Answers for Lesson 7-1, pp. 368–370 Exercises

1. 1 : 1000

2. 1 : 370

3. $3b$

4. $\frac{4}{3}$

5. $\frac{b}{4}$

6. $\frac{b}{a}$

7. $\frac{3}{a}$

8. $4a$

9. $\frac{7}{4}$

10. $\frac{3}{7}$

11. $\frac{b + 4}{4}$

12. 4

13. $1\frac{2}{3}$

14. 4

15. 6.875

16. 7.2

17. 7.2

18. 7.5

19. 14

20. 7

21. 125 mi

22. about 75 mi

23. about 135 mi

24. about 67.5 mi

25. 18 in. by 22.5 in.

26. 13 : 6

27. 5 : 4

28. 4 : 3

29. A

30. $\frac{7}{3}$

31. $\frac{9}{4}$

32. $\frac{30}{18}$

33. $\frac{b}{2}$

34. Check students' work.

35. 6

36. 32

37. 16.5

38. 6

39. 4

40. $\frac{12}{19}$

41. 4, -3

42. $\frac{1}{2}, -\frac{5}{6}$

43. 16 cm

44. 0.348 in.

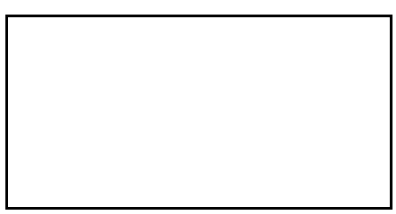
45. 9; 18

46. 9; 12

47. 8; 21

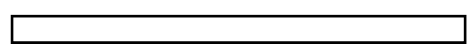
48–51. Answers may vary. Samples are given.

48.



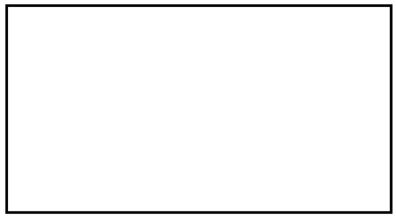
Scale 1 in. = 5 ft

49.



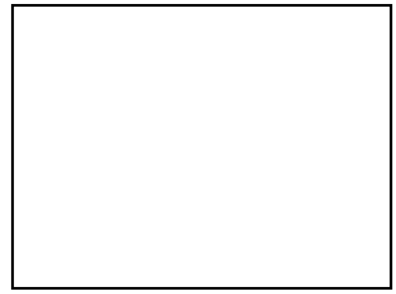
Scale 1 cm = 10 ft

50.



Scale 1 in. = 46 ft

51.



Scale 1 cm = 32 ft

52. Elaine did not convert units, and thought the ratios equaled 1.

53. $\frac{b}{d}$ or $\frac{a}{c}$

54. $\frac{c}{d}$ or $\frac{a}{b}$

55. $\frac{c + 2d}{d}$

56. $\frac{a}{b} = \frac{c}{d}$ (Given); $ad = bc$ (Cross-Product Prop.); $bc = ad$ (Symm. Prop. of =); $\frac{bc}{ac} = \frac{ad}{ac}$ (Div. Prop. of =); $\frac{b}{a} = \frac{d}{c}$ (Simplify)

57. $\frac{a}{b} = \frac{c}{d}$ (Given); $ad = bc$ (Cross-Prod. Prop.); $\frac{ad}{cd} = \frac{bc}{cd}$ (Div. Prop. of =); $\frac{a}{c} = \frac{b}{d}$ (Simplify)

58. $\frac{a}{b} = \frac{c}{d}$ (Given); $\frac{a}{b} + 1 = \frac{c}{d} + 1$ (Add. Prop. of =); $\frac{a}{b} + \frac{b}{b} = \frac{c}{d} + \frac{d}{d}$ (Subst.); $\frac{a + b}{b} = \frac{c + d}{d}$ (Simplify)

59. $x = 5; y = 24$

60. $x = 3; y = 15$

61. $x = 3; y = 21$

Answers for Lesson 7-2, pp. 375–378 Exercises

1. $\angle JHY$

2. $\angle R$

3. $\angle JXY$

4. HY

5. JT

6. HY

7. no; $\frac{20}{30} \neq \frac{36}{52}$

8. yes; $QRST \sim XWZY$; $\frac{3}{4}$

9. yes; $KLMJ \sim PQNO$; $\frac{3}{5}$

10. yes; $ABCD \sim FGHE$; $\frac{4}{5}$

11. No; corr. ∠s are not ≅.

12. yes; $\triangle ABC \sim \triangle FED$; $\frac{7}{5}$

13. $x = 4$; $y = 3$

14. $x = 20$; $y = 17.5$; $z = 7.5$

15. $x = 16$; $y = 4.5$; $z = 7.5$

16. $x = 6$; $y = 8$; $z = 10$

17. 6.6 in. by 11 in.

18. 3.6 in. by 6 in.

19. 70 mm

20. 54 in. by 87.37 in.

21. 2 : 3

22. 3 : 2

23. 50

24. 50

25. 70

26. $\frac{2}{3}$

27. 7.5 m

28. 5.6 m

29. Yes; corr. ∠s are ≅ and corr. sides are proportional with a ratio of 1 : 1.

30. equal sign, similarity symbol; Answers may vary. Sample: ≅ figures are similar with = areas.

31. C

32. $x = 60$, $y = 25$

33. 2.6 cm

34. 3 : 4

35. 3 : 1

36. 2 : 1

37. 1 : 2

38. 4 : 3

39. 2 : 3

40. sides of 2 cm; ∠s of 60° and 120°

41. sides of 2 cm; $\angle$s of 60° and 120°

42. sides of 3.2 cm; $\angle$s of 60° and 120°

43. sides of 0.8 cm; $\angle$s of 60° and 120°

44. sides of 1 cm; $\angle$s of 60° and 120°

45. sides of 3 cm; $\angle$s of 60° and 120°

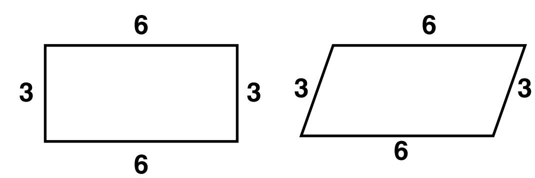
46. 16.2 in.

47. 6.2 in.

48. No; corr. sides are not in proportion.

49. Yes; explanations may vary. Sample: The ratios of radii, diameters, and circumferences of 2 circles are =.

50. Answers may vary. Sample:



51. **a.** **(1)** Corr. sides of ~ polygons are proport.

(2) Subst.

(3) Cross-Product Prop.

(4) Subtr. Prop.

b. Length cannot be negative.

c. 1.6180

52. **a.** 21, 34, 55, 89, 144, 233, 377

b. 1.6; 1.625; 1.6154; 1.6190; 1.6176; 1.6182; 1.6180; 1.6181; 1.6180

c. The ratios get closer to the golden ratio.

Answers for Lesson 7-3, pp. 385–388 Exercises

1. Yes; $\triangle ABC \sim \triangle FED$; SSS ~ Thm.

2. No; more info. is needed.

3. Ex. 1: $\frac{2}{3}$ (for $\triangle ABC$ to $\triangle FED$); Ex. 2: Not possible; the ⚠ aren't necessarily similar.

4. yes; $\triangle FHG \sim \triangle KHJ$; AA ~ Post.

5. No; $\frac{6}{3} \neq \frac{10}{4}$.

6. No; $\frac{20}{45} \neq \frac{25}{55}$.

7. Yes; $\triangle APJ \sim \triangle ABC$; SSS ~ Thm. or SAS ~ Thm.

8. Yes; $\triangle NMP \sim \triangle NQR$; SAS ~ Thm.

9. No; $\frac{32}{22} \neq \frac{45}{30}$.

10. AA ~ Post.; 7.5

11. AA ~ Post.; 2.5

12. AA ~ Post.; $12\frac{5}{6}$

13. AA ~ Post.; 12

14. AA ~ Post.; 8

15. AA ~ Post.; 15

16. SAS ~ Thm.; 12 m

17. AA ~ Post.; 220 yd

18. AA ~ Post.; 15 ft 9 in.

19. AA ~ Post.; 90 ft

20. Answers may vary. Sample: She can measure her shadow and use ~ ⚠ to find the length of the shadow of the proposed building.

21. 151 m

22. **a.** trapezoid

b. $\triangle RSZ \sim \triangle TWZ$; AA ~ Post.

23. **a.** No; the corr. ∠s may not be $\cong$.

b. Yes; every isosc. rt. △ is a 45°-45°-90° △. Therefore, by AA ~ Thm. they are all ~.

24. Yes; $\triangle GMK \sim \triangle SMP$; SAS ~ Thm.

25. Yes; $\triangle AWV \sim \triangle AST$; SAS $\sim$ Thm.

26. Yes; $\triangle XYZ \sim \triangle MNK$; SSS $\sim$ Thm.

27. No; there is only one pair of $\cong$ $\angle$s.

28. 45 ft

29. Check students' work.

30. 3 : 2

31. 2 : 1

32. 12 : 7

33. 4 : 3

34. 3 : 1

35. 3 : 2

36. 3 : 2

37. 2 : 1

38. 3 : 1

39. 6 : 1

40. Check students' work. Draw $\triangle ABC$. Construct $\angle A \cong \angle R$. Construct $\overline{RS}$ such that $RS = 3AB$, and $\overline{RT}$ such that $RT = 3AC$. Connect points S and T.

41. **1.** $RT \cdot TQ = MT \cdot TS$ (Given)

2. $\frac{MT}{TQ} = \frac{RT}{TS}$ (Prop. of Proportions)

3. $\angle RTM \cong \angle STQ$ (Vert. $\angle$s are $\cong$.)

4. $\triangle RTM \sim \triangle STQ$ (SAS $\sim$ Thm.)

42. **1.** $\ell_1 \parallel \ell_2$, $\overline{EF} \perp \overline{AF}$, $\overline{BC} \perp \overline{AF}$ (Given)

2. $\angle EFD$ and $\angle BCA$ are right $\angle$s. (Def. of $\perp$)

3. $\angle EFD \cong \angle BCA$ (All rt. $\angle$s are $\cong$.)

4. $\angle BAC \cong \angle EDF$ (If $\parallel$ lines, then corr. $\angle$s are $\cong$.)

5. $\triangle ABC \sim \triangle DEF$ (AA $\sim$)

6. $\frac{BC}{AC} = \frac{EF}{DF}$ (Def. of similar)

43. **1.** $\frac{BC}{AC} = \frac{EF}{DF}$, $\overline{EF} \perp \overline{AF}$, $\overline{BC} \perp \overline{AF}$ (Given)

2. $\angle ACB$ and $\angle DFE$ are rt. $\angle$s. (Def. of $\perp$)

3. $\angle ACB \cong \angle DFE$ (All rt. $\angle$s are $\cong$.)

4. $\triangle ABC \sim \triangle DEF$ (SAS $\sim$)

5. $\angle BAC \cong \angle EDF$ (Def. of similar)

6. $\ell_1 \parallel \ell_2$, (If corr. $\angle$s are $\cong$, then $\parallel$ lines.)

44. $\triangle ADC \sim \triangle CBD \sim \triangle ABC$; $\overline{CD}$ is an altitutde to the hypotenuse of a rt. triangle, $\triangle ABC$. Therefore, it divides $\triangle ABC$ into two triangles ($\triangle ADC$ and $\triangle CBD$) that are similar to each other and to the original triangle.

Answers for Lesson 7-4, pp. 394–396 Exercises

1. 6

2. $2\sqrt{10}$

3. $4\sqrt{3}$

4. 12

5. $14\sqrt{2}$

6. 25

7. $6\sqrt{6}$

8. $3\sqrt{7}$

9. s

10. r

11. c

12. a; a

13. h

14. b

15. 9

16. 20

17. 10

18. $6\sqrt{3}$

19. 12

20. 60

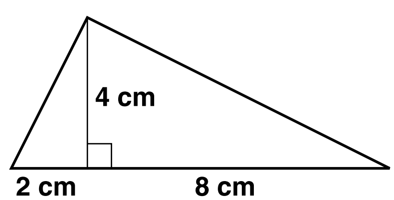
21. **a.** 18 mi

b. 24 mi

22. KNL; JNK

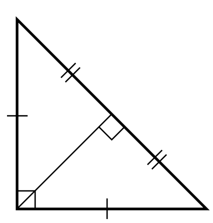
23. **a.** 4 cm

b.



c. Answers may vary. Sample: Draw a 10-cm segment. 2 cm from one endpoint, construct a ⊥ of length 4 cm. Connect to form a △.

24. **a.**



b. They are =. Explanations may vary. Sample: The altitude and hyp. segments are ≅ sides of two isosc. ⚠.

25. (10, 6), (−2, 6)

26. $4\sqrt{3}$

27. 14

28. 2

29. $\sqrt{14}$

30. 1

31. 2.5

32. $10\sqrt{10}$

33. 121

34. $x = 12; y = 3\sqrt{7}; z = 4\sqrt{7}$

35. $x = 12\sqrt{5}; y = 12; z = 6\sqrt{5}$

36. $x = 4; y = 2\sqrt{13}; z = 3\sqrt{13}$

37. $12\sqrt{2}$

38. C

39. $\ell_1 = \sqrt{2}, \ell_2 = \sqrt{2}, a = 1, h_2 = 1$

40. $\ell_1 = 2\sqrt{13}, \ell_2 = 3\sqrt{13}, h = 13, a = 6$

41. $\ell_1 = \ell_2 = 6\sqrt{2}, h = 12, h_2 = 6$

42. $\ell_2 = 2\sqrt{3}, h = 4, a = \sqrt{3}, h_1 = 1$

43. $\ell_1 = 5, a = \frac{60}{13}, h_1 = \frac{25}{13}, h_2 = \frac{144}{13}$

44. $\ell_2 = \frac{4\sqrt{7}}{3}, h = \frac{16}{3}, a = \sqrt{7}, h_2 = \frac{7}{3}$

45. $\ell_1 = 8\sqrt{5}, \ell_2 = 4\sqrt{5}, h_1 = 4, h_2 = 20$

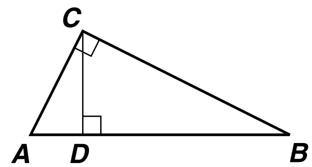
46. $\ell_1 = 6, h = 12, a = 3\sqrt{3}, h_2 = 9$

47. C is equidistant from A and B so C is on the ⊥ bisector of $\overline{AB}$ (⊥ Bis. Thm.) which thus must be $\overline{CM}$, the altitude to the hypotenuse. Since M is the midpoint of $\overline{AB}$, $AM = \frac{1}{2}AB$. Also, by Corollary 2 to Thm. 7-3, x is the geometric mean of AM and AB, so $\frac{\frac{1}{2}AB}{x} = \frac{AM}{x} = \frac{x}{AB}$. By the Cross-Product Property, $\frac{1}{2}AB^2 = x^2$, so $AB = x\sqrt{2}$.

48. As in Exercise 47, the altitude to the hypotenuse $\overline{CM}$ is the $\perp$ bisector of $\overline{AB}$. Thus $AM = 10$ and $AB = 20 = BC = CA$. By Corollary 1 to Thm. 7-3, BC is the geometric mean of MB and BD, so $\frac{MB}{BC} = \frac{BC}{BD} = \frac{BC}{MB + MD}$. Substitute in the values for BC and MB and solve for MD. By the Cross-Product Property, $10(10 + MD) = 20^2$, so $MD = 30$. By Corollary 1 to Thm. 7-3, h is the geometric mean of MB and MD, so $\frac{MB}{h} = \frac{h}{MD}$, $h^2 = 300$, and $h = 3\sqrt{10}$.

49. 3 **50.** 4 **51.** 4.5

52. a.



Given: rt. $\triangle ABC$ with alt. $\overline{CD}$;
Prove: $AC \cdot BC = AB \cdot CD$

b. Yes; $AC \cdot BC = 2 \times \text{area } \triangle ABC$ and $AB \cdot CD = 2 \times \text{area } \triangle ABC$.

53. a. By Corollary 2 to Thm. 7-3, $\frac{c}{a} = \frac{a}{r}$ and $\frac{c}{b} = \frac{b}{q}$. Combined with $c = q + r$, the resulting system can be reduced to $c^2 = a^2 + b^2$.

b. The square of the hypotenuse of a right triangle is equal to the sum of the squares of the legs of the triangle.

54. As in Exercise 47, the altitude to the hypotenuse $\overline{CM}$ is the $\perp$ bisector of $\overline{AB}$. Thus, $AM = MB = x$ and $AB = 2x = BC = CA$. By Corollary 1 to Thm. 7-3, BC is the geometric mean of MB and BD, so $\frac{x}{2x} = \frac{2x}{BD} = \frac{2x}{x + MD}$. By the Cross-Product Property, $x(x + MD) = 4x^2$, so $MD = 3x$. By Corollary 1 to Thm. 7-3, h is the geometric mean of MB and MD, so $\frac{x}{h} = \frac{h}{3x}$, $h^2 = 3x^2$, and $h = 3\sqrt{x}$.

Answers for Lesson 7-5, pp. 400–404 Exercises

1. 7.5

2. 8

3. 5.2

4. *d*

5. *c*

6. *b*

7. *d*

8. 7.5

9. $3\frac{1}{3}$

10. 9.6

11. 6

12. 4.8

13. 35

14. 3.6

15. $\frac{40}{7}$

16. 12

17. *KS*

18. *SQ*

19. *JP*

20. *KP*

21. *KM*

22. *PM*

23. *JP*

24. *LW*

25. 559 ft

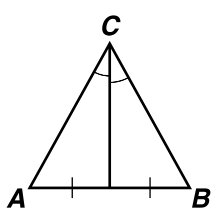
26. 671 ft

27. 2.4 cm and 2.6 cm; 3.3 cm and 8.7 cm; 3.8 cm and 9.2 cm

28. Answers may vary. Sample: 9 cm and 13.5 cm

29. $x = 18$ m; $y = 12$ m

30. a.



b. isosceles; △-∠ Bisector Thm.

31. 20

32. 2.5

33. $\frac{2}{7}$, 3

34. a. Given

b. Prop. of Proportions

c. Segment Add. Post.

d. Reflexive Prop. of $\cong$

e. SAS $\sim$ Thm.

f. Corr. $\angle$s of $\sim$ $\triangle$s are $\cong$.

g. If corr. $\angle$s are $\cong$, lines are $\parallel$.

35. a. $\frac{AB}{BC}$

b. $\frac{WX}{XY}$

c. $\frac{AB}{BC} = \frac{WX}{XY}$

36. Yes; since $\frac{6}{10} = \frac{9}{15}$, the segments are $\parallel$ by the Converse of the Side-Splitter Thm.

37. No; $\frac{28}{12} \neq \frac{24}{10}$.

38. Yes; since $\frac{15}{12} = \frac{20}{16}$, the segments are $\parallel$ by the Converse of the Side-Splitter Thm.

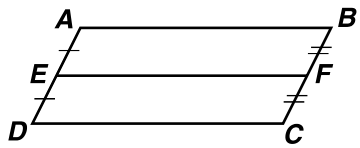
39. Measure $\overline{AC}$, $\overline{CE}$, and $\overline{BD}$. Use the Side-Splitter Thm. Write the proport. $\frac{AC}{CE} = \frac{AB}{BD}$ and solve for AB.

40. 4.5 cm or 12.5 cm

41. 6 **42.** 2.5 **43.** 19.5

44. The two segments are x and y. $\frac{x}{y} = \frac{ks}{s} = k$, so $x = ky$.

45. a. A midsegment of a ▱ connects the midpts. of 2 opp. sides.

b. 

Given: ▱$ABCD$ with $\overline{EF}$ connecting the midpts. of $\overline{AD}$ and $\overline{BC}$ Prove: $\overline{AB} \parallel \overline{EF}$; $\overline{EF} \parallel \overline{CD}$

1. ▱$ABCD$ (Given)

2. $\overline{AE} \parallel \overline{BF}$ and $\overline{ED} \parallel \overline{FC}$ (Def. of ▱)

3. $\overline{AD} \cong \overline{BC}$ (Opp. sides of ▱ are ≅.)

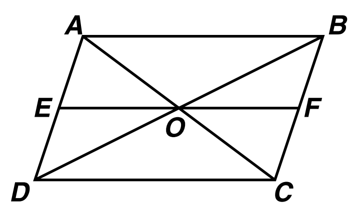
4. E and F are midpts. of $\overline{AD}$ and $\overline{BC}$. (Given)

5. $AE = ED = \frac{1}{2}AD$; $BF = FC = \frac{1}{2}BC$ (Def. of midpt.)

6. $AE = BF$, $ED = FC$ (Subst.)

7. $ABFE$ and $EFCD$ are ▱s (If one pair of opp. sides of a quad. is ≅ and ∥, it is a ▱.)

8. $\overline{AB} \parallel \overline{EF}$ and $\overline{EF} \parallel \overline{CD}$ (Opp. sides of a ▱ are ∥.)

c. 

Given: ▱$ABCD$ with midsegment $\overline{EF}$ Prove: $\overline{EF}$ bisects $\overline{AC}$ and $\overline{BD}$. Since $\overline{AB} \parallel \overline{EF} \parallel \overline{DC}$ by part (b), and $\overline{EF}$ bisects $\overline{AD}$, by the Side-Splitter Thm., $\overline{EF}$ bisects $\overline{AC}$ and $\overline{BD}$.

46. If a ray passes through the vertex of an angle of a triangle and splits the opposite side into segments that are proportional to the other two sides of the triangle, then the ray bisects the angle. Explanations may vary. Sample: Refer to diagram in proof of Theorem 7-5, p. 400. It is given that $\frac{CD}{DB} = \frac{CA}{BA}$, and by the Side-Splitter Thm., $\frac{CD}{DB} = \frac{CA}{AF}$, so $BA = AF$. $\triangle ABF$ is isosceles by the Isos. Triangle Thm., so $\angle 3 \cong \angle 4$. $\angle 2 \cong \angle 4$ by the Alt. Int. Angles Thm., and $\angle 1 \cong \angle 3$ by the Corr. Angles Thm., so by substitution, $\angle 1 \cong \angle 2$, and therefore $\overline{AD}$ bisects $\angle CAB$.

47. **a.** 14

b. 11