **10.** $y = 17$ **11.** $y = -5$ **12.** $z = 30$

13. Symmetric property of equality

14. Multiplication property of equality

15. Transitive property of equality

16. Subtraction property of equality

17.

Statements	Reasons
1. $\overline{AX} \cong \overline{DX}$ $\overline{XB} \cong \overline{XC}$	**1.** Given
2. $AX + XC = DX + XB$	**2.** Addition Postulate of Equality
3. $AX + XC = AC$ $DX + XB = DB$	**3.** Segment Addition Postulate
4. $AC = DB$	**4.** Transitive property of equality
5. $\overline{AC} \cong \overline{DB}$	**5.** Definition of congruent segments

18. Transitive property of segment congruence: If $\overline{AB} \cong \overline{CD}$ and $\overline{CD} \cong \overline{EF}$, then $\overline{AB} \cong \overline{EF}$. Let $\overline{AB}$ represent the section of leaking pipe, $\overline{CD}$ the section of the measuring tape, and $\overline{EF}$ the new section of pipe.

19. $\angle 1 \cong \angle 4$ by the Congruent Complements Theorem.

Chapter 2 Standardized Test *(pp. 122–123)*

1. C **2.** A **3.** C **4.** B

5. $7x + 1 = 9x - 5$

$-2x = -6$

$x = 3$

$AC = AB + BC$

$= 7x + 1 + 2x + 20$

$= 9x + 21$

$= 9(3) + 21$

$= 27 + 21$

$= 48$

E

6. C

7. $9x + 14 = 5x + 54$

$4x = 40$

$x = 10$

C

8. $m\angle RQS = 180° - m\angle PQR$

$= 180° - 48°$

$= 132°$

D

9. B **10.** E

11. **a.** 31°

b. $m\angle 4 = 90° - m\angle 5$

$= 90° - 29°$

$= 61°$

c. 122° **d.** 35°

12.

Statements	Reasons
1. $\overleftrightarrow{BF} \perp \overleftrightarrow{HD}$	**1.** Given
2. $\angle BAH$, $\angle BAD$, $\angle DAF$, and $\angle FAH$ are right angles.	**2.** Definition of perpendicular lines
3. $m\angle BAH = 90°$	**3.** Definition of right angle
4. $\overleftrightarrow{GC} \perp \overleftrightarrow{AE}$	**4.** Given
5. $\angle CAE$ and $\angle EAG$ are right angles.	**5.** Definition of perpendicular lines
6. $m\angle CAE = 90°$	**6.** Definition of right angle
7. $m\angle BAH = m\angle CAE$	**7.** Substitution property of equality
8. $\angle BAH \cong \angle CAE$	**8.** Definition of congruent angles

13. You are given that $\angle 6$ and $\angle 2$ are vertical angles. By the Vertical Angles Theorem, $\angle 6 \cong \angle 2$.

14. complementary

15. **a.** no

b. Yes; show that both are 90° angles and are thus congruent.

c. Yes; show that each segment has length $\frac{1}{2}AE$

16. **a.** false **b.** true **c.** false

17.

Statements	Reasons
1. $\overleftrightarrow{AE} \perp \overleftrightarrow{XC}$	**1.** Given
2. $\angle AXC$ is a right angle.	**2.** Definition of perpendicular lines
3. $m\angle AXC = 90°$	**3.** Definition of right angle
4. $m\angle BXA + m\angle CXB = m\angle AXC$	**4.** Angle Addition Postulate
5. $m\angle BXA + m\angle CXB = 90°$	**5.** Substitution prop. of equality
6. $\angle BXA$ and $\angle CXB$ are complementary.	**6.** Definition of complementary angles

Chapter 2 Algebra Review *(pp. 124–125)*

1. $y = 6x + 4$

$(8) = 6(-2) + 4$

$8 = -12 + 4$

$8 \neq -8$

no

2. $y = -10x - 2$

$(-12) = -10(1) - 2$

$-12 = -10 - 2$

$-12 = -12$

yes

3. $y = -\frac{1}{4}x - 18$

$(-17) = -\frac{1}{4}(-4) - 18$

$-17 = 1 - 18$

$-17 = -17$

yes

4. $y = \frac{3}{2}x + 10$

$(12) = \frac{3}{2}(4) + 10$

$12 = 6 + 10$

$12 = 16$

no

5. $y = \frac{5}{9}x + 34$

$(27) = \frac{5}{9}(-9) + 34$

$27 = -5 + 34$

$27 \neq 29$

no

6. $y = \frac{2}{3}x - 6$

$(0) = \frac{2}{3}(9) - 6$

$0 = 6 - 6$

$0 = 0$

yes

7. $y = \frac{4}{5}x - 2$

$(-3) = \frac{4}{5}(10) - 2$

$-3 = 8 - 2$

$-3 \neq 6$

no

8. $y = \frac{1}{2}x + 7$

$(7) = \frac{1}{2}(4) + 7$

$7 = 2 + 7$

$7 \neq 9$

no

9. $2x - 3y = 10$

$2(3) - 3(4) = 10$

$6 - 12 = 10$

$-6 \neq 10$

no

10. $9x - y = -4$

$9(-1) - (-5) = -4$

$-9 + 5 = -4$

$-4 = -4$

yes

11. $y - 6 = \frac{3}{4}x$

$12 - 6 = \frac{3}{4}(8)$

$12 - 6 = 6$

$6 = 6$

yes

12. $y + 5 = \frac{5}{3}x$

$(10) + 5 = \frac{5}{3}(9)$

$15 = 15$

yes

13. $m = \frac{6 - 1}{3 - 4} = \frac{5}{-1} = -5$

14. $m = \frac{-2 - 0}{5 - (-8)} = \frac{-2}{13} = -\frac{2}{13}$

15. $m = \frac{8 - 6}{9 - 5} = \frac{2}{4} = \frac{1}{2}$

16. $m = \frac{-3 - (-4)}{7 - 0} = \frac{1}{7}$

17. $m = \frac{18 - 7}{-3 - (-1)} = \frac{11}{-2} = -\frac{11}{2}$

18. $m = \frac{10 - (-4)}{1 - (-6)} = \frac{14}{7} = 2$

19. $m = \frac{2 - (-10)}{-2 - 4} = \frac{12}{-6} = -2$

20. $m = \frac{1 - 1}{-11 - 11} = \frac{0}{-22} = 0$

21. $m = \frac{8 - (-5)}{5 - 14} = \frac{13}{-9} = -\frac{13}{9}$

22. $m = \frac{-1 - 5}{-1 - (-7)} = \frac{-6}{6} = -1$

23. $m = \frac{-6 - 8}{-3 - (-12)} = \frac{-14}{9} = -\frac{14}{9}$

24. $m = \frac{-10 - 13}{2 - (-9)} = \frac{-23}{11} = -\frac{23}{11}$

25. $m = \frac{-4 - 3}{0 - 12} = \frac{-7}{-12} = \frac{7}{12}$

26. $m = \frac{10 - (-8)}{-7 - 9} = \frac{18}{-16} = -\frac{9}{8}$

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

28. $y = mx + b$

$1 = 2m + 5$

$-4 = 2m$

$-2 = m$

$y = -2x + 5$

29. $y = mx + b$

$3 = -5m - 12$

$15 = -5m$

$-3 = m$

$y = -3x - 12$

30. $y = mx + b$

$10 = -3m + 8$

$2 = -3m$

$-\frac{2}{3} = m$

$y = -\frac{2}{3}x + 8$

31. $y = mx + b$

$0 = 7m + 13$

$-13 = 7m$

$-\frac{13}{7} = m$

$y = -\frac{13}{7}x + 13$

32. $y = mx + b$

$-3 = -3m - 2$

$-1 = -3m$

$\frac{1}{3} = m$

$y = \frac{1}{3}x - 2$

33. $y = mx + b$

$4 = -1m - 8$

$12 = -m$

$-12 = m$

$y = -12x - 8$

34. $y = mx + b$

$8 = -11m - 14$

$22 = -11m$

$-2 = m$

$y = -2x - 14$

35. $y = mx + b$

$-6 = 4m - 2$

$-4 = 4m$

$-1 = m$

$y = -x - 2$

36. $y = mx + b$

$-8 = 5m + 7$

$-15 = 5m$

$-3 = m$

$y = -3x + 7$

37. $y = mx + b$

$-1 = -2m - 5$

$4 = -2m$

$-2 = m$

$y = -2x - 5$

38. $y = mx + b$

$3 = 2m + 2$

$1 = 2m$

$\frac{1}{2} = m$

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

39. $y = mx + b$

$0.5 = 3m + 1.5$

$-1 = 3m$

$-\frac{1}{3} = m$

$y = -\frac{1}{3}x + 1.5$

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

$= -1$

$y - 2 = -(x - 1)$

$y - 2 = -x + 1$

$y = -x + 3$

41. $m = \frac{3 - 9}{-5 - (-7)} = \frac{-6}{2}$

$= -3$

$y - 3 = -3(x + 5)$

$y - 3 = -3x - 15$

$y = -3x - 12$

42. $m = \frac{-5 - (-1)}{4 - 5} = \frac{-4}{-1}$

$= 4$

$y + 1 = 4(x - 5)$

$y + 1 = 4x - 20$

$y = 4x - 21$

43. $m = \frac{-6 - 4}{3 - (-2)} = \frac{-10}{5}$

$= -2$

$y - 4 = -2(x + 2)$

$y - 4 = -2x - 4$

$y = -2x$

44. $m = \frac{8 - (-7)}{0 - (-3)} = \frac{15}{3}$

$= 5$

$y - 8 = 5(x - 0)$

$y - 8 = 5x$

$y = 5x + 8$

45. $m = \frac{-4 - 2}{-1 - 1} = \frac{-6}{-2}$

$= 3$

$y - 2 = 3(x - 1)$

$y - 2 = 3x - 3$

$y = 3x - 1$

46. $m = \frac{4 - (-2)}{0 - 6} = \frac{6}{-6}$

$= -1$

$y - 4 = -(x - 0)$

$y - 4 = -x$

$y = -x + 4$

47. $m = \frac{-3 - 3}{-3 - (-4)} = \frac{-6}{1}$

$= -6$

$y - 3 = -6(x + 4)$

$y - 3 = -6x - 24$

$y = -6x - 21$

48. $m = \frac{-2 - 2}{-5 - (-3)} = \frac{-4}{-2}$

$= 2$

$y - 2 = 2(x + 3)$

$y - 2 = 2x + 6$

$y = 2x + 8$

49. $m = \frac{-1 - (-9)}{14 - 10} = \frac{8}{4}$

$= 2$

$y + 9 = 2(x - 10)$

$y + 9 = 2x - 20$

$y = 2x - 29$

50. $m = \frac{0 - (-2)}{5 - (-1)} = \frac{2}{6} = \frac{1}{3}$

$y - 0 = \frac{1}{3}(x - 5)$

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

51. $m = \frac{-1 - 4}{6 - (-6)} = \frac{-5}{12} = -\frac{5}{12}$

$y + 1 = -\frac{5}{12}(x - 6)$

$y + 1 = -\frac{5}{12}x + \frac{5}{2}$

$y = -\frac{5}{12}x + \frac{3}{2}$