Solutions Key
Similarity

ARE YOU READY? PAGE 451

1. E
2. F
3. B
4. D
5. A
6. $\frac{16}{20} = \frac{4(4)}{4(5)} = \frac{4}{5}$
7. $\frac{14}{21} = \frac{7(2)}{7(3)} = \frac{2}{3}$
8. $\frac{33}{121} = \frac{11(3)}{11(11)} = \frac{3}{11}$
9. $\frac{56}{80} = \frac{8(7)}{8(10)} = \frac{7}{10}$
10. 18 to 24
    6(3) to 6(4)
    3 to 4
11. 34 to 18
    2(17) to 2(9)
    17 to 9
12. Total # of CDs is:
    36 + 18 + 34 + 24 = 112
    36 to 112
    4(9) to 4(28)
    9 to 28
13. 112 to 24
    8(14) to 8(3)
    14 to 3
14. yes; pentagon
15. yes; hexagon
16. no
17. yes; octagon
18. $P = 2\ell + 2w$
    $= 2(8.3) + 2(4.2)$
    $= 25$ ft
19. $P = 6s$
    $= 6(30) = 180$ cm
20. $P = 4s$
    $= 4(11.4) = 45.6$ m
21. $P = 5s$
    $= 5(3.9) = 19.5$ in.

7-1 RATIO AND PROPORTION, PAGES 454–459

CHECK IT OUT! PAGES 454–456

1. slope $= \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$
   $= \frac{5 - 3}{6 - (-2)}$
   $= \frac{2}{8} = \frac{1}{4}$
2. Let ∠ measures be x, $6x$, and $13x$. Then $x + 6x + 13x = 180$. After like terms are combined, $20x = 180$. So $x = 9$. The ∠ measures are $x = 9°$, $6x = 6(9) = 54°$, and $13x = 13(9) = 117°$.

3a. $\frac{3}{8} = \frac{x}{56}$
$3(56) = x(8)$
$168 = 8x$
$x = 21$

b. $\frac{2y}{9} = \frac{8}{4y}$
$2y(4y) = 9(8)$
$8y^2 = 72$
$y^2 = 9$
$y = \pm 3$

c. $\frac{d}{3} = \frac{6}{2}$
$d(2) = 3(6)$
$2d = 18$
$d = 9$

d. $\frac{x + 3}{4} = \frac{9}{x + 3}$
$(x + 3)(x + 3) = 4(9)$
$x^2 + 6x + 9 = 36$
$x^2 + 6x - 27 = 0$
$(x - 3)(x + 9) = 0$
$x = 3$ or -9

4. $16s = 20t$
$\frac{t}{s} = \frac{16}{20}$
$\frac{t}{s} = \frac{4}{5} = 4{:}5$

5. **1 Understand the Problem**
Answer will be height of new tower.
2 Make a Plan
Let y be height of new tower. Write a proportion that compares the ratios of model height to actual height.
$\frac{\text{height of 1st tower}}{\text{height of 1st model}} = \frac{\text{height of new tower}}{\text{height of new model}}$
$\frac{1328}{8} = \frac{y}{9.2}$
3 Solve
$\frac{1328}{8} = \frac{y}{9.2}$
$1328(9.2) = 8(y)$
$12{,}217.6 = 8y$
$y = 1527.2$ m
4 Look Back
Check answer in original problem. Ratio of actual height to model height is 1328 : 8, or 166 : 1. Ratio of actual height to model height for new tower is 1527.2 : 9.2 In simplest form, this ratio is also 166 : 1. So ratios are equal, and answer is correct.

THINK AND DISCUSS, PAGE 457

1. No; ratio 6 : 7 is < 1, but ratio 7 : 6 is > 1.
2. She can see if cross products are =. Since 3(28) = 7(12), ratios do form a proportion. Therefore ratios are = and fractions are equivalent.
3.

Definition: A proportion is an eqn. stating that 2 ratios are =.	Properties: If $\frac{a}{b} = \frac{c}{d}$, then $ad = bc$, $\frac{b}{a} = \frac{d}{c}$, and, $\frac{a}{c} = \frac{b}{d}$
Proportion	
Example: Possible answer: $\frac{1}{3} = \frac{4}{12}$ is a proportion.	Nonexample: Possible answer: $\frac{1}{3} = \frac{4}{13}$ is not a proportion.

EXERCISES, PAGES 457–459

GUIDED PRACTICE, PAGE 457

1. means: 3 and 2; extremes: 1 and 6
2. sv; tu
3. slope $= \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$
   $= \frac{4 - 3}{1 - (-1)} = \frac{1}{2}$
4. slope $= \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$
   $= \frac{2 - (-2)}{2 - (-2)}$
   $= \frac{4}{4} = \frac{1}{1}$

5. slope $= \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$
$= \frac{-1 - 1}{2 - (-1)}$
$= \frac{-2}{3} = -\frac{2}{3}$

6. Let side lengths be $2x$, $4x$, $5x$, and $7x$. Then $2x + 4x + 5x + 7x = 36$. After like terms are combined, $18x = 36$. So $x = 2$. The shortest side measures $2x = 2(2) = 4$ m.

7. Let ∠ measures be $5x$, $12x$, and $19x$. Then $5x + 12x + 19x = 180$. After like terms are combined, $36x = 180$. So $x = 5$. The largest ∠ measures $19x = 19(5) = 95°$.

8. $\frac{x}{2} = \frac{40}{16}$
$x(16) = 2(40)$
$16x = 80$
$x = 5$

9. $\frac{7}{y} = \frac{21}{27}$
$7(27) = y(21)$
$189 = 21y$
$y = 9$

10. $\frac{6}{58} = \frac{t}{29}$
$6(29) = 58(t)$
$174 = 58t$
$t = 3$

11. $\frac{y}{3} = \frac{27}{y}$
$y(y) = 3(27)$
$y^2 = 81$
$y = \pm 9$

12. $\frac{16}{x-1} = \frac{x-1}{4}$
$16(4) = (x - 1)(x - 1)$
$64 = x^2 - 2x + 1$
$0 = x^2 - 2x - 63$
$0 = (x - 9)(x + 7)$
$x = 9$ or -7

13. $\frac{x^2}{18} = \frac{x}{6}$
$x^2(6) = 18(x)$
$6x^2 - 18x = 0$
$6x(x - 3) = 0$
$x = 0$ or 3

14. $2a = 8b$
$\frac{a}{b} = \frac{8}{2}$
$\frac{a}{b} = \frac{4}{1} = 4{:}1$

15. $6x = 27y$
$\frac{6}{27} = \frac{y}{x}$
$\frac{y}{x} = \frac{2}{9} = 2{:}9$

16. **1 Understand the Problem**
Answer will be height of Arkansas State Capitol.
2 Make a Plan
Let x be height of Arkansas State Capitol. Write a proportion that compares the ratios of height to width.
$$\frac{\text{height of U.S. Capitol}}{\text{width of U.S. Capitol}} = \frac{\text{height of Arkansas Capitol}}{\text{width of Arkansas Capitol}}$$
$$\frac{288}{752} = \frac{x}{564}$$
3 Solve
$\frac{288}{752} = \frac{x}{564}$
$288(564) = 752(x)$
$162{,}432 = 752x$
$x = 216$ ft
4 Look Back
Check answer in original problem. Ratio of height to width for U.S. Capitol is 288 : 752, or 18 : 47. Ratio of height to width for Arkansas State Capitol is 216 : 564 In simplest form, this ratio is also 18 : 47. So ratios are equal, and answer is correct.

PRACTICE AND PROBLEM SOLVING, PAGES 458–459

17. slope $= \frac{4 - 1}{1 - 0} = \frac{3}{1}$

18. slope $= \frac{-4 + 1}{3 - 0} = -\frac{1}{1}$

19. slope $= \frac{0 + 3}{3 - 1} = \frac{3}{2}$

20. Let side lengths be $4x$ and $4x$, and let base length be $7x$.
$4x + 4x + 7x = 52.5$
$15x = 52.5$
$x = 3.5$
length of base $= 7(3.5) = 24.5$ cm

21. Let ∠ measures be $2x$, $3x$, $2x$, and $3x$. By Quad. ∠ Sum Thm., sum of ∠ measures is 360°.
$2x + 3x + 2x + 3x = 360$
$10x = 360$
$x = 36$
∠ measures are $2(36) = 72°$, $3(36) = 108°$, 72°, and 108°.

22. $\frac{6}{8} = \frac{9}{y}$
$6y = 8(9) = 72$
$y = 12$

23. $\frac{x}{14} = \frac{50}{35}$
$35x = 14(50) = 700$
$x = 20$

24. $\frac{z}{12} = \frac{3}{8}$
$8z = 12(3) = 36$
$z = 4.5$

25. $\frac{2m + 2}{3} = \frac{12}{2m + 2}$
$(2m + 2)^2 = 3(12)$
$4m^2 + 8m + 4 = 36$
$4m^2 + 8m - 32 = 0$
$m^2 + 2m - 8 = 0$
$(m - 2)(m + 4) = 0$
$m = 2$ or -4

26. $\frac{5y}{16} = \frac{125}{y}$
$5y^2 = 16(125)$
$5y^2 = 2000$
$y^2 = 400$
$y = \pm 20$

27. $\frac{x + 2}{12} = \frac{5}{x - 2}$
$(x + 2)(x - 2) = 12(5)$
$x^2 - 4 = 60$
$x^2 = 64$
$x = \pm 8$

28. $5y = 25x$
$\frac{5}{25} = \frac{x}{y}$
$\frac{x}{y} = \frac{1}{5}$

29. $35b = 21c$
$\frac{b}{c} = \frac{21}{35} = \frac{3}{5}$
Ratio is 3 : 5.

30. Let x represent height of actual windmill.
$$\frac{\text{height of windmill}}{\text{width of windmill}} = \frac{\text{height of model}}{\text{width of model}}$$
$\frac{x}{20} = \frac{1.2}{0.8}$
$0.8x = 20(1.2) = 24$
$x = 30$ m

31. $\frac{a}{b} = \frac{5}{7}$
$7a = 5b$

32. $\frac{a}{b} = \frac{5}{7}$
$7a = 5b$
$7 = \frac{5b}{a}$
$\frac{7}{5} = \frac{b}{a}$

33. $\frac{a}{b} = \frac{5}{7}$
$7a = 5b$
$\frac{7a}{5} = b$
$\frac{a}{5} = \frac{b}{7}$

34. Cowboys lost
$16 - 10 = 6$ games.
wins : losses $= 10:6$
$= \frac{10}{2}:\frac{6}{2}$
$= 5:3$

35. slope $= \frac{5 + 4}{21 + 6}$
$= \frac{9}{27} = \frac{1}{3}$

36. slope $= \frac{1 + 5}{6 - 16}$
$= \frac{6}{-10} = -\frac{3}{5}$

37. slope $= \frac{5.5 + 2}{4 - 6.5}$
$= \frac{7.5}{-2.5} = -3$

38. slope $= \frac{0 - 1}{-2 + 6} = -\frac{1}{4}$

39a. $\frac{1.25 \text{ in.}}{15 \text{ in.}} = \frac{x \text{ in.}}{9600 \text{ in.}}$

b. $1.25(9600) = 15x$
$12{,}000 = 15x$
$x = 800$ in.
$= 66$ ft 8 in.

40. Quad. is a rect. because opp. sides are ≅ and diags. are ≅.

41. Areas are $6^2 = 36$ cm^2 and $9^2 = 81$ cm^2.
$\frac{36}{81} = \frac{4}{9}$

42. $\frac{5}{3.5} = \frac{20}{w}$
$5w = 3.5(20) = 70$
$w = 14$ in.

43. A ratio is a comparison of 2 numbers by div.
A proportion is an eqn. stating that 2 ratios are =.

TEST PREP, PAGE 459

44. B
$x + 4x + 5x = 18$
$10x = 18$
$x = 1.8$ in.
$4x = 4(1.8) = 7.2$ in.,
$5x = 5(1.8) = 9$ in.

45. H
$\frac{3}{5} = \frac{x}{y}$
$3y = 5x$
$y = \frac{5x}{3}$
$\frac{y}{5} = \frac{x}{3}$

46. A
$\frac{5}{2} = \frac{1.25}{v}$
$5v = 2(1.25) = 2.5$
$v = \frac{1}{2}$

47. First, cross multiply:
$36x = 15(72) = 1080$
Then divide both sides by 36:
$\frac{36x}{36} = \frac{1080}{36}$
Finally, simplify:
$x = 30$
You must assum that $x \neq 0$.

CHALLENGE AND EXTEND, PAGE 459

48. Perimeters are $2(3) + 2(5) = 16$ and $2x + 2(4) = 2x + 8$.
$\frac{4}{7} = \frac{16}{2x + 8}$
$4(2x + 8) = 7(16)$
$8x + 32 = 112$
$8x = 80$
$x = 10$

49. Given $\frac{a}{b} = \frac{c}{d}$, add 1 to both sides of eqn:
$\frac{a}{b} + \frac{b}{b} = \frac{c}{d} + \frac{d}{d}$
Adding fractions on both sides of eqn. gives
$\frac{a + b}{b} = \frac{c + d}{d}$.

50. Possible proportions are $\frac{1}{2} = \frac{3}{6}, \frac{1}{3} = \frac{2}{6}, \frac{2}{1} = \frac{6}{3}, \frac{2}{6} = \frac{1}{3}, \frac{3}{1} = \frac{6}{2}, \frac{3}{6} = \frac{1}{2}, \frac{6}{2} = \frac{3}{1}$, and $\frac{6}{3} = \frac{2}{1}$.
There are 8 possible proportions. Total number of outcomes $= 4! = 24$.
Probability $= \frac{8}{24} = \frac{1}{3}$

51. $\frac{x^2 + 9x + 18}{x^2 - 36} = \frac{(x + 6)(x + 3)}{(x + 6)(x - 6)}$
$= \frac{x + 3}{x - 6}$, where $x \neq \pm 6$

SPIRAL REVIEW, PAGE 459

52. $y - 6(0) = -3$
$y = -3$

53. $(3) - 6x = -3$
$-6x = -6$
$x = 1$

54. $y - 6(-4) = -3$
$y + 24 = -3$
$y = -27$

55. Think: Use Same-Side Ext. ∠s Thm. to find y, then use Vert. ∠s Thm.
$3y + 2y + 20 = 180$
$5y = 160$
$y = 32$
$m\angle ABD = 3y$
$= 3(32) = 96°$

56. Think: Use Vert. ∠s Thm.
$m\angle CDB = 2y + 20$
$= 2(32) + 20$
$= 84°$

57. $9^2 \stackrel{?}{=} 5^2 + 8^2$
$81 \stackrel{?}{=} 25 + 64$
$81 < 89$
△ is acute.

58. $20^2 \stackrel{?}{=} 8^2 + 15^2$
$400 \stackrel{?}{=} 64 + 225$
$400 > 289$
△ is obtuse.

59. $25^2 \stackrel{?}{=} 7^2 + 24^2$
$625 \stackrel{?}{=} 49 + 576$
$625 = 625$
△ is a right triangle.

TECHNOLOGY LAB: EXPLORE THE GOLDEN RATIO, PAGES 460–461

ACTIVITY 1

1. Check students' work. The equal ratios have the approximate value of 1.62.
2. The ratios have the same value as the ratios in Step 1.

TRY THIS, PAGE 461

1. If side length of square is 2 units, then $MB = 1$ unit and $BC = 2$ units. $\overline{MC}$ is hyp. of rt. △ formed by $\overline{MB}$ and $\overline{BC}$. By Pyth. Thm.,
$MC = \sqrt{5}$ units
$AE = \sqrt{5} + 1$ units
$\frac{AE}{EF} = \frac{\sqrt{5}+1}{2} \approx 1.618$

2. $BE = \sqrt{5} - 1$ units
$\frac{BE}{EF} = \frac{\sqrt{5}-1}{2} \approx 0.618$
The sign of the numerator in this fraction is different from that of the fraction in **Try This** Problem 1.

3. Quotients have values that approach 1.618.

4. There are $1 + 1 = 2$ rabbits.

5. There are $8 + 13 = 21$ petals on the daisy.

6. No; $\frac{5.4}{4} \approx 1.4$

7. Yes; $\frac{4.5}{2.8} \approx 1.6$

7-2 RATIOS IN SIMILAR POLYGONS, PAGES 462–467

CHECK IT OUT! PAGES 462–464

1. $\angle C \cong \angle H$. By Rt. $\angle \cong$ Thm., $\angle B \cong \angle G$.
By 3rd $\angle$s Thm., $\angle A \cong \angle J$.
$\frac{AB}{JG} = \frac{10}{5} = 2, \frac{BC}{GH} = \frac{6}{3} = 2, \frac{AC}{JH} = \frac{11.6}{5.8} = 2$

2. **Step 1** Identify pairs of $\cong$ $\angle$s.
$\angle L \cong \angle P$ (Given)
$\angle M \cong \angle N$ (Rt. $\angle \cong$ Thm.)
$\angle J \cong \angle S$ (3rd $\angle$s Thm.)
Step 2 Compare corr. sides.
$\frac{JL}{SP} = \frac{75}{30} = \frac{5}{2}, \frac{LM}{PN} = \frac{60}{24} = \frac{5}{2}, \frac{JM}{SN} = \frac{45}{18} = \frac{5}{2}$
yes; similarity ratio is $\frac{5}{2}$, and $\triangle LMJ \sim \triangle PNS$.

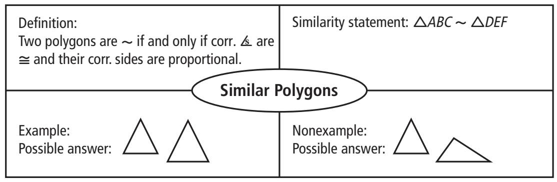
3. Let x be length of the model boxcar in inches. Rect. model of boxcar is ~ to rect. boxcar, so corr. lengths are proportional.
$$\frac{\text{length of boxcar}}{\text{length of model}} = \frac{\text{width of boxcar}}{\text{width of model}}$$
$$\frac{36.25}{x} = \frac{9}{1.25}$$
$$36.25(1.25) = 9x$$
$$45.3125 = 9x$$
$$x = \frac{45.3125}{9} \approx 5 \text{ in.}$$

THINK AND DISCUSS, PAGE 464

1. $\cong$ symbol is formed.

2. Sides of rect. $EFGH$ are 9 times as long as corr. sides of rect. $ABCD$.

3. Possible answers: reg. polygons of same type; Ⓢ

4. 

EXERCISES, PAGES 465–467

GUIDED PRACTICE, PAGE 465

1. Possible answer: students' desks

2. $\angle M \cong \angle U$ and $\angle N \cong \angle V$. By 3rd $\angle$s Thm., $\angle P \cong \angle W$.
$\frac{MN}{UV} = \frac{4}{8} = \frac{1}{2}, \frac{MP}{UW} = \frac{3}{6} = \frac{1}{2}, \frac{NP}{VW} = \frac{2}{4} = \frac{1}{2}$

3. $\angle A \cong \angle H$ and $\angle C \cong \angle K$. By def. of $\cong$ $\angle$s, and taking vertices clockwise in both figures, $\angle B \cong \angle J$ and $\angle D \cong \angle L$.
$\frac{AB}{HJ} = \frac{8}{12} = \frac{2}{3}, \frac{BC}{JK} = \frac{4}{6} = \frac{2}{3}, \frac{CD}{KL} = \frac{4}{6} = \frac{2}{3},$
$\frac{DA}{LH} = \frac{8}{12} = \frac{2}{3}$

4. **Step 1** Identify pairs of $\cong$ $\angle$s. Think: All $\angle$s of a rect. are rt. $\angle$s and are $\cong$.
$\angle A \cong \angle E$, $\angle B \cong \angle F$, $\angle C \cong \angle G$, and $\angle D \cong \angle H$.
Step 2 Compare corr. sides.
$\frac{AB}{EF} = \frac{135}{90} = \frac{3}{2}, \frac{AD}{EH} = \frac{45}{30} = \frac{3}{2}$
Yes; since opp. sides of a rect. are $\cong$, corr. sides are proportional. Similarity ratio is $\frac{3}{2}$, and $ABCD \sim EFGH$.

5. **Step 1** Identify pairs of $\cong$ $\angle$s.
$\angle M \cong \angle W$, $\angle P \cong \angle U$ (Given)
$\angle R \cong \angle X$ (3rd $\angle$s Thm.)
Step 2 Compare corr. sides.
$\frac{RM}{XW} = \frac{8}{12} = \frac{2}{3}, \frac{MP}{WU} = \frac{10}{15} = \frac{2}{3}, \frac{RP}{XU} = \frac{4}{6} = \frac{2}{3}$
yes; similarity ratio is $\frac{2}{3}$, and $\triangle RMP \sim \triangle XWU$.

6. Let x be height of reproduction in feet. Reproduction is ~ to original, so corr. lengths are proportional.
$$\frac{\text{height of reproduction}}{\text{height of original}} = \frac{\text{width of reproduction}}{\text{width of original}}$$
$$\frac{x}{73} = \frac{24}{58}$$
$$58x = 73(24) = 1752$$
$$x = \frac{1752}{58} \approx 30 \text{ ft}$$

PRACTICE AND PROBLEM SOLVING, PAGES 465–466

7. $\angle K \cong \angle T$, $\angle L \cong \angle U$ (Given)
$\angle J \cong \angle S$, $\angle M \cong \angle V$ (Rt. $\angle \cong$ Thm.)
$\frac{JK}{ST} = \frac{20}{24} = \frac{5}{6}, \frac{KL}{TU} = \frac{14}{16.8} = \frac{5}{6}, \frac{LM}{UV} = \frac{30}{36} = \frac{5}{6},$
$\frac{JM}{SV} = \frac{10}{12} = \frac{5}{6}$

8. $\angle A \cong \angle X$, $\angle C \cong \angle Z$ (Given)
$\angle B \cong \angle Y$ (3rd $\angle$s Thm.)
$\frac{AB}{XY} = \frac{8}{4} = 2, \frac{BC}{YZ} = \frac{6}{3} = 2, \frac{CA}{ZX} = \frac{12}{6} = 2$

9. **Step 1** Identify pairs of ≅ ∠s.
$m\angle R = 90 - 53 = 37°$
$\angle R \cong \angle U$ (Def. of ≅ ∠s)
$\angle S \cong \angle Z$ (Rt. ∠ ≅ Thm.)
$\angle Q \cong \angle X$ (3rd ∠s Thm.)
Step 2 Compare corr. sides.
$\frac{QR}{XU} = \frac{35}{40} = \frac{7}{8}, \frac{QS}{XZ} = \frac{21}{24} = \frac{7}{8}, \frac{RS}{UZ} = \frac{28}{32} = \frac{7}{8}$
yes; similarity ratio $= \frac{7}{8}$; $\triangle RSQ \sim \triangle UZX$

10. **Step 1** Identify pairs of ≅ ∠s.
$\angle A \cong \angle M, \angle B \cong \angle J, \angle C \cong \angle K, \angle D \cong \angle L$
(Rt. ∠ ≅ Thm.)
Step 2 Compare corr. sides.
$\frac{AB}{MJ} = \frac{18}{24} = \frac{3}{4}, \frac{AD}{ML} = \frac{AD}{JK} = \frac{36}{54} = \frac{2}{3}$
no; the rectangles are not similar

11. $\frac{\text{model length}}{\text{car length}} = \frac{1}{56}$
$\frac{3}{\ell} = \frac{1}{56}$
$3(56) = \ell$
$\ell = 168 \text{ in.} = 14 \text{ ft}$

12. Let x, y be side lengths of squares $ABCD$ and $PQRS$. Areas are x^2 and y^2, so
$\frac{x^2}{y^2} = \frac{4}{36} = \frac{1}{9}$
$\frac{x}{y} = \sqrt{\frac{1}{9}} = \frac{1}{3}$
$\sim$ ratio of $ABCD$ to $PQRS = \frac{x}{y} = \frac{1}{3}$
$\sim$ ratio of $PQRS$ to $ABCD = \frac{y}{x} = \frac{3}{1}$

13. sometimes (iff acute ∠s are ≅)

14. always (all (rt.) ∠s are ≅, all side-length ratios are =)

15. never (in trap., 1 pair sides are ∦, so opp. pairs of ∠s cannot be ≅; but in ▱, they are ≅)

16. always (by CPCTC, all corr. ∠s are ≅, and since corr. sides ≅, ∼ ratio = 1)

17. sometimes (similar polygons are ≅ iff ∼ ratio = 1)

18. By def. of reg. polygons, corr. int. ∠s are ≅, and side lengths are ≅ and thus proportional. So any 2 reg. polygons with same number of sides are ∼.

19. $\frac{EF}{AB} = \frac{FG}{BC}$
$\frac{x+3}{4} = \frac{2x-4}{3}$
$3(x+3) = 4(2x-4)$
$3x + 9 = 8x - 16$
$25 = 5x$
$x = 5$

20. $\frac{MP}{XZ} = \frac{NP}{YZ}$
$\frac{x+5}{30} = \frac{4x-10}{75}$
$75(x+5) = 30(4x-10)$
$5(x+5) = 2(4x-10)$
$5x + 25 = 8x - 20$
$45 = 3x$
$x = 15$

21. Possible answer:
$\frac{\text{Statue of Liberty's nose}}{\text{Statue of Liberty's hand}} \approx \frac{\text{your nose}}{\text{your hand}}$
$\frac{x \text{ ft}}{16.4 \text{ ft}} \approx \frac{2 \text{ in.}}{7 \text{ in.}}$
$7x \approx 2(16.4) = 32.8$
$x \approx 4.7$
Estimated length of Statue of Liberty's nose is 4.7 ft (or between 4.5 ft and 5 ft).

22. If 2 polygons are ∼, then their corr. ∠s are ≅ and their corr. sides are proportional. If corr. ∠s of 2 polygons are ≅ and their corr. sides are proportional, then polygons are ∼.

23. ▱$JKLM \sim$ ▱$NOPQ \rightarrow \angle O \cong \angle K \rightarrow m\angle O = 75°$
$NOPQ$ a ▱ $\rightarrow \angle Q \cong \angle O \rightarrow m\angle Q = 75°$
$\angle O$ and $\angle Q$ are 75° ∠s.

24. $\frac{\text{width on blueprint}}{\text{actual width}} = \frac{\text{length on blueprint}}{\text{actual length}}$
$\frac{w}{14} = \frac{3.5}{18}$
$18w = 14(3.5) = 49$
$w = \frac{49}{18} \approx 2.7 \text{ in.}$

25. Polygons must be ≅. Since polygons are ∼, their corr. ∠s must be ≅. Since ∼ ratio is 1, corr. sides must have same length.

26a. $\frac{\text{height of tree on backdrop}}{\text{height of tree on flat}} = \frac{1}{10}$
$\frac{0.9}{h} = \frac{1}{10}$
$0.9(10) = h$
$h = 9 \text{ ft}$

b. $\frac{\text{height of tree on flat}}{\text{height of actual tree}} = \frac{1}{2}$
$\frac{9}{H} = \frac{1}{2}$
$9(2) = H$
$H = 18 \text{ ft}$

c. $\sim \text{ ratio} = \frac{\text{height of tree on backdrop}}{\text{height of actual tree}}$
$= \frac{0.9}{18} = \frac{1}{20}$

TEST PREP, PAGE 467

27. C
$\frac{y}{14.4} = \frac{8.4}{4.8}$
$4.8y = 14.4(8.4)$
$= 120.96$
$y = 25.2$

28. F
$\frac{5}{2} = \frac{GL}{PS}$
$\frac{5}{2} = \frac{20}{PS}$
$5PS = 20(2) = 40$
$PS = 8$

29. Ratios of sides are not the same: $\frac{12}{3.5} = \frac{24}{7}$, $\frac{10}{2.5} = 4$, $\frac{6}{1.5} = 4$

CHALLENGE AND EXTEND, PAGE 467

30. $\frac{\text{model length}}{\text{building length}} = \frac{1}{500}$
$\frac{\ell}{200} = \frac{1}{500}$
$500\ell = 200$
$\ell = 0.4 \text{ ft} = 4.8 \text{ in.}$
$\frac{\text{model width}}{\text{building width}} = \frac{1}{500}$
$\frac{w}{140} = \frac{1}{500}$
$500w = 140$
$w = 0.28 \text{ ft} = 3.36 \text{ in.}$

31. Since $\overline{QR} \parallel \overline{ST}$, $\angle PQR \cong \angle PST$ and $\angle PRQ \cong \angle PTS$ by Alt. Int. ∠s Thm. $\angle P \cong \angle P$ by Reflex. Prop. of ≅. Thus corr. ∠s of $\triangle PQR$ and $\triangle PST$ are ≅. Since $PS = 6$ and $PT = 8$, $\frac{PQ}{PS} = \frac{PR}{PT} = \frac{QR}{ST} = \frac{1}{2}$. Therefore $\triangle PQR \sim \triangle PST$ by def. of ~ polygons.

32a. By HL, $\triangle ABD \cong \triangle CBD$, so $\angle A \cong \angle C$, and $m\angle A = m\angle C = 45°$. So $\triangle ABC$ is a 45°-45°-90° △.
$AC = AB\sqrt{2} = 1\sqrt{2} = \sqrt{2}$
$m\angle CBD = 90 - \angle C = 45°$, so $\triangle CDB$ is also *a* 45°-45°-90° △. So
$BC = 1 = DC\sqrt{2} = DB\sqrt{2}$
$\sqrt{2} = 2DC = 2DB$
$DC = DB = \frac{\sqrt{2}}{2}$

b. From part a., corr. ∠s *of* $\triangle ABC$ *and* $\triangle CDB$.
$\frac{AB}{BD} = \frac{BC}{DC} = \frac{AC}{BC} = \sqrt{2}$. By def. of ~, $\triangle ABC \sim \triangle CDB$.

33a. rect. $ABCD$ ~ rect. $BCFE$

b. $\frac{\ell}{1} = \frac{1}{\ell - 1}$

c. $\ell(\ell - 1) = 1$
$\ell^2 - \ell = 1$
$\ell^2 - \ell - 1 = 0$
$\ell = \frac{1 \pm \sqrt{1^2 - 4(1)(-1)}}{2}$
$= \frac{1 \pm \sqrt{5}}{2}$
Think: $\ell > 0$, so take positive sq. root.
$\ell = \frac{1 + \sqrt{5}}{2}$

d. $\ell \approx 1.6$

SPIRAL REVIEW, PAGE 467

34. # of orders = # of permutations of 4 things
$= 4! = 24$

35. Think: Kite → diags. are ⊥. So $\angle QTR$ is a rt. ∠.
$m\angle QTR = 90°$

36. Think: $\triangle PST \cong \triangle RST$. By CPCTC,
$\angle PST \cong \angle RST$
$m\angle PST = m\angle RST = 20°$

37. Think: $\triangle PST$ is a rt. △. So $\angle PST$ and $\angle TPS$ are comp.
$m\angle TPS = 90 - m\angle PST$
$= 90 - 20 = 70°$

38. $\frac{x}{4} = \frac{y}{10}$
$10x = 4y$

39. $\frac{x}{4} = \frac{y}{10}$
$10x = 4y$
$\frac{10x}{y} = 4$
$\frac{10}{y} = \frac{4}{x}$

40. $\frac{x}{4} = \frac{y}{10}$
$x = \frac{4y}{10}$
$\frac{x}{y} = \frac{4}{10}$ or $\frac{2}{5}$

TECHNOLOGY LAB: PREDICT TRIANGLE SIMILARITY RELATIONSHIPS, PAGES 468–469

ACTIVITY 1, PAGE 468

3. The ratios of cor. side lengths are =.

TRY THIS, PAGE 468

1. △ Sum Thm.
2. Yes; in ~ △s, corr. sides are proportional.

ACTIVITY 2, PAGE 468

3. corr. ∠s are ≅.

TRY THIS, PAGE 469

3. Yes; if 2 △s have their corr. sides in same ratio, then they are ~.
4. They are similar in that both allow you to conclude that corr. ∠s are ≅. They are different in that the conjecture suggests that △s with corr. sides in same ratio have same shape, but SSS ≅ Thm. allows you to conclude that the △s have both same shape and same size.

ACTIVITY 3, PAGE 469

3. The ratio of the corr. sides of $\triangle ABC$ and $\triangle DEF$ are proportional.
4. The corr. ∠s of the △s are ≅.

TRY THIS, PAGE 469

5. Yes; corr. sides are proportional and corr. ∠s are ≅.
6. If △s have 2 pairs of corr. sides in same proportion and included ∠s are ≅, then △s are ~. This is related to the SAS ≅ Thm.

7-3 TRIANGLE SIMILARITY: AA, SSS, AND SAS, PAGES 470–477

CHECK IT OUT! PAGES 470–473

1. By △ Sum Thm., $m\angle C = 47°$, so $\angle C \cong \angle F$. $\angle B \cong \angle E$ by Rt. ∠ ≅ Thm. Therefore $\triangle ABC \sim \triangle DEF$ by AA ~.
2. $\angle TXU \cong \angle VXW$ by Vert. ∠s Thm.
$\frac{TX}{VX} = \frac{12}{16} = \frac{3}{4}$, $\frac{XU}{XW} = \frac{15}{20} = \frac{3}{4}$
Therefore $\triangle TXU \sim \triangle VXW$ by SAS ~.
3. **Step 1** Prove △s are ~.
It is given that $\angle RSV \cong \angle T$. By the Reflex. Prop. of ≅, $\angle R \cong \angle R$. Therefore $\triangle RSV \sim \triangle RTU$ by AA ~.
Step 2 Find RT.
$\frac{RT}{RS} = \frac{TU}{SV}$
$\frac{RT}{10} = \frac{12}{8}$
$8RT = 10(12) = 120$
$RT = 15$

4.

Statements	Reasons
1. M is mdpt. of $\overline{JK}$, N is mdpt. of $\overline{KL}$, and P is mdpt. of $\overline{JL}$.	1. Given
2. $MP = \frac{1}{2}KL$, $MN = \frac{1}{2}JL$, $NP = \frac{1}{2}KJ$	2. △ Midsegs. Thm.
3. $\frac{MP}{KL} = \frac{MN}{JL} = \frac{NP}{KJ} = \frac{1}{2}$	3. Div. Prop. of =
4. $\triangle JKL \sim \triangle NPM$	4. SSS ~ *Step 3*

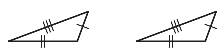
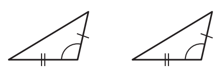
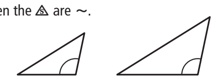
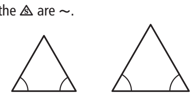
5.
$$\frac{FG}{AC} = \frac{BF}{AB}$$
$$\frac{FG}{5x} = \frac{4}{4x}$$
$$FG(4x) = 4(5x)$$
$$4FG = 20$$
$$FG = 5$$

THINK AND DISCUSS, PAGE 473

1. $\angle A \cong \angle D$ or $\angle C \cong \angle F$ 2. $\frac{BA}{ED} = \frac{3}{5}$

3. No; corr. sides need to be proportional but not necessarily ≅ for ⊿s to be ~.

4.

	Congruence	Similarity
SSS	If 3 sides of 1 △ are respectively ≅ to 3 sides of another △, then the ⊿s are ≅. 	If 3 sides of 1△ are proportional to the 3 corr. sides of another △, then the ⊿s are ~. 
SAS	If 2 sides and the included ∠ of 1 △ are ≅ to 2 sides and the included ∠ of another △, then the ⊿s are ≅. 	If 2 sides of 1△ are proportional to 2 sides of another △ and their included ∠s are ≅, then the ⊿s are ~. 
AA		If 2 ∠s of 1△ are ≅ to 2 ∠s of another △, then the ⊿s are ~. 

EXERCISES, PAGES 474–477

GUIDED PRACTICE, PAGE 474

1. By def. of ∠ ≅, $\angle C \cong \angle H$. By △ Sum Thm., $m\angle A = 47°$, so $\angle A \cong \angle F$. Therefore $\triangle ABC \sim \triangle FGH$ by AA ~.

2. $\angle P \cong \angle T$ (given). $\angle QST$ is a rt. ∠ by the Lin. Pair Thm., so $\angle QST \cong \angle RSP$. Therefore $\triangle QST \sim \triangle RSP$ by AA ~.

3. $\frac{DE}{JK} = \frac{8}{16} = \frac{1}{2}$, $\frac{DF}{JL} = \frac{6}{12} = \frac{1}{2}$, $\frac{EF}{KL} = \frac{10}{20} = \frac{1}{2}$
Therefore $\triangle DEF \sim \triangle JKL$ by SSS ~.

4. $\angle NMP \cong \angle RMQ$ (given)
$\frac{MN}{MR} = \frac{4}{6} = \frac{2}{3}$, $\frac{MP}{MQ} = \frac{8}{4+8} = \frac{8}{12} = \frac{2}{3}$
Therefore $\triangle MNP \sim \triangle MRQ$ by SAS ~.

5. **Step 1** Prove ⊿s are ~.
It is given that $\angle C \cong \angle E$. $\angle A \cong \angle A$ by Reflex. Prop. of ≅. Therefore $\triangle AED \cong \triangle ACB$ by AA ~.
Step 2 Find *AB*.
$$\frac{AB}{AD} = \frac{BC}{DE}$$
$$\frac{AB}{6} = \frac{15}{9}$$
$$9AB = 15(6) = 90$$
$$AB = 10$$

6. **Step 1** Prove ⊿s are ~.
Since $\overline{UV} \parallel \overline{XY}$, by Alt. Int. ∠s Thm., $\angle U \cong \angle Y$ and $\angle V \cong \angle X$. Therefore $\triangle UVW \sim \triangle YXW$ by AA ~.
Step 2 Find *WY*.
$$\frac{WY}{WU} = \frac{WX}{WV}$$
$$\frac{WY}{9} = \frac{8.75}{7}$$
$$7WY = 9(8.75) = 78.75$$
$$WY = 11.25$$

7.

Statements	Reasons
1. $\overline{MN} \parallel \overline{KL}$	1. Given
2. $\angle JMN \cong \angle JKL$, $\angle JNM \cong \angle JLK$	2. Corr. ∠s Post.
3. $\triangle JMN \sim \triangle JKL$	3. AA ~ *Step 2*

8.

Statements	Reasons
1. $SQ = 2QP$, $TR = 2RP$	1. Given
2. $SP = SQ + QP$, $TP = TR + RP$	2. Seg. Add. Post.
3. $SP = 2QP + QP$, $TP = 2RP + RP$	3. Subst.
4. $SP = 3QP$, $TP = 3RP$	4. Seg. Add. Post.
5. $\frac{SP}{QP} = 3$, $\frac{TP}{RP} = 3$	5. Div. Prop. of =
6. $\angle P \cong \angle P$	6. Reflex. Prop. of ≅
7. $\triangle PQR \sim \triangle PST$	7. SAS ~ *Steps 5, 6*

9. SAS or SSS ~ Thm.

10. **Step 1** Prove ⊿s are ~.
$\angle S \cong \angle S$ by Reflex. Prop. of ≅
$\frac{SA}{SC} = \frac{733 + 586}{586} \approx 2.25$, $\frac{SB}{SD} = \frac{800 + 644}{644} \approx 2.24$
Therefore $\triangle SAB \sim \triangle SCD$ by SAS ~.
Step 2 Find *AB*.
$$\frac{AB}{CD} = \frac{SA}{SC}$$
$$\frac{AB}{533} \approx 2.25$$
$$AB \approx 2.25(533)$$
$$\approx 1200 \text{ m or } 1.2 \text{ km}$$

PRACTICE AND PROBLEM SOLVING, PAGES 475–476

11. $\angle G \cong \angle G$ by Reflex. Prop. of ≅. $\angle GLH \cong \angle K$ by Rt. ∠ ≅ Thm. Therefore $\triangle HLG \sim \triangle JKG$ by AA ~.

12. By Isosc. △ Thm., $\angle B \cong \angle C$ and $\angle E \cong \angle F$. By △ Sum Thm.,
$$32 + 2m\angle B = 180$$
$$2m\angle B = 148°$$
$$m\angle B = 74°$$
By def. of ≅ ∠s, $\angle B \cong \angle E$ and $\angle C \cong \angle F$.
Therefore $\triangle ABC \sim \triangle DEF$ by AA ~.

13. $\angle K \cong \angle K$ by Reflex. Prop. of $\cong$

$\frac{KL}{KN} = \frac{6}{4} = \frac{3}{2}, \frac{KM}{KL} = \frac{5+4}{6} = \frac{3}{2}$

Therefore $\triangle KLM \sim \triangle KNL$ by SAS $\sim$.

14. $\frac{UV}{XY} = \frac{VW}{YZ} = \frac{WU}{ZX} = \frac{4}{5.5} = \frac{8}{11}$

Therefore $\triangle UVW \sim \triangle XYZ$ by SSS $\sim$.

15. Step 1 Prove △s are $\sim$.

It is given that $\angle ABD \cong \angle C$. $\angle A \cong \angle A$ by Reflex. Prop. of $\cong$. Therefore $\triangle ABD \cong \triangle ACB$ by AA $\sim$.

Step 2 Find AB.

$\frac{AB}{AD} = \frac{AC}{AB}$

$\frac{AB}{4} = \frac{4+12}{AB}$

$AB^2 = 4(16) = 64$

$AB = +\sqrt{64} = 8$

16. Step 1 Prove △s are $\sim$.

Since $\overline{ST} \parallel \overline{VW}$, $\angle PST \cong \angle V$ by Corr. ∠s Post. $\angle P \cong \angle P$ by Reflex. Prop. of $\cong$. Therefore $\triangle PST \sim \triangle PVW$ by AA $\sim$.

Step 2 Find PS.

$\frac{PS}{PV} = \frac{ST}{VW}$

$\frac{PS}{PS+6} = \frac{10}{17.5} = \frac{4}{7}$

$7PS = 4(PS + 6)$

$7PS = 4PS + 24$

$3PS = 24$

$PS = 8$

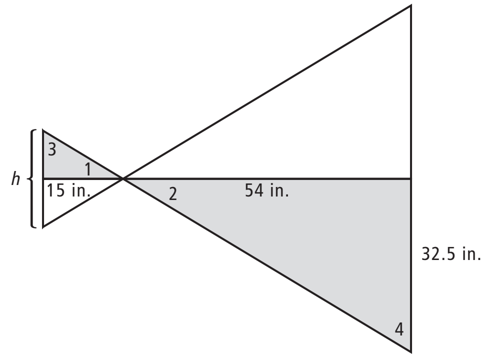
17.

Statements	Reasons
1. $CD = 3AC$, $CE = 3BC$	1. Given
2. $\frac{CD}{AC} = 3, \frac{CE}{BC} = 3$	2. Div. Prop. of $\cong$
3. $\angle ACB \cong \angle DCE$	3. Vert. ∠s Thm.
4. $\triangle ABC \sim \triangle DEC$	4. SAS $\sim$ *Steps 2, 3*

18.

Statements	Reasons
1. $\frac{PR}{MR} = \frac{QR}{NR}$	1. Given
2. $\angle R \cong \angle R$	2. Reflex. Prop. of $\cong$
3. $\triangle PQR \sim \triangle MNR$	3. SAS $\sim$ *Steps 1, 2*
4. $\angle 1 \cong \angle 2$	4. Def. of $\sim$ △s

19.



By Vert. ∠s Thm., $\angle 1 \cong \angle 2$. Since vert. sides are $\parallel$, $\angle 3 \cong \angle 4$ by Corr. ∠s Post., so marked △s are $\sim$. Therefore,

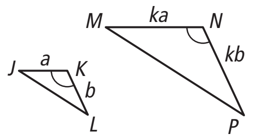
$\frac{h \div 2}{1.25} = \frac{32.5}{54}$

$54\left(\frac{h}{2}\right) = 1.25(32.5)$

$27h = 40.625$

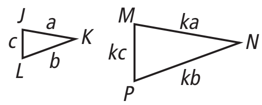
$h \approx 1.5$ in.

20.



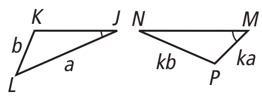
yes; SAS $\sim$

21.



yes; SSS $\sim$

22.



no

23. Think: $\triangle PQR \cong \triangle PST$ by AA $\sim$.

$\frac{PS}{PQ} = \frac{ST}{QR}$

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

$4(x + 3) = 3(x + 5)$

$4x + 12 = 3x + 15$

$x = 3$

24. Think: $\triangle EFG \cong \triangle HJG$ by AA $\sim$.

$\frac{EG}{GH} = \frac{FG}{GJ}$

$\frac{2x-2}{15} = \frac{x+9}{20}$

$20(2x - 2) = 15(x + 9)$

$40x - 40 = 15x + 135$

$25x = 175$

$x = 7$

25a. Think: Calculate $\frac{\text{slant edge lengths}}{\text{base edge length}}$ for each pyramid.

Pyramid A: $\frac{12}{10} = \frac{6}{5}$; Pyramid B: $\frac{9}{7.2} = \frac{5}{4}$;

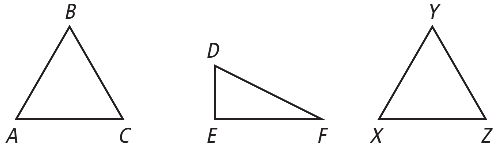
Pyramid C: $\frac{9.6}{8} = \frac{6}{5}$

Since slant edges of each pyramid are $\cong$, Pyramids A and C are $\sim$ by SSS $\sim$.

Lengths are $=$.

b. $\frac{\text{base of A}}{\text{base of C}} = \frac{10}{8} = \frac{5}{4}$

26. Possible answer: Yes; If corr. ∠s are ≅ and corr. sides are prop., $\triangle ABC \sim \triangle XYZ$.



27. Think: Since all horiz. lines are ∥, 3 △s with horiz. bases are ∼ by AA ∼.

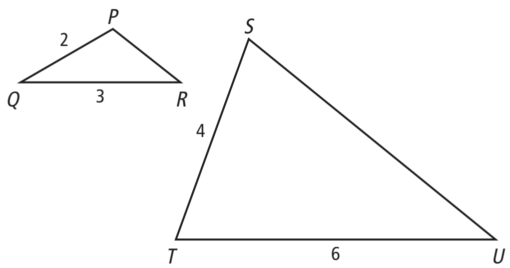
$\frac{JK}{6} = \frac{3}{9}$ $\qquad$ $\frac{MN}{6} = \frac{6}{9}$

$9JK = 6(3) = 18$ $\qquad$ $9MN = 6(6) = 36$

$JK = 2$ ft $\qquad$ $MN = 4$ ft

28. Since $\triangle ABC \sim \triangle DEF$, by def. of ∼ △s, $\angle A \cong \angle D$ and $\angle B \cong \angle E$. Similarly, since $\triangle DEF \sim \triangle XYZ$, $\angle D \cong \angle X$ and $\angle E \cong \angle Y$. Thus by Trans. Prop. of ≅, $\angle A \cong \angle X$ and $\angle B \cong \angle Y$. So $\triangle ABC \sim \triangle XYZ$ by AA ∼.

29. Possible answer:



30. Since $\triangle KNJ$ is isosc. with vertex $\angle N$, $\overline{KN} \cong \overline{JN}$ by def. of an isosc. △. $\angle NKJ \cong \angle NJK$ by Isosc. △ Thm. It is given that $\angle H \cong \angle L$, so $\triangle GHJ \cong \triangle MLK$ by AA ∼.

31a. The △s are ∼ by AA ∼ if you assume that camera is ∥ to hurricane (that is, $\overline{YX} \parallel \overline{AB}$).

b. $\triangle YWZ \sim \triangle BCZ$ and $\triangle XWZ \sim \triangle ACZ$, also by AA ∼.

c.

$$\frac{XW}{AC} = \frac{WZ}{ZC} = \frac{50}{150}$$
$$150XW = 50AC$$
$$\frac{YW}{BC} = \frac{WZ}{ZC} = \frac{50}{150}$$
$$150YW = 50BC$$
$$150XW + 150YW = 50AC + 50BC$$
$$150XY = 50AB$$
$$50AB = 150(35) = 5250$$
$$AB = 105 \text{ mi}$$

32. Solution B is incorrect. The proportion should be $\frac{8}{10} = \frac{8 + y}{14}$.

33. Let measure of vertex ∠s be $x°$. Then by Isosc. △ Thm., base ∠s in each △ must measure $\left(\frac{180 - x}{2}\right)°$. So △s are ∼ by AA ∼.

TEST PREP, PAGE 477

34. C

$\frac{TU}{PQ} = \frac{UV}{QR}$

$\frac{TU}{60} = \frac{60 + 20}{40 + 60} = \frac{4}{5}$

$5TU = 60(4) = 240$

$TU = 48$

35. J

$\frac{FG}{BC} = \frac{10.5}{42} = \frac{1}{4}$

$\frac{GH}{CD} = \frac{14.5}{58} = \frac{1}{4}$

36. C

Rects. ∼ → $\overline{BC} \sim \overline{FG}$, $\angle C \sim \angle G$, and $\overline{CD} \sim \overline{GH}$, which are conditions for SAS ∼.

37. 30

$\frac{x}{12} = \frac{20}{8}$

$8x = 12(20) = 240$

$x = 30$

CHALLENGE AND EXTEND, PAGE 477

38. Assume that $AB < DE$ and choose X on $\overline{DE}$ so that $\overline{AB} \cong \overline{DX}$. Then choose Y on $\overline{DF}$ so that $\overleftrightarrow{XY} \parallel \overline{EF}$. By Corr. ∠s Post., $\angle DXY \cong \angle DEF$ and $\angle DYX \cong \angle DFE$. Therefore $\triangle DXY \sim \triangle DEF$ by AA ∼. By def. of ∼ △s, $\frac{DX}{DE} = \frac{XY}{EF} = \frac{DY}{DF}$. By def. of ≅, $AB = DX$. So $\frac{AB}{DE} = \frac{XY}{EF}$. It is given that $\frac{AB}{DE} = \frac{BC}{EF}$, so $XY = BC$. $\overline{XY} \cong \overline{BC}$ by def. of ≅. Similarly, $\overline{DY} \cong \overline{AC}$, so $\triangle ABC \cong \triangle DXY$ by SSS ≅ Thm. It follows that $\triangle ABC \sim \triangle DXY$. Then by Trans. Prop. of ∼, $\triangle ABC \sim \triangle DEF$.

39. Assume that $AB < DE$ and choose X on $\overline{DE}$ so that $\overline{XE} \cong \overline{AB}$. Then choose Y on $\overline{EF}$ so that $\overleftrightarrow{XY} \parallel \overline{DF}$. $\angle EXY \cong \angle EDF$ by Corr. ∠s Post., $\angle E \cong \angle E$ by Reflex. Prop. of ≅. Therefore $\triangle XEY \sim \triangle DEF$ by AA ∼. By def. of ∼ △s, $\frac{XE}{DE} = \frac{EY}{EF}$. It is given that $\frac{AB}{DE} = \frac{BC}{EF}$. By def. of ≅, $XE = AB$, so $\frac{XE}{DF} = \frac{BC}{EF}$. Thus by def. of ≅, $BC = EY$ and so $\overline{BC} \cong \overline{EY}$. It is also given that $\angle B \cong \angle E$, so $\triangle ABC \cong \triangle XEY$ by SAS ≅ Thm. It follows that $\triangle ABC \sim \triangle XEY$. Then by Trans. Prop. of ∼, $\triangle ABC \sim \triangle DEF$.

40. Think: Use △ Sum Thm. and def. of ∼.

$$m\angle X + m\angle Y + m\angle Z = 180$$
$$2x + 5y + 102 - x + 5x + y = 180$$
$$6x + 6y = 78$$
$$x + y = 13$$
$$y = 13 - x$$

Think: Use def. of ∼.

$\angle A \cong \angle X$

$m\angle A = m\angle X$

$50 = 2x + 5y$

$50 = 2x + 5(13 - x)$

$50 = 65 - 3x$

$3x = 15$

$x = 5$

$y = 13 - 5 = 8$

$m\angle Z = 5(5) + 8 = 33°$

SPIRAL REVIEW, PAGE 477

41. $100 = \frac{96 + 99 + 105 + 105 + 94 + 107 + x}{7}$

$700 = 606 + x$

$x = 94$

42. Possible answer: (0, 4), (0, 0), (2, 0)

43. Possible answer: $(0, k)$, $(2k, k)$, $(2k, 0)$, $(0, 0)$

44. $\dfrac{2x}{10} = \dfrac{35}{25}$

$25(2x) = 10(35)$

$50x = 350$

$x = 7$

45. $\dfrac{5y}{450} = \dfrac{25}{10y}$

$5y(10y) = 450(25)$

$50y^2 = 11{,}250$

$y^2 = 225$

$y = \pm 15$

46. $\dfrac{b-5}{28} = \dfrac{7}{b-5}$

$(b-5)^2 = 28(7) = 196$

$b - 5 = \pm 14$

$b = 5 \pm 14 = 19 \text{ or } -9$

7A MULTI-STEP TEST PREP, PAGE 478

1. $\dfrac{\text{height of model}}{\text{height of real engine}} = \dfrac{1}{87}$

$\dfrac{2.5}{x} = \dfrac{1}{87}$

$2.5(87) = x$

$x = 217.5 \text{ in.} \approx 18 \text{ ft}$

2. $\dfrac{\text{height of model}}{\text{height of real station}} = \dfrac{1}{87}$

$\dfrac{y}{20} = \dfrac{1}{87}$

$87y = 20$

$y \approx 0.23 \text{ ft} \approx 2\frac{3}{4} \text{ in.}$

3. $\dfrac{\text{height of model}}{\text{height of actual restaurant}} = \dfrac{1}{87}$

$\dfrac{z}{24} = \dfrac{1}{87}$

$87z = 24$

$z \approx 0.28 \text{ ft} \approx 3 \text{ in.}$

4. $\dfrac{\text{base of B}}{\text{base of G}} = \dfrac{8}{14} = \dfrac{5}{7}; \dfrac{\text{slant of B}}{\text{slant of G}} = \dfrac{6}{10} = \dfrac{3}{5}$; not ~

$\dfrac{\text{base of G}}{\text{base of H}} = \dfrac{14}{6} = \dfrac{7}{3}; \dfrac{\text{slant of G}}{\text{slant of H}} = \dfrac{10}{4.5} = \dfrac{20}{9}$; not ~

$\dfrac{\text{base of B}}{\text{base of H}} = \dfrac{8}{6} = \dfrac{4}{3}; \dfrac{\text{slant of B}}{\text{slant of H}} = \dfrac{6}{4.5} = \dfrac{4}{3}$; ~

Bank's and hotel's roofs are ~, by SSS ~.

READY TO GO ON? PAGE 479

1. slope $= \dfrac{-1+2}{4+1} = \dfrac{1}{5}$

2. slope $= \dfrac{-3-3}{2+1}$

$= \dfrac{-6}{3} = \dfrac{-2}{1}$

3. slope $= \dfrac{1-3}{4+4} = \dfrac{-2}{8}$

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

4. slope $= 0$

5. $\dfrac{y}{6} = \dfrac{12}{9}$

$9y = 6(12) = 72$

$y = 8$

6. $\dfrac{16}{24} = \dfrac{20}{t}$

$16t = 24(20) = 480$

$t = 30$

7. $\dfrac{x-2}{4} = \dfrac{9}{x-2}$

$(x-2)^2 = 4(9) = 36$

$x - 2 = \pm 6$

$x = 2 \pm 6$

$= -4 \text{ or } 8$

8. $\dfrac{2}{3y} = \dfrac{y}{24}$

$2(24) = 3y(y)$

$48 = 3y^2$

$16 = y^2$

$y = \pm 4$

9. $\dfrac{\text{length of building}}{\text{length of model}} = \dfrac{\text{width of building}}{\text{width of model}}$

$\dfrac{\ell}{1.4} = \dfrac{240}{0.8}$

$0.8\ell = 1.4(240) = 336$

$\ell = 420 \text{ m}$

10. $\dfrac{AB}{WX} = \dfrac{64}{96} = \dfrac{2}{3}; \dfrac{AD}{WZ} = \dfrac{30}{50} = \dfrac{3}{5}$; no

11. By def. of comp. ∠s, m∠M = 23° and m∠K = 67°; so ∠J ≅ ∠N, ∠M ≅ ∠P, and ∠R ≅ ∠K;

$\dfrac{JM}{NP} = \dfrac{24}{36} = \dfrac{2}{3}; \dfrac{MR}{PK} = \dfrac{26}{39} = \dfrac{2}{3}; \dfrac{JR}{NK} = \dfrac{10}{15} = \dfrac{2}{3}$

yes; $\frac{2}{3}$; △JMR ~ △NPK

12. Think: Assume magnet ~ portrait.

$\dfrac{\text{length of magnet}}{\text{length of portrait}} = \dfrac{\text{width of magnet}}{\text{width of portrait}}$

$\dfrac{\ell}{30} = \dfrac{3.5}{21}$

$21\ell = 30(3.5) = 105$

$\ell = 5 \text{ cm}$

13.

Statements	Reasons
1. *ABCD* is a ▱.	1. Given
2. $\overline{AD} \parallel \overline{BC}$	2. Def. of ▱
3. ∠*EDG* ≅ ∠*FBG*	3. Alt. Int. ∠s Thm.
4. ∠*EGD* ≅ ∠*FGB*	4. Vert. ∠s Thm.
5. △*EDG* ~ △*FBG*	5. AA ~ *Steps 3, 4*

14.

Statements	Reasons
1. $MQ = \frac{1}{3}MN$, $MR = \frac{1}{3}MP$	1. Given
2. $\frac{MQ}{MN} = \frac{1}{3}, \frac{MR}{MP} = \frac{1}{3}$	2. Div. Prop. of =
3. $\frac{MQ}{MN} = \frac{MR}{MP}$	3. Trans. Prop. of =
4. ∠*M* ≅ ∠*M*	4. Reflex. Prop. of ≅
5. △*MQR* ~ △*MNP*	5. SAS ~ *Steps 3, 4*

15. Think: △*XYZ* ~ △*VUZ* with ratio of proportion $\frac{5}{2}$, by SAS ~.

$\dfrac{XY}{UV} = \dfrac{5}{2}$

$2XY = 5UV$

$2XY = 5(16) = 80$

$XY = 40 \text{ ft}$

TECHNOLOGY LAB: INVESTIGATE ANGLE BISECTORS OF A TRIANGLE, PAGE 480

TRY THIS, PAGE 480

1. $\dfrac{BD}{AB} = \dfrac{CD}{AC}$ or $\dfrac{BD}{CD} = \dfrac{AB}{AC}$.

2. $\dfrac{BD}{CD} = \dfrac{AB}{AC}$ or $\dfrac{BD}{AB} = \dfrac{CD}{AC}$.

ACTIVITY 2:

2. Check students' work.

3. $\dfrac{DI}{DG} = \dfrac{DE + DF}{\text{perimeter } \triangle DEF}$

4. $\frac{DI}{DG} = \frac{DE + DF}{DE + DF + EF}$; the length of the seg. from the vertex of the bisected ∠ to the incenter divided by the length of the seg. from the vertex to the opp. side is = to the sum of the sides of the bisected ∠ divided by the perimeter of the △.

TRY THIS, PAGE 480

3. Check students' work.

4. Check students' work.

7-4 APPLYING PROPERTIES OF SIMILAR TRIANGLES, PAGES 481–487

CHECK IT OUT! PAGES 482–483

1. It is given that $\overline{PQ} \parallel \overline{LM}$, so $\frac{PL}{PN} = \frac{QM}{QN}$ by △ Prop. Thm.

$\frac{3}{PN} = \frac{2}{5}$

$15 = 2PN$

$PN = 7.5$

2. $AD = 36 - 20 = 16$ and $BE = 27 - 15 = 12$, so

$\frac{DC}{AD} = \frac{20}{16} = \frac{5}{4}$

$\frac{EC}{BE} = \frac{15}{12} = \frac{5}{4}$

Since $\frac{DC}{AD} = \frac{EC}{BE}$, $\overline{DE} \parallel \overline{AB}$ by Conv. of △ Prop. Thm.

3. $\overleftrightarrow{AK} \parallel \overleftrightarrow{BL} \parallel \overleftrightarrow{CM} \parallel \overleftrightarrow{DN}$

$\frac{KL}{LM} = \frac{AB}{BC}$

$\frac{2.6}{LM} = \frac{2.4}{1.4}$

$2.4(LM) = 2.6(1.4)$

$LM \approx 1.5$ cm

$\frac{KL}{MN} = \frac{AB}{CD}$

$\frac{2.6}{MN} = \frac{2.4}{2.2}$

$2.4(MN) = 2.6(2.2)$

$MN \approx 2.4$ cm

4. $\frac{BD}{CD} = \frac{AB}{BC}$ by △ ∠ Bis. Thm.

$\frac{4.5}{\frac{y}{2}} = \frac{9}{y} = \frac{8}{y-2}$

$9(y - 2) = 8y$

$9y - 18 = 8y$

$y = 18$

$AC = y - 2$

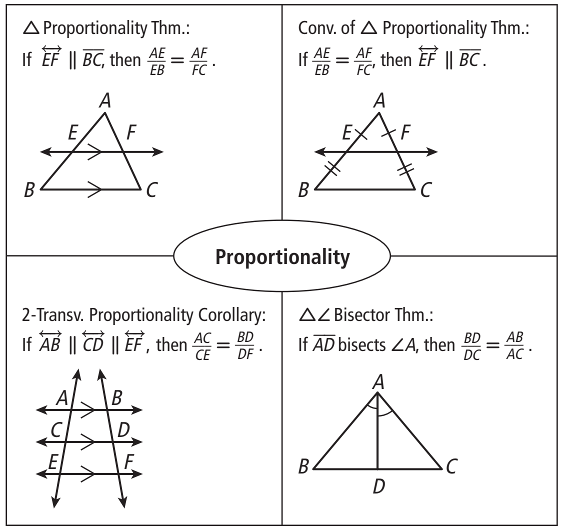
$= 18 - 2 = 16$

$DC = \frac{y}{2} = \frac{18}{2} = 9$

THINK AND DISCUSS, PAGE 484

1. Possible answer: $\frac{AX}{XB} = \frac{AY}{YC}$; $\frac{AX}{AB} = \frac{XY}{BC}$; $\frac{AY}{AC} = \frac{XY}{BC}$;

2.



EXERCISES, PAGES 484–487

GUIDED PRACTICE, PAGES 484–485

1. It is given that $\overline{CD} \parallel \overline{FG}$, so $\frac{CE}{CF} = \frac{DE}{DG}$ by △ Prop. Thm.

$\frac{32}{24} = \frac{40}{DG}$

$32DG = 960$

$DG = 30$

2. It is given that $\overline{QR} \parallel \overline{PN}$, so $\frac{QM}{QP} = \frac{RM}{RN}$ by △ Prop. Thm.

$\frac{8}{5} = \frac{10}{RN}$

$8RN = 50$

$RN = 6.25$

3. $\frac{EC}{AC} = \frac{1.5}{1.5} = 1$; $\frac{ED}{DB} = \frac{1.5}{1.5} = 1$

Since $\frac{EC}{AC} = \frac{ED}{DB}$, $\overline{AB} \parallel \overline{CD}$ by Conv. of △ Prop. Thm.

4. $\frac{VU}{US} = \frac{67.5}{54} = \frac{5}{4}$; $\frac{VT}{TR} = \frac{90}{72} = \frac{5}{4}$

Since $\frac{VU}{US} = \frac{VT}{TR}$, $\overline{TU} \parallel \overline{RS}$ by Conv. of △ Prop. Thm.

5. Let ℓ represent length of Broadway between 34th and 35th Streets.

$\frac{\ell}{275} = \frac{250}{240}$

$240\ell = 275(250)$

$\ell \approx 286$ ft

6. $\frac{QR}{RS} = \frac{PQ}{PS}$ by △ ∠ Bis. Thm.

$\frac{x-2}{x+1} = \frac{12}{16}$

$16(x - 2) = 12(x + 1)$

$16x - 32 = 12x + 12$

$4x = 44$

$x = 11$

$QR = 11 - 2 = 9$; $RS = 11 + 1 = 12$

7. $\frac{BC}{CD} = \frac{AB}{AD}$ by △ ∠ Bis. Thm.

$$\frac{6}{y-1} = \frac{9}{2y-4}$$
$$6(2y-4) = 9(y-1)$$
$$12y - 24 = 9y - 9$$
$$3y = 15$$
$$y = 5$$
$CD = 5 - 1 = 4$; $AD = 2(5) - 4 = 6$

PRACTICE AND PROBLEM SOLVING, PAGES 485–486

8. $\frac{GJ}{JL} = \frac{HK}{KL}$

$$\frac{6}{4} = \frac{8}{KL}$$
$$6KL = 32$$
$$KL = 5\frac{1}{3}$$

9. $\frac{XY}{YU} = \frac{XZ}{ZV}$

$$\frac{30 - 18}{18} = \frac{XZ}{30}$$
$$12(30) = 18XZ$$
$$XZ = 20$$

10. $\frac{EC}{CA} = \frac{12}{4} = 3, \frac{ED}{DB} = \frac{14}{4\frac{2}{3}} = \frac{42}{14} = 3$

So $\overline{AB} \parallel \overline{CD}$ by Conv. of △ Prop. Thm.

11. $\frac{PM}{MQ} = \frac{9 - 2.7}{2.7} = 2\frac{1}{3}, \frac{PN}{NR} = \frac{10 - 3}{3} = 2\frac{1}{3}$

So $\overline{MN} \parallel \overline{QR}$ by Conv. of △ Prop. Thm.

12. $\frac{LM}{GL} = \frac{HJ}{GH}$

$$\frac{LM}{11.3} = \frac{2.6}{10.4}$$
$$LM = \frac{2.6}{10.4}(11.3)$$
$$\approx 2.83 \text{ ft}$$

$\frac{MN}{GL} = \frac{JK}{GH}$

$$\frac{MN}{11.3} = \frac{2.2}{10.4}$$
$$MN = \frac{2.2}{10.4}(11.3) \approx 2.39 \text{ ft}$$

13. $\frac{BC}{CD} = \frac{AB}{AD}$

$$\frac{z-4}{\frac{z}{2}} = \frac{12}{10}$$
$$10(z-4) = \frac{z}{2}(12)$$
$$10z - 40 = 6z$$
$$4z = 40$$
$$z = 10$$
$BC = 10 - 4 = 6$; $CD = \frac{10}{2} = 5$

14. $\frac{TU}{UV} = \frac{ST}{SV}$

$$\frac{2y}{14.4} = \frac{4y-2}{24}$$
$$24(2y) = 14.4(4y-2)$$
$$48y = 57.6y - 28.8$$
$$28.8 = 9.6y$$
$$y = 3$$
$ST = 4(3) - 2 = 10$; $TU = 2(3) = 6$

15. $\frac{AB}{BD} = \frac{AC}{\mathbf{CE}}$

16. $\frac{\mathbf{AD}}{DF} = \frac{AE}{EG}$

17. $\frac{DF}{\mathbf{BD}} = \frac{EG}{CE}$

18. $\frac{AF}{AB} = \frac{\mathbf{AG}}{AC}$

19. $\frac{BD}{CE} = \frac{\mathbf{DF}}{EG}$

20. $\frac{AB}{AC} = \frac{BF}{\mathbf{CG}}$

21. Let x represent length of 3rd side.

either

$$\frac{x}{20} = \frac{12}{16}$$
$$16x = 240$$
$$x = 15 \text{ in.}$$

or

$$\frac{x}{20} = \frac{16}{12}$$
$$12x = 320$$
$$x = \frac{80}{3} = 26\frac{2}{3} \text{ in.}$$

22a. $\frac{AC}{BD} = \frac{CE}{DF}$

b. $\frac{81.6}{80} = \frac{CE}{70}$

$$81.6(70) = 80CE$$
$$CE = 71.4 \text{ cm}$$

c. $\frac{AJ}{BK} = \frac{AC}{BD}$

$$\frac{AJ}{80 + 70 + 60 + 40} = \frac{81.6}{80}$$
$$AJ = \frac{81.6}{80}(250) = 255 \text{ cm}$$

23.

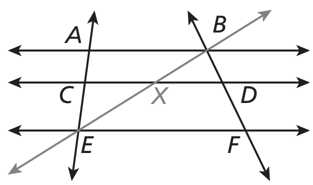
Statements	Reasons
1. $\frac{AE}{EB} = \frac{AF}{FC}$	1. Given
2. $\angle A \cong \angle A$	2. Reflex. Prop. of ≅
3. $\triangle AEF \sim \triangle ABC$	3. SAS ~ *Steps 1, 2*
4. $\angle AEF \cong \angle ABC$	4. Def. of ~ △
5. $\overleftrightarrow{EF} \parallel \overline{BC}$	5. Conv. of Corr. ∠s Post.

24.

Statements	Reasons
1. $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}, \overleftrightarrow{CD} \parallel \overleftrightarrow{EF}$	1. Given
2. Draw $\overleftrightarrow{EB}$ intersecting $\overline{CD}$ at X.	2. 2 pts. determine a line
3. $\frac{AC}{CE} = \frac{BX}{XE}$	3. △ Prop. Thm.
4. $\frac{BX}{XE} = \frac{BD}{DF}$	4. △ Prop. Thm.
5. $\frac{AC}{CE} = \frac{BD}{DF}$	5. Trans. Prop. of =

25a. $\frac{PR}{RT} = \frac{QS}{SU}$

$$\frac{x}{x+2} = \frac{\frac{x}{2}}{x-2} = \frac{x}{x(x-2)}$$
$$2x(x-2) = x(x+2)$$
$$2x^2 - 4x = x^2 + 2x$$
$$x^2 - 6x = 0$$
$$x(x-6) = 0$$
$$x = 6 \ (\textit{since } x > 0)$$



$PR = 6$; $RT = 6 + 2 = 8$; $QS = \frac{6}{2} = 3$;
$SU = 6 - 2 = 4$

b. $\frac{PR}{RT} = \frac{QS}{SU}$ or $\frac{6}{8} = \frac{3}{4}$

26. Think: Use △ Prop. Thm. and △ ∠ Bis. Thm.

$$\frac{EF}{BE} = \frac{CD}{BC} = \frac{AD}{AB}$$
$$\frac{EF}{10} = \frac{24}{18} = \frac{4}{3}$$
$$3EF = 40$$
$$EF = 13\frac{1}{3}$$

27. $\dfrac{ST}{TQ} = \dfrac{SR}{RQ} = \dfrac{PN}{NM}$

$\dfrac{ST}{10} = \dfrac{6}{4}$

$4ST = 60$

$ST = 15$

28. Total length along Chavez St. is $150 + 200 + 75 = 425$ ft.

$\dfrac{x}{150} = \dfrac{500}{425} = \dfrac{20}{17}$

$17x = 150(20) = 3000$

$x \approx 176$ ft

$\dfrac{y}{200} = \dfrac{500}{425} = \dfrac{20}{17}$

$17y = 4000$

$y \approx 235$ ft

$\dfrac{z}{75} = \dfrac{500}{425} = \dfrac{20}{17}$

$17z = 1500$

$z = 88$ ft

29. Draw a seg. on tracing paper whose length is = to the vert. dist. from line 1 to line 6 or no greater than the diag. dist. from line 1 to line 6 of the notebook paper. Place the tracing paper over the notebook paper so that the seg. spans exactly 6 of the lines on the notebook paper. Then mark the spots where the tracing-paper seg. crosses the line on the notebook paper. The method works by the 2-Transv. Proportionality Corollary.

30. Think: Use △ Prop. Thm. First find *EX*.

$\dfrac{EX}{AX} = \dfrac{EY}{DY}$

$\dfrac{EX}{17} = \dfrac{16}{18}$

$18EX = 272$

$EX = 15\frac{1}{9}$

$AE = AX + XE$

$= 17 + 15\frac{1}{9} = 32\frac{1}{9}$

$\dfrac{EC}{AE} = \dfrac{DB}{AD}$

$\dfrac{EC}{32^1/_9} = \dfrac{7.5}{15} = \dfrac{1}{2}$

$2EC = 32\frac{1}{9}$

$EC = 16\frac{1}{18}$

31. Possible answer: $\dfrac{BD}{CD} = \dfrac{AB}{AC}$; △ ∠ Bis. Thm.

TEST PREP, PAGE 487

32. C

$\dfrac{US}{SR} = \dfrac{20}{35} = \dfrac{4}{7}, \dfrac{VT}{TR} = \dfrac{16}{28} = \dfrac{4}{7}$

33. J

$\dfrac{AB}{25} = \dfrac{16}{20}$

$20AB = 400$

$AB = 20$

34. C

Let x be dist. to 1st St.

$\dfrac{x}{2.4} = \dfrac{2.1}{2.8} = \dfrac{3}{4}$

$4x = 7.2$

$x = 1.8$ mi

$x + 2.4 = 4.2$ mi

35. $\dfrac{x}{24} = \dfrac{20}{16} = \dfrac{5}{4}$

$4x = 120$

$x = 30$

$\dfrac{y}{15} = \dfrac{16}{20} = \dfrac{4}{5}$

$5y = 60$

$y = 12$

possible answer: $\dfrac{20}{16} = \dfrac{15}{12}; \dfrac{20}{16} = \dfrac{30}{24}; \dfrac{15}{12} = \dfrac{30}{24};$

$\dfrac{20 + 15}{30} = \dfrac{16 + 12}{24}; \dfrac{20}{15 + 30} = \dfrac{16}{12 + 24};$

$\dfrac{20}{20 + 15 + 30} = \dfrac{16}{16 + 12 + 24}$

CHALLENGE AND EXTEND, PAGE 487

36. $P = AB + BC + AC$

$29 = AB + 9 + AC$

$20 - AB = AC$

$\dfrac{AB}{AC} = \dfrac{BD}{CD}$

$\dfrac{AB}{20 - AB} = \dfrac{4}{5}$

$5AB = 4(20 - AB)$

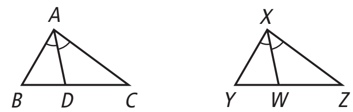
$9AB = 80$

$AB = 8\frac{8}{9}$

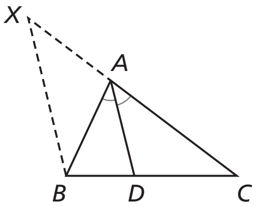
$AC = 20 - 8\frac{8}{9} = 11\frac{1}{9}$

37. Given: $\triangle ABC \sim \triangle XYZ$, $\overline{AD}$ bisects $\angle BAC$, and $\overline{XW}$ bisects $\angle YXZ$.

Prove: $\dfrac{AD}{XW} = \dfrac{AB}{XY}$

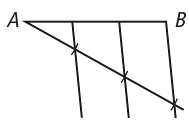


Statements	Reasons
1. $\triangle ABC \sim \triangle XYZ$	1. Given
2. $\angle B \cong \angle Y$	2. Def. of ∼ polygons
3. $m\angle BAC = m\angle YXZ$	3. Def. of ∼ polygons
4. $\overline{AD}$ bisects $\angle BAC$ and $\overline{XW}$ bisects $\angle YXZ$.	4. Given
5. $m\angle BAC = 2m\angle BAD$, $m\angle YXZ = 2m\angle YXW$	5. Def. of ∠ bis.
6. $2m\angle BAD = 2m\angle YXW$	6. Trans. Prop. of =
7. $m\angle BAD = m\angle YXW$	7. Div. Prop. of =
8. $\triangle ABD \sim \triangle XYW$	8. AA ∼ *Steps 2, 7*
9. $\dfrac{AD}{XW} = \dfrac{AB}{XY}$	9. △ Prop. Thm.

38. 

Statements	Reasons
1. $\overline{AD}$ bisects $\angle A$.	1. Given
2. Draw $\overline{BX} \parallel \overline{AD}$, extending $\overline{AC}$ to X.	2. ∥ Post.
3. $\frac{BD}{DC} = \frac{AX}{AC}$	3. △ Prop. Thm.
4. $\angle CAD \cong \angle AXB$	4. Corr. ∠s Post.
5. $\angle CAD \cong \angle DAB$	5. Def of ∠ bis.
6. $\angle DAB \cong \angle ABX$	6. Alt. Int. ∠s Thm.
7. $\angle DAB \cong \angle AXB$	7. Trans. Prop. of ≅
8. $\angle ABX \cong \angle AXB$	8. Trans. Prop. of ≅
9. $\overline{AX} \cong \overline{AB}$	9. Conv. Isosc. △ Thm.
10. $AX = AB$	10. Def. of ≅ segs.
11. $\frac{BD}{DC} = \frac{AB}{AC}$	11. Subst.

39. Possible answer: Check students' work.



SPIRAL REVIEW, PAGE 487

40. $5 = 1 + 4$, $6 = 2 + 4$, … nth term is $n + 4$

41. $3 = 3(1)$, $6 = 3(2)$, … nth term is $3n$

42. $1 = 1^2$, $4 = 2^2$, $9 = 3^2$, … nth term is n^2

43. Let $C = (x, y)$.

$3 = \frac{1 + x}{2}$ $\quad -7 = \frac{4 + y}{2}$

$6 = 1 + x$ $\quad -14 = 4 + y$

$x = 5$ $\quad y = -18$

$C = (5, -18)$

44. $\angle A \cong \angle A$ (Reflex. Prop. of ≅)

$\frac{AB}{AD} = \frac{8}{12} = \frac{2}{3}$, $\frac{AC}{AE} = \frac{6}{9} = \frac{2}{3}$

Therefore $\triangle ABC \sim \triangle ADE$ by SAS ∼.

45. $\angle KLJ \cong \angle NLM$ (Vert. ∠s Thm.)

$\angle K \cong \angle N$ (△ Sum Thm. → $m\angle N = 68°$)

Therefore $\triangle JKL \sim \triangle MNL$ by AA ∼.

7-5 USING PROPORTIONAL RELATIONSHIPS, PAGES 488–494

CHECK IT OUT! PAGES 488–490

1. **Step 1** Convert measurements to inches.

$GH = 5$ ft 6 in. $= 5(12)$ in. $+ 6$ in. $= 66$ in.

$JH = 5$ ft $= 5(12)$ in. $= 60$ in.

$NM = 14$ ft 2 in. $= 14(12)$ in. $+ 2$ in. $= 170$ in.

Step 2 Find ∼ △s.

Because sun's rays are ∥, $\angle J \cong \angle N$. Therefore $\triangle GHJ \cong \triangle LMN$ by AA ∼.

Step 3 Find LM.

$\frac{GH}{LM} = \frac{JH}{NM}$

$\frac{66}{LM} = \frac{60}{170}$

$60LM = 66(170)$

$LM = 187$ in. $= 15$ ft 7 in.

2. Use a ruler to measure dist. between City Hall and El Centro College. Dist. is 4.5 cm.

To find actual dist. y, write a proportion comparing map dist. to actual dist.

$\frac{4.5}{y} = \frac{1.5}{300}$

$1.5y = 4.5(300)$

$1.5y = 1350$

$y = 900$

Actual dist. is 900 m, or 0.9 km.

3. **Step 1** Set up proportions to find length ℓ and width w of of scale drawing.

$\frac{\ell}{74} = \frac{1}{20}$ $\quad \frac{w}{60} = \frac{1}{20}$

$20\ell = 74$ $\quad 20w = 60$

$\ell = 3.7$ in. $\quad w = 3$ in.

Step 2 Use a ruler to draw a rect. with new dimensions. (Check students' work.)

4. Similarity ratio of $\triangle ABC$ to $\triangle DEF$ is $\frac{4}{12}$, or $\frac{1}{3}$.

By Proportional Perimeters and Areas Thm., ratio of △s' perimeters is also $\frac{1}{3}$, and ratio of △s' areas is $\left(\frac{1}{3}\right)^2$, or $\frac{1}{9}$.

Perimeter

$\frac{P}{42} = \frac{1}{3}$

$3P = 42$

$P = 14$ mm

Area

$\frac{A}{96} = \frac{1}{9}$

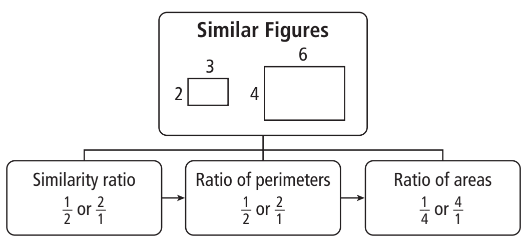
$9A = 96$

$A = 10\frac{2}{3}$ mm^2

Perimeter of $\triangle ABC$ is 14 mm, and area is $10\frac{2}{3}$ mm^2.

THINK AND DISCUSS, PAGE 490

1. Set up a proportion: $\frac{5.5}{x} = \frac{1}{25}$. Then solve for x to find actual dist.: $x = 5.5(25) = 137.5$ mi.

2. 

EXERCISES, PAGES 491–494

GUIDED PRACTICE, PAGE 491

1. indirect measurement
2. **Step 1** Convert measurements to inches.
   5 ft 6 in. = 5(12) in. + 6 in. = 66 in.
   4 ft = 4(12) in. = 48 in.
   40 ft = 40(12) in. = 480 in.
   Step 2 Find ~ △s.
   Since marked ∠s are ≅, △s are ~ by AA ~.
   Step 3 Find height of dinosaur, *h*.
   $\frac{h}{66} = \frac{480}{48}$
   $\frac{h}{66} = 10$
   $h = 10(66) = 660$ in.
   Height of dinosaur is 660 in., or 55 ft.
3. Use a ruler to measure to-scale length of $\overline{AB}$.
   Length is 0.25 in.
   To find actual length *AB*, write a proportion comparing to-scale length to actual length.
   $\frac{0.25}{AB} = \frac{1}{48}$
   $AB = 0.25(48) = 12$ ft
4. Use a ruler to measure to-scale length of $\overline{CD}$.
   Length is 0.75 in.
   To find actual length *CD*, write a proportion comparing to-scale length to actual length.
   $\frac{0.75}{CD} = \frac{1}{48}$
   $CD = 0.75(48) = 36$ ft
5. Use a ruler to measure to-scale length of $\overline{EF}$.
   Length is 1.25 in.
   To find actual length *EF*, write a proportion comparing to-scale length to actual length.
   $\frac{1.25}{EF} = \frac{1}{48}$
   $EF = 1.25(48) = 60$ ft
6. Use a ruler to measure to-scale length of $\overline{FG}$.
   Length is 0.5 in.
   To find actual length *FG*, write a proportion comparing to-scale length to actual length.
   $\frac{0.5}{FG} = \frac{1}{48}$
   $FG = 0.5(48) = 24$ ft
7. **Step 1** Set up proportions to find length ℓ and width *w* of scale drawing.
   $\frac{\ell}{10} = \frac{1}{1}$ $\qquad$ $\frac{w}{4.6} = \frac{1}{1}$
   $\ell = 10$ cm $\qquad$ $w = 4.6$ cm
   Step 2 Use a ruler to draw a rect. with new dimensions. (Check students' drawings.)
8. **Step 1** Set up proportions to find length ℓ and width *w* of scale drawing.
   $\frac{\ell}{10} = \frac{1}{2}$ $\qquad$ $\frac{w}{4.6} = \frac{1}{2}$
   $2\ell = 10$ $\qquad$ $2w = 4.6$ cm
   $\ell = 5$ cm $\qquad$ $w = 2.3$ cm
   Step 2 Use a ruler to draw a rect. with new dimensions. (Check students' drawings.)
9. **Step 1** Set up proportions to find length ℓ and width *w* of scale drawing.
   $\frac{b}{10} = \frac{1}{2.3}$ $\qquad$ $\frac{w}{4.6} = \frac{1}{2.3}$
   $2.3b = 10$ $\qquad$ $2.3w = 4.6$ cm
   $b = 4.3$ cm $\qquad$ $w = 2$ cm
   Step 2 Use a ruler to draw a rect. with new dimensions. (Check students' drawings.)
10. Similarity ratio of *MNPQ* to *RSTU* is $\frac{4}{6}$, or $\frac{2}{3}$.
    By Proportional Perimeters and Areas Thm., ratio of perimeters is also $\frac{2}{3}$.
    $\frac{14}{P} = \frac{2}{3}$
    $2P = 14(3) = 42$
    $P = 21$
    Perimeter of *RSTU* is 21 cm.
11. Ratio of areas is $\left(\frac{2}{3}\right)^2$, or $\frac{4}{9}$.
    $\frac{12}{A} = \frac{4}{9}$
    $4A = 12(9) = 108$
    $A = 27$
    Area of *RSTU* is 27 cm^2.

PRACTICE AND PROBLEM SOLVING, PAGES 491–493

12. 5 ft 2 in. = 62 in.; 7 ft 9 in. = 93 in.; 15.5 ft = 186 in.
    $\frac{h}{62} = \frac{186}{93} = 2$
    $h = 62(2) = 124$ in. $= 10\frac{1}{3}$ ft or 10 ft 4 in.
13. map dist. for $\overline{JK} = 6$ cm
    $\frac{6}{JK} = \frac{1}{9.4}$
    $JK = 6(9.4) \approx 57$ km
14. map dist. for $\overline{NP} = 0.45$ cm
    $\frac{0.45}{NP} = \frac{1}{9.4}$
    $NP = 0.45(9.4) \approx 4$ km
15. **Step 1** Set up proportions to find base *b* and height *h* of scale drawing.
    $\frac{b}{150} = \frac{1.5}{100}$ $\qquad$ $\frac{h}{200} = \frac{1.5}{100}$
    $100b = 225$ $\qquad$ $100h = 300$
    $b = 2.25$ in. $\qquad$ $h = 3$ in.
    Step 2 Use a ruler to draw a rt. △ with new dimensions. (Check students' drawings.)
16. **Step 1** Set up proportions to find base *b* and height *h* of scale drawing.
    $\frac{b}{150} = \frac{1}{300}$ $\qquad$ $\frac{h}{200} = \frac{1}{300}$
    $300b = 150$ $\qquad$ $300h = 200$
    $b = 0.5$ in. $\qquad$ $h \approx 0.67$ in.
    Step 2 Use a ruler to draw a rt. △ with new dimensions. (Check students' drawings.)
17. **Step 1** Set up proportions to find base *b* and height *h* of scale drawing.
    $\frac{b}{150} = \frac{1}{150}$ $\qquad$ $\frac{h}{200} = \frac{1}{150}$
    $150b = 150$ $\qquad$ $150h = 200$
    $b = 1$ in. $\qquad$ $h \approx 1.3$ in.
    Step 2 Use a ruler to draw a rt. △ with new dimensions. (Check students' drawings.)

18. scale factor $= \frac{60}{90} = \frac{2}{3}$

$\frac{P}{381} = \frac{2}{3}$

$3P = 762$

$P = 254$ m

19. $\frac{A}{1944} = \left(\frac{2}{3}\right)^2 = \frac{4}{9}$

$9A = 7776$

$A = 864 \text{ m}^2$

20. scale factor $= \frac{10 \text{ ft}}{0.5 \text{ in.}}$

$= 20$

map dist. $= \frac{30}{16}$ in.

$\frac{x}{\frac{30}{16}} = 20$

$x = \frac{30}{16}(20)$

≈ 38 ft

21. map dist. $= \frac{10}{8}$ in.

$\frac{x}{\frac{10}{8}} = 20$

$x = \frac{10}{8}(20)$

$= 25$ ft

22. map dist. $= \frac{25}{16}$ in.

$\frac{x}{\frac{25}{16}} = 20$

$x = \frac{25}{16}(20)$

≈ 32 ft

23. map dist. $= \frac{32}{16}$ in.

$\frac{x}{\frac{32}{16}} = 20$

$x = \frac{32}{16}(20)$

≈ 39 ft

24. By Proportional Perimeters and Areas Thm., $\sim$ ratio $=$ ratio of perimeters $= \frac{8}{9}$.

25. By Proportional Perimeters and Areas Thm., ratio of areas $= (\sim \text{ratio})^2$.

$\frac{16}{25} = (\sim \text{ratio})^2$

$\sim \text{ratio} = \sqrt{\frac{16}{25}} = \frac{4}{5}$

26. ratio of areas $= (\sim \text{ratio})^2$

ratio of areas $=$ (ratio of perims.)^2

$\frac{4}{81} = (\text{ratio of perims.})^2$

ratio of perims. $= \sqrt{\frac{4}{81}} = \frac{2}{9}$

27. $\frac{\text{scale width}}{\text{model width}} = \frac{1}{50}$

$\frac{w}{15} = \frac{1}{50}$

$w = \frac{15}{50} = 0.3$ ft

$\frac{\text{scale length}}{\text{model length}} = \frac{1}{50}$

$\frac{\ell}{60} = \frac{1}{50}$

$\ell = \frac{60}{50} = 1.2$ ft

28a. hyp. of $\triangle PQR = \sqrt{3^2 + 4^2} = 5$ in.

hyp. of $\triangle WXY = \sqrt{6^2 + 8^2} = 10$ in.

$\frac{\text{perimeter of } \triangle PQR}{\text{perimeter of } \triangle WXY} = \frac{3 + 4 + 5}{6 + 8 + 10}$

$= \frac{12}{24} = \frac{1}{2}$

b. $\frac{\text{area of } \triangle PQR}{\text{area of } \triangle WXZ} = \frac{\frac{1}{2}(4)(4)}{\frac{1}{2}(8)(6)}$

$= \frac{6}{24} = \frac{1}{4}$

c. The ratio of areas is square of ratio of perimeters.

29. Let ℓ_1 and w_1 be dimensions of rect. *ABCD*; let ℓ_2 and w_2 be dimensions of rect. *EFGH*.

$A_1 = \ell_1 w_1$

$135 = \ell_1(9)$

$\ell_1 = 15$ in.

Think: Rects. are $\sim$; let scale factor be s.

$\frac{\ell_2}{\ell_1} = \frac{w_2}{w_1} = s$

$\ell_2 = s\ell_1,\ w_2 = sw_1$

$A_2 = \ell_2 w_2$

$= (s\ell_1)(sw_1)$

$= s^2 A_1$

$240 = 135s^2$

$\frac{16}{9} = s^2$

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

$\ell_2 = s\ell_1$

$= \frac{4}{3}(15) = 20$ in.

$w_2 = sw_1$

$= \frac{4}{3}(9) = 12$ in.

30. Check students' work.

$\frac{\text{scale length}}{\text{actual length}} = \frac{\ell}{94} = \frac{0.25}{10}$

$10\ell = 23.5$

$\ell = 2.35$ in.

$\frac{\text{scale width}}{\text{actual width}} = \frac{w}{50} = \frac{0.25}{10}$

$10w = 12.5$

$w = 1.25$ in.

31a. $\sim$ ratio $= \frac{1 \text{ in.}}{2 \text{ ft}}$

$= \frac{1 \text{ in.}}{24 \text{ in.}} = \frac{1}{24}$

b. actual dimensions are $24(2) = 48$ in. and $24(3) = 72$ in.

actual area $= (48)(72) = 3456 \text{ in.}^2$

model area $= (2)(3) = 6 \text{ in.}^2$

$\frac{\text{model area}}{\text{actual area}} = \frac{3456}{6} = \frac{1}{576}$

c. actual area $= (4 \text{ ft})(6 \text{ ft}) = 24 \text{ ft}^2$

32. In photo, height of person $\approx \frac{1}{2}$ in. and height of statue $\approx 1\frac{5}{8}$ in.

$\frac{\text{actual height of statue}}{\text{height of statue in photo}}$

$= \frac{\text{actual height of person}}{\text{height of statue in person}}$

$\frac{h}{1.625} \approx \frac{5}{0.5}$

$0.5h \approx 8$

$h \approx 16$ ft

33. $\frac{\text{map length}}{\text{actual length}} = \text{scale factor}$

$\frac{\ell}{1 \text{ km}} = \frac{1 \text{ cm}}{900{,}000 \text{ cm}} = \frac{1 \text{ cm}}{9 \text{ km}}$

$\ell = \frac{1}{9}$ cm

34. By $\triangle$ Midseg. Thm., def. of mdpt., and SSS $\cong$, $\triangle XYZ \cong \triangle ZJX$; so $\triangle$s have same height h. Therefore height of $\triangle JKL = h + h = 2h$. Since $KL = 2ZX$,

$$\begin{aligned} \text{area of } \triangle JKL &= \frac{1}{2}(2ZX)(2h) \\ &= 2(ZX)h \\ &= 4\left(\frac{1}{2}(ZX)(h)\right) \\ &= 4(\text{area of } \triangle XYZ) \end{aligned}$$

$$\frac{\text{area of } \triangle JKL}{\text{area of } \triangle XYZ} = \frac{4}{1}$$

35. 1 cm : 5 m; Since each cm will represent 5 m, this drawing will be $\frac{1}{5}$ size of the 1 cm : 1 m drawing.

36. $\frac{4(x-2)}{4(2x)} = \frac{x-2}{2x} = \frac{4}{9}$

$$\begin{aligned} 9(x-2) &= 8x \\ 9x - 18 &= 8x \\ x &= 18 \end{aligned}$$

$AB = 18 - 2 = 16$ units
$HE = 2(18) = 36$ units

37. With a scale of 1 : 1, drawing is same size as actual object.

38. Suppose x and y are whole-number side lengths of smaller square and larger square. Then $2x^2 = y^2$. Thus $x\sqrt{2} = y$. A whole number that is multiplied by $\sqrt{2}$ cannot equal a whole number, since $\sqrt{2}$ is irrational.

TEST PREP, PAGE 493

39. D

$$\begin{aligned} \text{area of } \triangle RST &= (\text{scale factor})^2(\text{area of } \triangle ABC) \\ &= \left(\frac{15}{10}\right)^2(24) = \frac{9}{4}(24) = 54 \text{ m}^2 \end{aligned}$$

40. G

$$\frac{3.75}{\ell} = \frac{0.25}{1}$$
$$3.75 = 0.25\ell$$
$$\ell = 15 \text{ ft}$$

41. C. Ratio of perimeters = ~ ratio = $\frac{4}{9}$

42. F

$$\begin{aligned} \text{area of } \triangle 2 &= (\sim \text{ratio})^2(\text{area of } \triangle 1) \\ &= \left(\frac{1}{2}\right)^2(16) = 4 \text{ ft}^2 \end{aligned}$$

CHALLENGE AND EXTEND, PAGE 494

43a. $\frac{x}{1.5 \times 10^8 \text{ km}} = \frac{1 \text{ km}}{10^9 \text{ km}} = \frac{10^3 \text{ m}}{10^9 \text{ km}}$

$$\begin{aligned} x &= \frac{10^3 \text{ m}}{10^9 \text{ km}}(1.5 \times 10^8 \text{ km}) \\ &= 1.5 \times 10^2 \text{ m or } 150 \text{ m} \end{aligned}$$

43b. $\frac{d}{1.28 \times 10^4 \text{ km}} = \frac{10^3 \text{ m}}{10^9 \text{ km}}$

$$\begin{aligned} d &= \frac{10^3 \text{ m}}{10^9 \text{ km}}(1.28 \times 10^4 \text{ km}) \\ &= 1.28 \times 10^{-2} \text{ m or } 1.28 \text{ cm} \end{aligned}$$

44. It is given that $\triangle ABC \sim \triangle DEF$. Let $\frac{AB}{DE} = x$. Then $AB = DEx$ by Mult. Prop. of =. Similarly, $BC = EFx$ and $AC = DFx$. By Add. Prop. of =, $AB + BC + AC = DEx + EFx + DFx$. Thus $AB + BC + AC = x(DE + EF + DF)$. By Div. Prop. of =, $\frac{AB + BC + AC}{DE + EF + DF} = x$. By subst., $\frac{AB + BC + AC}{DE + EF + DF} = \frac{AB}{DE}$.

45. It is given that $\triangle PQR \sim \triangle WXY$. Draw $\perp$s from Q and X to meet $\overline{PR}$ at S and $\overline{WY}$ at Z. By def. of ~ polygons, $\frac{PQ}{WX} = \frac{QR}{XY} = \frac{PR}{WY}$, and $\angle P \cong \angle W$. In $\triangle PQS$ and $\triangle WXZ$, $\angle PSQ \cong \angle WZX$. Thus $\triangle PQS \sim \triangle WXZ$ by AA ~. $\frac{PQ}{WZ} = \frac{QS}{XZ} = \frac{PS}{WZ}$ by def. of ~ polygons. $\frac{QR}{XY} = \frac{SP}{ZW}$ by subst. $\frac{\text{Area of } \triangle PQR}{\text{area of } \triangle WXY} = \frac{PR}{WY} \cdot \frac{QS}{XZ} = \frac{PR^2}{WY^2}$.

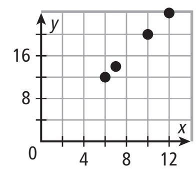
46a. $\frac{6}{WX} = \frac{1}{2}$, $WX = 12$ $\qquad$ $\frac{7}{XY} = \frac{1}{2}$, $XY = 14$

$\frac{10}{YZ} = \frac{1}{2}$, $YZ = 20$ $\qquad$ $\frac{12}{WZ} = \frac{1}{2}$, $WZ = 24$

b.

Quad. *PQRS*		Quad. *WXYZ*	
Side	**Length (m)**	**Side**	**Length (m)**
PQ	6	***WX***	12
QR	7	***XY***	14
RS	10	***YZ***	20
PS	12	***WZ***	24

c.



d. $WX = 12 = 2PQ$; similarly $XY = 2QR$, $YZ = 2RS$, and $WZ = 2PS$. So eqn. is $y = 2x$.

SPIRAL REVIEW, PAGE 494

47.
$$\begin{aligned} (x-3)^2 &= 49 \\ x - 3 &= \pm 7 \\ x &= 3 \pm 7 \\ &= 10 \text{ or } -4 \end{aligned}$$

48.
$$\begin{aligned} (x+1)^2 - 4 &= 0 \\ (x+1)^2 &= 4 \\ x + 1 &= \pm 2 \\ x &= -1 \pm 2 \\ &= -3 \text{ or } 1 \end{aligned}$$

49.
$$\begin{aligned} 4(x+2)^2 - 28 &= 0 \\ 4(x+2)^2 &= 28 \\ (x+2)^2 &= 7 \\ x + 2 &= \pm\sqrt{7} \\ x &= -2 \pm \sqrt{7} \\ &\approx 0.65 \text{ or } -4.65 \end{aligned}$$

50. slope of $\overline{AB} = \frac{2}{3}$; slope of $\overline{CD} = \frac{-2}{-3} = \frac{2}{3}$
slope of $\overline{BC}$ = slope of $\overline{AD} = 0$
$\overline{AB} \parallel \overline{CD}$ and $\overline{BC} \parallel \overline{AD}$, so $ABCD$ is a ▱.

51. slope of $\overline{JK} = \frac{2}{2} = 1$; slope of $\overline{LM} = \frac{-2}{-2} = 1$

slope of $\overline{KL} = \frac{-3}{3} = -1$; slope of $\overline{JM} = \frac{-3}{3} = -1$

$\overline{JK} \parallel \overline{LM}$ and $\overline{KL} \parallel \overline{JM}$, so $JKLM$ is a ▱.

52. $58x = 26y$

$y : x = 58 : 26 = 29 : 13$

7-6 DILATIONS AND SIMILARITY IN THE COORDINATE PLANE, PAGES 495–500

CHECK IT OUT! PAGES 495–497

1. **Step 1** Multiply vertices of photo $A(0, 0)$, $B(0, 4)$, $C(3, 4)$, $D(3, 0)$ by $\frac{1}{2}$.

Rect. $ABCD$ Rect. $A'B'C'D'$

$A(0, 0) \rightarrow A'\left(\frac{1}{2}(0), \frac{1}{2}(0)\right) \rightarrow A'(0, 0)$

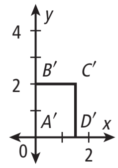
$B(0, 0) \rightarrow B'\left(\frac{1}{2}(0), \frac{1}{2}(4)\right) \rightarrow B'(0, 2)$

$C(0, 0) \rightarrow C'\left(\frac{1}{2}(3), \frac{1}{2}(4)\right) \rightarrow C'(1.5, 2)$

$D(0, 0) \rightarrow D'\left(\frac{1}{2}(3), \frac{1}{2}(0)\right) \rightarrow D'(1.5, 0)$

Step 2 Plot pts. $A'(0, 0)$, $B'(0, 2)$, $C'(1.5, 2)$, and $D'(1.5, 0)$. Draw the rectangle.

Check student's work

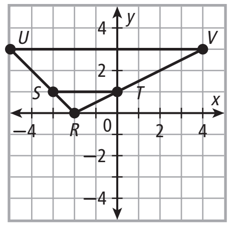


2. Since $\triangle MON \sim \triangle POQ$,

$$\frac{PO}{MO} = \frac{OQ}{ON}$$
$$\frac{-15}{-10} = \frac{3}{2} = \frac{-30}{ON}$$
$$3ON = -60$$
$$ON = -20$$

N lies on y-axis, so its x-coord. is 0. Since $ON = -20$, its y-coord. must be -20. Coords. of N are $(0, -20)$. $(0, -30) \rightarrow \left(\frac{2}{3}(0), \frac{2}{3}(-30)\right) \rightarrow (0, -20)$, so scale factor is $\frac{2}{3}$.

3. **Step 1** Plot pts. and draw △s.



Step 2 Use Dist. Formula to find side lengths.

$RS = \sqrt{(-3+2)^2 + (1-0)^2} = \sqrt{2}$

$RT = \sqrt{(0+2)^2 + (1-0)^2} = \sqrt{5}$

$RU = \sqrt{(-5+2)^2 + (3-0)^2} = \sqrt{18} = 3\sqrt{2}$

$RV = \sqrt{(4+2)^2 + (3-0)^2} = \sqrt{45} = 3\sqrt{5}$

Step 3 Find similarity ratio.

$\frac{RS}{RU} = \frac{\sqrt{2}}{3\sqrt{2}} = \frac{1}{3}$ $\frac{RT}{RV} = \frac{\sqrt{5}}{3\sqrt{5}} = \frac{1}{3}$

Since $\frac{RS}{RU} = \frac{RT}{RV}$ and $\angle R \cong \angle R$ by Reflex. Prop. of $\cong$, $\triangle RST \sim \triangle RUV$ by SAS $\sim$.

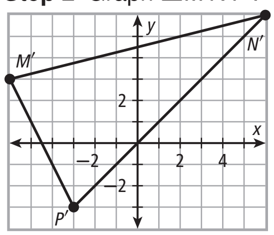
4. **Step 1** Multiply each coord. by 3 to find coords of vertices of $\triangle M'N'P'$.

$M(-2, 1) \rightarrow M'(3(-2), 3(1)) = M'(-6, 3)$

$N(2, 2) \rightarrow N'(3(2), 3(2)) = N'(6, 6)$

$P(-1, -1) \rightarrow P'(3(-1), 3(-1)) = P'(-3, -3)$

Step 2 Graph $\triangle M'N'P'$.



Step 3 Use Dist. Formula to find side lengths.

$MN = \sqrt{(2+2)^2 + (2-1)^2} = \sqrt{17}$

$M'N' = \sqrt{(6+6)^2 + (6-3)^2} = \sqrt{153} = 3\sqrt{17}$

$NP = \sqrt{(-1-2)^2 + (-1-2)^2} = \sqrt{18} = 3\sqrt{2}$

$N'P' = \sqrt{(-3-6)^2 + (-3-6)^2} = \sqrt{162} = 9\sqrt{2}$

$MP = \sqrt{(-1+2)^2 + (-1-1)^2} = \sqrt{5}$

$M'P' = \sqrt{(-3+6)^2 + (-3-3)^2} = \sqrt{45} = 3\sqrt{5}$

Step 4 Find similarity ratio.

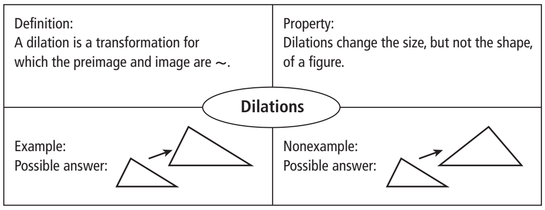
$\frac{M'N'}{MN} = \frac{3\sqrt{17}}{\sqrt{17}} = 3$, $\frac{N'P'}{NP} = \frac{9\sqrt{2}}{3\sqrt{2}} = 3$, $\frac{M'P'}{MP} = \frac{3\sqrt{5}}{\sqrt{5}} = 3$

Since $\frac{M'N'}{MN} = \frac{N'P'}{NP} = \frac{M'P'}{MP}$, $\triangle M'N'P' \sim \triangle MNP$ by SSS $\sim$.

THINK AND DISCUSS, PAGE 497

1. The scale factor is 4, since each coord. of preimage is multiplied by 4 in order to get coords. of image.

2.



EXERCISES, PAGES 498–500

GUIDED PRACTICE, PAGE 498

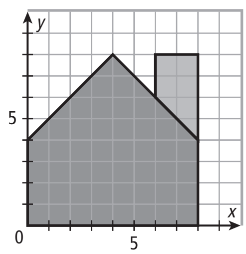
1. dilation **2.** scale factor

3. Step 1 Multiply vertices of figure $A(0, 0)$, $B(0, 2)$, $C(2, 4)$, $D(3, 3)$, $E(3, 4)$, $F(4, 4)$, $G(4, 2)$, $H(4, 0)$ by 2.

Fig. $ABCDEFGH$ Fig. $A'B'C'D'E'F'G'H'$

$A(0, 0) \rightarrow A'(2(0), 2(0)) \rightarrow A'(0, 0)$
$B(0, 2) \rightarrow B'(2(0), 2(2)) \rightarrow B'(0, 4)$
$C(2, 4) \rightarrow C'(2(2), 2(4)) \rightarrow C'(4, 8)$
$D(3, 3) \rightarrow D'(2(3), 2(3)) \rightarrow D'(6, 6)$
$E(3, 4) \rightarrow E'(2(3), 2(4)) \rightarrow E'(6, 8)$
$F(4, 4) \rightarrow F'(2(4), 2(4)) \rightarrow F'(8, 8)$
$G(4, 2) \rightarrow G'(2(4), 2(2)) \rightarrow G'(8, 4)$
$H(4, 0) \rightarrow H'(2(4), 2(0)) \rightarrow H'(8, 0)$

Step 2 Plot pts. A', B', C', D', E', F', G', and H'. Draw the figure.



4. Since $\triangle AOB \sim \triangle COD$,

$$\frac{AO}{CO} = \frac{OB}{OD}$$
$$\frac{10}{CO} = \frac{6}{15}$$
$$150 = 6CO$$
$$CO = 25$$

C lies on x-axis, so its y-coord. is 0. Since $CO = 25$, its x-coord. must be 25. Coords. of C are (25, 0).

$(10, 0) \rightarrow \left(\frac{5}{2}(10), \frac{5}{2}(0)\right) \rightarrow (25, 0)$, so scale factor is $\frac{5}{2}$.

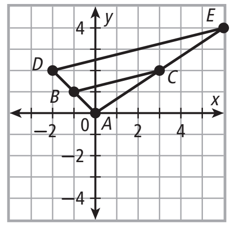
5. Since $\triangle ROS \sim \triangle POQ$,

$$\frac{RO}{PO} = \frac{OS}{OQ}$$
$$\frac{4}{10} = \frac{OS}{-20}$$
$$-80 = 10OS$$
$$OS = -8$$

S lies on y-axis, so its x-coord. is 0. Since $OS = -8$, its y-coord. must be -8. Coords. of S are $(0, -8)$.

$(0, -20) \rightarrow \left(\frac{2}{5}(0), \frac{2}{5}(-20)\right) \rightarrow (0, -8)$, so scale factor is $\frac{5}{2}$.

6. Step 1 Plot pts. and draw ⚠s.



Step 2 Use Dist. Formula to find side lengths.

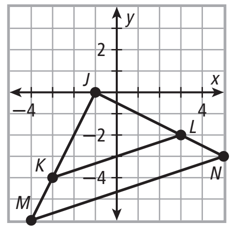
$$AB = \sqrt{(-1 - 0)^2 + (1 - 0)^2} = \sqrt{2}$$
$$AC = \sqrt{(3 - 0)^2 + (2 - 0)^2} = \sqrt{13}$$
$$AD = \sqrt{(-2 - 0)^2 + (2 - 0)^2} = \sqrt{8} = 2\sqrt{2}$$
$$AE = \sqrt{(6 - 0)^2 + (4 - 0)^2} = \sqrt{52} = 2\sqrt{13}$$

Step 3 Find similarity ratio.

$$\frac{AB}{AD} = \frac{\sqrt{2}}{2\sqrt{2}} = \frac{1}{2} \qquad \frac{AC}{AE} = \frac{\sqrt{13}}{2\sqrt{13}} = \frac{1}{2}$$

Since $\frac{AB}{AD} = \frac{AC}{AE}$ and $\angle A \cong \angle A$ by Reflex. Prop. of $\cong$, $\triangle ABC \sim \triangle ADE$ by SAS $\sim$.

7. Step 1 Plot pts. and draw ⚠s.



Step 2 Use Dist. Formula to find side lengths.

$$JK = \sqrt{(-3 + 1)^2 + (-4 - 0)^2} = \sqrt{20} = 2\sqrt{5}$$
$$JL = \sqrt{(3 + 1)^2 + (-2 - 0)^2} = \sqrt{20} = 2\sqrt{5}$$
$$JM = \sqrt{(-4 + 1)^2 + (-6 - 0)^2} = \sqrt{45} = 3\sqrt{5}$$
$$JN = \sqrt{(5 + 1)^2 + (-3 - 0)^2} = \sqrt{45} = 3\sqrt{5}$$

Step 3 Find similarity ratio.

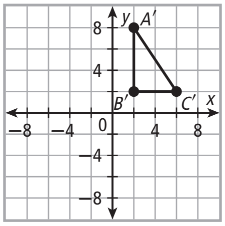
$$\frac{JK}{JM} = \frac{2\sqrt{5}}{3\sqrt{5}} = \frac{2}{3} \qquad \frac{JL}{JN} = \frac{2\sqrt{5}}{3\sqrt{5}} = \frac{2}{3}$$

Since $\frac{JK}{JM} = \frac{JL}{JN}$ and $\angle J \cong \angle J$ by Reflex. Prop. of $\cong$, $\triangle JKL \sim \triangle JMN$ by SAS $\sim$.

8. Step 1 Multiply each coord. by 2 to find coords of vertices of $\triangle A'B'C'$.

$A(1, 4) \rightarrow A'(2(1), 2(4)) = A'(2, 8)$
$B(1, 1) \rightarrow B'(2(1), 2(1)) = B'(2, 2)$
$C(3, 1) \rightarrow C'(2(3), 2(1)) = C'(6, 2)$

Step 2 Graph $\triangle A'B'C'$.



Step 3 Use Dist. Formula to find side lengths.

$AB = \sqrt{(1-1)^2 + (1-4)^2} = 3$
$A'B' = \sqrt{(2-2)^2 + (2-8)^2} = 6$
$BC = \sqrt{(3-1)^2 + (1-1)^2} = 2$
$B'C' = \sqrt{(6-2)^2 + (2-2)^2} = 4$
$AC = \sqrt{(3-1)^2 + (1-4)^2} = \sqrt{13}$
$A'C' = \sqrt{(6-2)^2 + (2-8)^2} = \sqrt{52} = 2\sqrt{13}$

Step 4 Find similarity ratio.

$\frac{A'B'}{AB} = \frac{6}{3} = 2, \frac{B'C'}{BC} = \frac{4}{2} = 2, \frac{A'C'}{AC} = \frac{2\sqrt{13}}{\sqrt{13}} = 2$

Since $\frac{A'B'}{AB} = \frac{B'C'}{BC} = \frac{A'C'}{AC}$, $\triangle ABC \sim \triangle A'B'C'$ by SSS $\sim$.

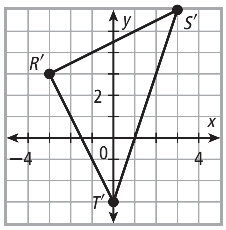
9. Step 1 Multiply each coord. by $\frac{3}{2}$ to find coords of vertices of $\triangle R'S'T'$.

$R(-2, 2) \rightarrow R'\left(\frac{3}{2}(-2), \frac{3}{2}(2)\right) = R'(-3, 3)$

$S(2, 4) \rightarrow S'\left(\frac{3}{2}(2), \frac{3}{2}(4)\right) = S'(3, 6)$

$T(0, -2) \rightarrow T'\left(\frac{3}{2}(0), \frac{3}{2}(-2)\right) = T'(0, -3)$

Step 2 Graph $\triangle R'S'T'$.



Step 3 Use Dist. Formula to find side lengths.

$RS = \sqrt{(2+2)^2 + (4-2)^2} = \sqrt{20} = 2\sqrt{5}$
$R'S' = \sqrt{(3+3)^2 + (6-3)^2} = \sqrt{45} = 3\sqrt{5}$
$ST = \sqrt{(0-2)^2 + (-2-4)^2} = \sqrt{40} = 2\sqrt{10}$
$S'T' = \sqrt{(0-3)^2 + (-3-6)^2} = \sqrt{90} = 3\sqrt{10}$
$RT = \sqrt{(0+2)^2 + (-2-2)^2} = \sqrt{20} = 2\sqrt{5}$
$R'T' = \sqrt{(0+3)^2 + (-3-3)^2} = \sqrt{45} = 3\sqrt{5}$

Step 4 Find similarity ratio.

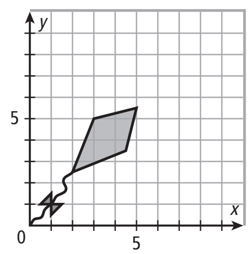
$\frac{R'S'}{RS} = \frac{3\sqrt{5}}{2\sqrt{5}} = \frac{3}{2}, \frac{S'T'}{ST} = \frac{3\sqrt{10}}{2\sqrt{10}} = \frac{3}{2},$

$\frac{R'T'}{RT} = \frac{3\sqrt{5}}{2\sqrt{5}} = \frac{3}{2}$

Since $\frac{R'S'}{RS} = \frac{S'T'}{ST} = \frac{R'T'}{RT}$, $\triangle RST \sim \triangle R'S'T'$ by SSS $\sim$.

PRACTICE AND PROBLEM SOLVING, PAGE 499

10. Coords. of kite are $A(4, 5)$, $B(9, 7)$, $C(10, 11)$, and $D(6, 10)$.
Coords. of image are $A(2, 2.5)$, $B(4.5, 3.5)$, $C(5, 5.5)$, and $D(3, 5)$.



11. $\frac{UO}{XO} = \frac{OV}{OY}$

$\frac{-9}{XO} = \frac{-3}{-8}$

$72 = -3XO$

$XO = -24$

X on x-axis $\rightarrow X = (-24, 0)$

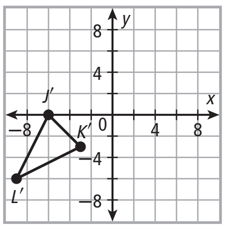
$(-9, 0) \rightarrow \left(\frac{8}{3}(-9), \frac{8}{3}(0)\right) = (-24, 0)$, so scale factor is $\frac{8}{3}$.

12. $\frac{MO}{KO} = \frac{ON}{OL}$
$\frac{16}{KO} = \frac{-24}{-15}$
$-240 = -24KO$
$KO = 10$
K on y-axis $\rightarrow K = (0, 10)$
$(0, 16) \rightarrow \left(\frac{5}{8}(0), \frac{5}{8}(16)\right) = (0, 10)$, so scale factor is $\frac{5}{8}$.

13. $DE = \sqrt{2^2 + 4^2} = 2\sqrt{5}$, $DF = \sqrt{4^2 + 4^2} = 4\sqrt{2}$
$DG = \sqrt{3^2 + 6^2} = 3\sqrt{5}$, $DH = \sqrt{6^2 + 6^2} = 6\sqrt{2}$
$\frac{DE}{DG} = \frac{2\sqrt{5}}{3\sqrt{5}} = \frac{2}{3}$, $\frac{DF}{DH} = \frac{4\sqrt{2}}{6\sqrt{2}} = \frac{2}{3}$
$\angle D \cong \angle D$ by Reflex. Prop. of $\cong$. So $\triangle DEF \sim \triangle DGH$ by SAS $\sim$.

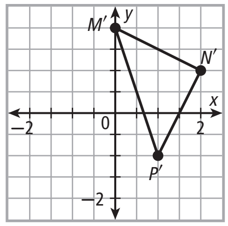
14. $MN = \sqrt{5^2 + 10^2} = 5\sqrt{5}$, $MP = \sqrt{15^2 + 5^2} = 5\sqrt{10}$
$MQ = \sqrt{10^2 + 20^2} = 10\sqrt{5}$, $MR = \sqrt{30^2 + 10^2} = 10\sqrt{10}$
$\frac{MN}{MQ} = \frac{5\sqrt{5}}{10\sqrt{5}} = \frac{1}{2}$, $\frac{MP}{MR} = \frac{5\sqrt{10}}{10\sqrt{10}} = \frac{1}{2}$
$\angle M \cong \angle M$ by Reflex. Prop. of $\cong$. So $\triangle MNP \sim \triangle MQR$ by SAS $\sim$.

15. **Step 1** Multiply each coord. by 3 to find coords of vertices of $\triangle J'K'L'$.
$J(-2, 0) \rightarrow J'(3(-2), 3(0)) = J'(-6, 0)$
$K(-1, -1) \rightarrow K'(3(-1), 3(-1)) = K'(-3, -3)$
$L(-3, -2) \rightarrow K'(3(-3), 3(-2)) = L'(-9, -6)$
Step 2 Graph $\triangle J'K'L'$.



Step 3 Find side lengths.
$JK = \sqrt{1^2 + 1^2} = \sqrt{2}$, $J'K' = \sqrt{3^2 + 3^2} = 3\sqrt{2}$
$KL = \sqrt{2^2 + 1^2} = \sqrt{5}$, $K'L' = \sqrt{6^2 + 3^2} = 3\sqrt{5}$
$JL = \sqrt{1^2 + 2^2} = \sqrt{5}$, $J'L' = \sqrt{3^2 + 6^2} = 3\sqrt{5}$
Step 4 Verify similarity.
Since $\frac{J'K'}{JK} = \frac{K'L'}{KL} = \frac{J'L'}{JL} = 3$, $\triangle JKL \sim \triangle J'K'L'$ by SSS $\sim$.

16. **Step 1** Multiply each coord. by $\frac{1}{2}$ to find coords of vertices of $\triangle M'N'P'$.
$M(0, 4) \rightarrow M'\left(\frac{1}{2}(0), \frac{1}{2}(4)\right) = M'(0, 2)$
$N(4, 2) \rightarrow N'\left(\frac{1}{2}(4), \frac{1}{2}(2)\right) = N'(2, 1)$
$P(2, -2) \rightarrow P'\left(\frac{1}{2}(2), \frac{1}{2}(-2)\right) = P'(1, -1)$
Step 2 Graph $\triangle M'N'P'$.



Step 3 Find side lengths.
$MN = \sqrt{4^2 + 2^2} = 2\sqrt{5}$, $M'N' = \sqrt{2^2 + 1^2} = \sqrt{5}$
$NP = \sqrt{2^2 + 4^2} = 2\sqrt{5}$, $N'P' = \sqrt{1^2 + 2^2} = \sqrt{5}$
$MP = \sqrt{2^2 + 6^2} = 2\sqrt{10}$, $M'P' = \sqrt{1^2 + 3^2} = \sqrt{10}$
Step 4 Verify similarity.
Since $\frac{M'N'}{MN} = \frac{N'P'}{NP} = \frac{M'P'}{MP} = \frac{1}{2}$, $\triangle MNP \sim \triangle M'N'P'$ by SSS $\sim$.

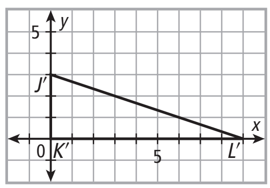
17. It is not a dilation; it changes shape of transformed figure.

18. Solution B is incorrect. Scale factor is ratio of a lin. measure of image to corr. lin. measure of preimage, so scale factor is $\frac{UW}{RT} = \frac{3}{2}$.

19. They are reciprocals. Similarity ratio of $\triangle ABC$ to $\triangle A'B'C'$ is $\frac{AB}{A'B'}$. Scale factor is $\frac{A'B'}{AB}$.

20a. Should use origin as vertex of rt. $\angle$; 1 unit reps. 60 cm $\rightarrow$ 3 units rep. 180 cm; so coords. are $J(0, 1)$, $K(0, 0)$, $L(3, 0)$.

b. $J \rightarrow J'(3(0), 3(1)) = J'(0, 3)$
$K \rightarrow K'(3(0), 3(0)) = K'(0, 0)$
$L \rightarrow L'(3(3), 3(0)) = L'(9, 0)$



TEST PREP, PAGE 500

21. A
Check similarity ratio: $\frac{2.4}{4} = \frac{3}{5} = \frac{-6}{-10}$

22. H
Perimeter is a lin. measure. So $P' = 2P = 2(60) = 120$.

23. A
$AB = 4$, $AC = BC = \sqrt{2^2 + 4^2} = 2\sqrt{5}$
$DE = |3 - 1| = 2$, $DF = EF = \sqrt{1^2 + 2^2} = \sqrt{5}$
$\frac{DE}{AB} = \frac{EF}{BC} = \frac{DF}{AC} = \frac{1}{2}$

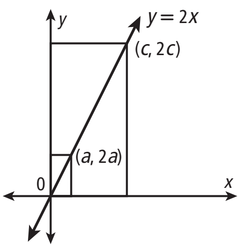
24. 15
$A \rightarrow A'(3(3), 3(2)) = A'(9, 6)$
$B \rightarrow B'(3(7), 3(5)) = B'(21, 15)$
$A'B' = \sqrt{12^2 + 9^2} = \sqrt{225} = 15$

CHALLENGE AND EXTEND, PAGE 500

25. Possible ~ statements: $\triangle XYZ \sim \triangle MNP$, $\triangle MPN$, $\triangle NMP$, $\triangle NPM$, $\triangle PMN$, or $\triangle PNM$. For each ~ statement, Z could lie either above or below $\overleftrightarrow{XY}$. So there are 2(6) = 12 different △s. They are all different, since MN, NP, and MP are all ≠.

26. scale factor $= \frac{XY}{MP} = \frac{2}{4} = \frac{1}{2}$
From M to N is rise of 2 and run of 1. So from X to Z is *either* rise of 1 and run of $\frac{1}{2}$ *or* rise of −1 and run of $\frac{1}{2}$. Therefore $Z = \left(1 \pm \frac{1}{2}, -2 \pm 1\right) = \left(1\frac{1}{2}, -1\right)$ or $\left(1\frac{1}{2}, -3\right)$.

27. All corr. ∠s of rects. are ≅ because they are all rt. ∠s. Suppose 1st rect. has vertex on line $y = 2x$ at (a, b). This pt. is a solution to the eqn., so $b = 2a$, and coords. of vertex are $(a, 2a)$. Similarly, for 2nd rect., coords. of vertex on line $y = 2x$ must be $(c, 2c)$.



1st rect. has dimensions a and $2a$, and 2nd rect. has dimensions c and $2c$. So all ratios of corr. sides $= \frac{c}{a}$. Therefore rects. are ~ by def.

28. scale factor $= \frac{DE}{AB} = \frac{6}{3} = 2$
From A to C is rise of 2 and run of 1.
2 positions for F are reflections in horiz. line $\overleftrightarrow{DE}$. So from D to F is rise of ±4 and run of 2. Therefore $F = (1 + 2, -1 \pm 4) = (3, 3)$ or $(3, -5)$.

SPIRAL REVIEW, PAGE 500

29. Possible answer: $2(50) + 5 + w \geq 250$
$105 + w \geq 250$

30. Think: $\triangle DEH \cong \triangle FEH$ by HL. So by CPCTC,
$\overline{HF} \cong \overline{DF}$
$HF = DF = 6.71$

31. Think: By Isosc. △ Thm., $\angle EDH \cong \angle EFH$, so by Rt. ∠ ≅ Thm., 3*rd* ∠s Thm, and ASA, $\triangle DFG \cong \triangle FDJ$. So by CPCTC,
$\overline{JF} \cong \overline{GD}$
$JF = GD = 5$

32. Think: Use Pyth. Thm.
$CF = \sqrt{CH^2 + HF^2}$
$= \sqrt{2^2 + 6.71^2} \approx 7.00$

33. $\frac{RT}{UV} = \frac{RS}{US}$
$\frac{RT}{9} = \frac{6+2}{6} = \frac{4}{3}$
$3RT = 36$
$RT = 12$

34. $\frac{VT}{VS} = \frac{RU}{US}$
$\frac{x}{x+3} = \frac{2}{6} = \frac{1}{3}$
$3x = x + 3$
$2x = 3$
$x = 1.5$
$VT = x = 1.5$

35. $ST = SV + VT$
$= x + 3 + x$
$= 2x + 3$
$= 2(1.5) + 3 = 6$

DIRECT VARIATION, PAGE 501

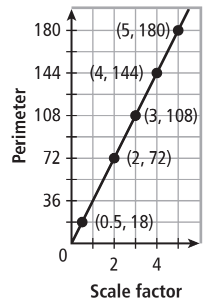
TRY THIS, PAGE 501

1. Step 1 Make a table to record data.

Scale Factor x	Side Length $s = x(6)$	Perimeter $P = 6s$
$\frac{1}{2}$	3	18
2	12	72
3	18	108
4	24	144
5	30	180

Step 2 Graph pts.

Since pts. are collinear and line that contains them includes origin, relationship is a direct variation.



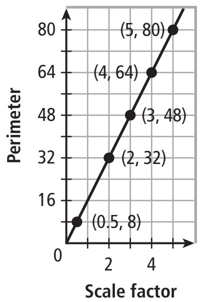
Step 3 Find eqn. of direct variation.
$y = kx$
$180 = k(5)$
$36 = k$
Thus constant of variation is 36.

2. Step 1 Make a table to record data.

Scale Factor x	Side Lengths $a = x(3)$	$b = x(6)$	$c = x(7)$	Perimeter $P = a + b + c$
$\frac{1}{2}$	$1\frac{1}{2}$	3	$3\frac{1}{2}$	8
2	6	12	14	32
3	9	18	21	48
4	12	24	28	64
5	15	30	35	80

Step 2 Graph pts.

Since pts. are collinear and line that contains them includes origin, relationship is a direct variation.



Step 3 Find eqn. of direct variation.

$y = kx$

$80 = k(5)$

$k = 16$

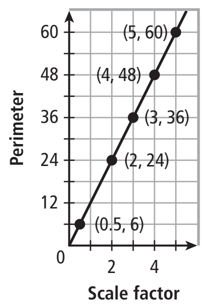
Thus constant of variation is 16.

3. Step 1 Make a table to record data.

Scale Factor x	Side Length $s = x(3)$	Perimeter $P = 4s$
$\frac{1}{2}$	$1\frac{1}{2}$	6
2	6	24
3	9	36
4	12	48
5	15	60

Step 2 Graph pts.

Since pts. are collinear and line that contains them includes origin, relationship is a direct variation.



Step 3 Find eqn. of direct variation.

$y = kx$

$60 = k(5)$

$k = 12$

Thus constant of variation is 12.

MULTI-STEP TEST PREP, PAGE 502

1. $\frac{EG}{FH} = \frac{GJ}{HK} = \frac{JC}{KC} = \frac{AE}{BF} = \frac{42.2}{40} = 1.055$

$EG = 1.055FH$

$= 1.055(40) = 42.2$ cm

$GJ = 1.055HK$

$= 1.055(35) \approx 36.9$ cm

$JC = 1.055KC$

$= 1.055(35) \approx 36.9$ cm

2. area of $\triangle ABC = \frac{1}{2}(BC)(AB)$

$= \frac{1}{2}(40 + 40 + 35 + 35)(50)$

$= 3750 \text{ cm}^2$

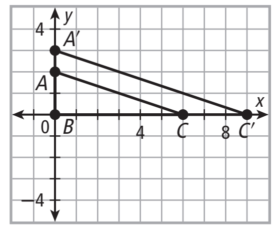
Think: Use Proportional Perimeters and Areas Thm.

area of drawing = (scale factor)^2(area of $\triangle ABC$)

$= \left(\frac{1}{25}\right)^2(3750)$

$= \frac{1}{625}(3750) = 6 \text{ cm}^2$

3.



7B READY TO GO ON?, PAGE 503

1. $\frac{ST}{QT} = \frac{RT}{PT}$

$\frac{ST}{ST + 16} = \frac{14}{14 + 12}$

$26ST = 14(ST + 16)$

$26ST = 14ST + 224$

$12ST = 224$

$ST = 18\frac{2}{3}$

2. $\frac{AB}{AC} = \frac{BD}{CD}$

$\frac{4y - 1}{5y} = \frac{6}{8}$

$8(4y - 1) = 6(5y)$

$32y - 8 = 30y$

$2y = 8$

$y = 4$

$AB = 4(4) - 1 = 15$

$AC = 5(4) = 20$

3. $\frac{FH}{EG} = \frac{HK}{GJ}$

$\frac{FH}{3.6} = \frac{2}{2.4}$

$2.4FH = 7.2$

$FH = 3$ cm

4. $\frac{\text{plan length of } \overline{AB}}{AB} = \frac{0.25}{AB} = \frac{1.5}{60}$

$15 = 1.5AB$

$AB = 10$ ft

5. $\frac{\text{plan length of } \overline{BC}}{BC} = \frac{0.75}{BC} = \frac{1.5}{60}$

$45 = 1.5BC$

$BC = 30$ ft

6. $\frac{\text{plan length of } \overline{CD}}{CD} = \frac{1}{CD} = \frac{1.5}{60}$

$60 = 1.5CD$

$CD = 40$ ft

7. $\dfrac{\text{plan length of } \overline{EF}}{EF} = \dfrac{0.5}{EF} = \dfrac{1.5}{60}$

$30 = 1.5EF$

$EF = 20$ ft

8. 5 ft 3 in. = 5(12) + 3 in. = 63 in.

5 ft 10 in. = 5(12) + 10 in. = 70 in.

40 ft = 40(12) in. = 480 in.

$\dfrac{h}{63} = \dfrac{480}{70}$

$70h = 63(480)$

$h = 432$ in. = 36 ft

9. By the Dist. Formula:

$AD = \sqrt{1^2 + 2^2} = \sqrt{5}$; $AB = \sqrt{2^2 + 4^2} = 2\sqrt{5}$

$AE = \sqrt{2^2 + 1^2} = \sqrt{5}$; $AC = \sqrt{4^2 + 2^2} = 2\sqrt{5}$

$\angle A \cong \angle A$ by the Reflex. Prop. of $\cong$.

By SAS ~, $\triangle ADE \sim \triangle ABC$.

10. By the Dist. Formula:

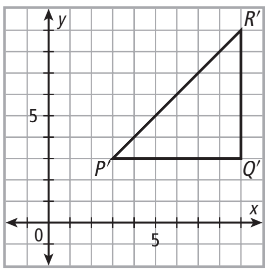
$RS = \sqrt{2^2 + 1^2} = \sqrt{5}$; $RU = \sqrt{4^2 + 2^2} = 2\sqrt{5}$

$RT = |-3 - 0| = 3$; $RV = |6 - 0| = 6$

$\dfrac{RS}{RU} = \dfrac{RT}{RV} = \dfrac{1}{2}$. $\angle SRT \cong \angle URV$ by the Vert. ∠s Thm.

By SAS ~, $\triangle RST \sim \triangle RUV$.

11.



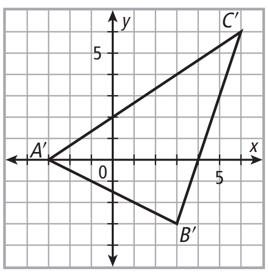
$PQ = QR = 2$; $P'Q' = Q'R' = 6$

$PR = \sqrt{2^2 + 2^2} = 2\sqrt{2}$; $P'R' = \sqrt{6^2 + 6^2} = 6\sqrt{2}$

$\dfrac{P'Q'}{PQ} = \dfrac{Q'R'}{QR} = \dfrac{6}{2} = 3$; $\dfrac{P'R'}{PR} = \dfrac{6\sqrt{2}}{2\sqrt{2}} = 3$

By SSS ~, $\triangle P'Q'R' \sim \triangle PQR$.

12.



$AB = \sqrt{4^2 + 2^2} = 2\sqrt{5}$; $A'B' = \sqrt{6^2 + 3^2} = 3\sqrt{5}$

$BC = \sqrt{2^2 + 6^2} = 2\sqrt{10}$; $B'C' = \sqrt{3^2 + 9^2} = 3\sqrt{10}$

$AC = \sqrt{6^2 + 4^2} = 2\sqrt{13}$; $A'C' = \sqrt{9^2 + 6^2} = 3\sqrt{13}$

$\dfrac{A'B'}{AB} = \dfrac{B'C'}{BC} = \dfrac{A'B'}{AB} = \dfrac{3}{2}$

By SSS ~, $\triangle A'B'C' \sim \triangle ABC$.

STUDY GUIDE: REVIEW, PAGES 504–507

1. proportion
2. dilation
3. means
4. ratio

LESSON 7-1, PAGE 504

5. slope of $m = \dfrac{1}{5}$

6. slope of $n = \dfrac{-3}{6} = -\dfrac{1}{2}$

7. slope of $p = \dfrac{6}{4} = \dfrac{3}{2}$

8. Let x, y be the largest and smallest parts respectively.

$\dfrac{x + y}{84} = \dfrac{6 + 3}{3 + 5 + 6}$

$x + y = \dfrac{84(9)}{14}$

$x + y = 54$

The sum of the smallest and largest parts is 54.

9. $\dfrac{\ell}{w} = \dfrac{7}{12}$

$\ell = \dfrac{7}{12}w$

$P = 2\ell + 2w$

$= 2\left(\dfrac{7}{12}w\right) + 2w$

$6P = 7w + 12w$

$6(95) = 19w$

$w = 30$

$\ell = \dfrac{7}{12}(30) = 17.5$

Side lengths are 17.5, 30, 17.5, 30.

10. $\dfrac{y}{7} = \dfrac{9}{3}$

$3y = 63$

$y = 21$

11. $\dfrac{10}{4} = \dfrac{25}{s}$

$10s = 100$

$s = 10$

12. $\dfrac{x}{4} = \dfrac{9}{x}$

$x^2 = 36$

$x = \pm 6$

13. $\dfrac{4}{z - 1} = \dfrac{z - 1}{36}$

$144 = (z - 1)^2$

$z - 1 = \pm 12$

$z = 1 \pm 12$

$= 13$ or -11

14. $\dfrac{12}{2x} = \dfrac{3x}{32}$

$384 = 6x^2$

$x^2 = 64$

$x = \pm 8$

15. $\dfrac{y + 1}{24} = \dfrac{2}{3(y + 1)}$

$3(y + 1)^2 = 48$

$(y + 1)^2 = 16$

$y + 1 = \pm 4$

$y = -1 \pm 4$

$= 3$ or -5

LESSON 7-2, PAGE 505

16. $\dfrac{JK}{PQ} = \dfrac{8}{4.8} = \dfrac{5}{3}$; $\dfrac{JM}{PS} = \dfrac{5}{3}$; all ∠s are rt ∠s, so $\cong$

yes, by def. of ~; ~ ratio $= \dfrac{5}{3}$; $JKLM \sim PQRS$

17. yes, by AA ~; ~ ratio $= \dfrac{TU}{WX} = \dfrac{12}{6} = 2$;

$\triangle TUV \sim \triangle WXY$

LESSON 7-3, PAGE 505

18.

Statements	Reasons
1. $JL = \frac{1}{3}JN$, $JK = \frac{1}{3}JM$	1. Given
2. $\frac{JL}{JN} = \frac{1}{3}, \frac{JK}{JM} = \frac{1}{3}$	2. Div. Prop. of =
3. $\frac{JL}{JN} = \frac{JK}{JM}$	3. Trans. Prop. of =
4. $\angle J \cong \angle J$	4. Reflex. Prop. of ≅
5. $\triangle JKL \sim \triangle JMN$	5. SAS ~ *Steps 3, 4*

19.

Statements	Reasons
1. $\overline{QR} \parallel \overline{ST}$	1. Given
2. $\angle RQP \cong \angle STP$	2. Alt. Int. ∠s Thm.
3. $\angle RPQ \cong \angle SPT$	3. Vert. ∠s Thm.
4. $\triangle PQR \sim \triangle PTS$	4. AA ~ *Steps 2, 3*

20.

Statements	Reasons
1. $\overline{BC} \parallel \overline{CE}$	1. Given
2. $\angle ABD \cong \angle C$	2. Corr. ∠s Post.
3. $\angle ADB \cong \angle E$	3. Corr. ∠s Post.
4. $\triangle ABD \sim \triangle ACE$	4. AA ~ *Steps 2, 3*
5. $\frac{AB}{AC} = \frac{BD}{CE}$	5. Def. of ~ polygons
6. $AB(CE) = AC(BD)$	6. Cross Products Prop.

LESSON 7-4, PAGE 506

21. $\frac{CE}{15} = \frac{8}{12}$
$12CE = 120$
$CE = 10$

22. $\frac{ST}{10} = \frac{3}{9}$
$9ST = 30$
$ST = 3\frac{1}{3}$

23. $\frac{JK}{JM} = \frac{JL}{JN} = \frac{1}{2}$
Since $\frac{JK}{JM} = \frac{JL}{JN}$
$\overline{KL} \parallel \overline{MN}$ by Conv. of △ Prop. Thm.

24. $EC/EA = \frac{ED}{EB} = \frac{3}{7}$
Since $\frac{EC}{EA} = \frac{ED}{EB}$
$\overline{AB} \parallel \overline{CD}$ by Conv. of △ Prop. Thm.

25. $\frac{SU}{RU} = \frac{SV}{RV}$
$\frac{y+1}{8} = \frac{2y}{12}$
$12(y + 1) = 8(2y)$
$12y + 12 = 16y$
$12 = 4y$
$y = 3$
$SU = 3 + 1 = 4$
$SV = 2(3) = 6$

26. $\frac{x+6}{30} = \frac{2x}{24}$
$24(x + 6) = 30(2x)$
$24x + 144 = 60x$
$144 = 36x$
$x = 4$
$AB = x + 6 + 2x$
$= 3x + 6$
$= 3(4) + 6 = 18$

27. $P = a + b + c$ where $b = a + x$, $c = 3 + 5 = 8$
$\frac{3}{a} = \frac{5}{a+x}$
$3(a + x) = 5a$
$3a + 3x = 5a$
$2a = 3x$
$P = a + a + x + 8$
$= 2a + x + 8$
$= 4x + 8$

LESSON 7-5, PAGE 507

28. 3 ft = 3(12) in. = 36 in.
5 ft 4 in. = 5(12) + 4 in. = 64 in.
14 ft 3 in. = 14(12) + 3 in. = 171 in.
$\frac{x}{64} = \frac{171}{36}$
$36x = 10{,}944$
$x = 304$ in. = 25 ft 4 in.

29. $\frac{6}{x} = \frac{12}{3+x}$
$6(3 + x) = 12x$
$18 + 6x = 12x$
$18 = 6x$
$x = 3$ ft

LESSON 7-6, PAGE 507

30. By the Dist. Formula:
$RS = \sqrt{2^2 + 2^2} = 2\sqrt{2}$; $RU = \sqrt{4^2 + 4^2} = 4\sqrt{2}$
$RT = \sqrt{1^2 + 3^2} = \sqrt{10}$; $RV = \sqrt{2^2 + 6^2} = 2\sqrt{10}$
$\frac{RS}{RU} = \frac{RT}{RV} = \frac{1}{2}$. $\angle R \cong \angle R$ by the Reflex. Prop. of ≅.
So $\triangle RST \sim \triangle RUV$ by SAS ~.

31. By the Dist. Formula:
$JK = \sqrt{2^2 + 1^2} = \sqrt{5}$; $JM = \sqrt{8^2 + 4^2} = 4\sqrt{5}$
$JL = |2 - 4| = 2$; $JN = |-4 - 4| = 8$
$\frac{JK}{JM} = \frac{JL}{JN} = \frac{1}{4}$. $\angle J \cong \angle J$ by the Reflex. Prop. of ≅.
So $\triangle JKL \sim \triangle JMN$ by SAS ~.

32. $\frac{AO}{CO} = \frac{OB}{OD}$
$\frac{12}{18} = \frac{OB}{-9}$
$-108 = 18OB$
$OB = -6$
Since *x*-coord. of *B* is 0, $B = (0, -6)$.
Scale factor $= \frac{12}{18} = \frac{2}{3}$.

33. Image vertices are $K'(0, 9)$, $L'(0, 0)$, $M'(12, 0)$.
By the Dist. Formula:
$KL = 3$; $K'L' = 9$; $LM = 4$; $L'M' = 12$
$KM = \sqrt{3^2 + 4^2} = 5$; $K'M' = \sqrt{9^2 + 12^2} = 15$
All proportions = 3, so $\triangle KLM \sim \triangle K'L'M'$ by SSS ~.

CHAPTER TEST, PAGE 508

1. slope of $\ell = \frac{-6 - 4}{10 + 6} = -\frac{5}{8}$

2. $\frac{5}{8} = \frac{3.5}{w}$
$5w = 28$
$w = 5.6$ in.

3. $\angle B \cong \angle N$ and $\angle C \cong \angle P$; yes, by AA ~;
~ ratio $= \frac{AB}{MN} = \frac{40}{60} = \frac{2}{3}$; $\triangle ABC \sim \triangle MNP$

4. $\frac{DE}{HJ} = \frac{55}{22} = \frac{5}{2}$; $\frac{DG}{HL} = \frac{40}{16} = \frac{5}{2}$
yes; since all ∠s are rt. ∠s and therefore ≅;
~ ratio = $\frac{5}{2}$; $DEFG \sim HJKL$ by def.

5.

Statements	Reasons
1. $RSTU$ is a ▱.	1. Given
2. $\overline{RU} \parallel \overline{ST}$	2. Def. of ▱
3. $\angle VRW \cong \angle TSW$	3. Alt. Int. ∠s Thm.
4. $\angle RWV \cong \angle SWT$	4. Vert ∠s Thm.
5. $\triangle RWV \sim \triangle SWT$	5. AA ~ *Steps 3, 4*

6. $\frac{CD}{AB} = \frac{DG}{BG}$
$\frac{CD}{2.5} = \frac{6}{9}$
$9CD = 2.5(6) = 15$
$CD \approx 1.7$ ft
$\frac{EF}{AB} = \frac{FG}{BG}$
$\frac{EF}{2.5} = \frac{3}{9}$
$9FG = 7.5$
$FG \approx 0.8$ ft

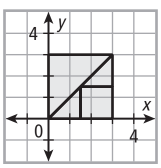
7. $\frac{PR}{21} = \frac{10}{18}$
$18PR = 210$
$PR = 11\frac{2}{3}$

8. $\frac{YW}{XY} = \frac{WZ}{XZ}$
$\frac{\frac{t}{2}}{8} = \frac{t-2}{12.8}$
$12.8\left(\frac{t}{2}\right) = 8(t-2)$
$6.4t = 8t - 16$
$16 = 1.6t$
$t = 10$
$YW = \frac{t}{2} = 5$
$WZ = t - 2 = 8$

9. 5 ft 8 in. = 5(12) + 8 in. = 68 in.
3 ft = 36 in.; 27 ft = 324 in.
$\frac{h}{68} = \frac{324}{36} = 9$
$h = 68(9) = 612$ in. = 51 ft

10. $\frac{\text{plan length of } \overline{AB}}{AB} = \frac{1.5}{30}$
$\frac{1.25}{AB} = \frac{1.5}{30}$
$37.5 = 1.5AB$
$AB = 25$ ft

11. By the Dist. Formula:
$AB = \sqrt{3^2 + 1^2} = \sqrt{10}$; $AD = \sqrt{9^2 + 3^2} = 3\sqrt{10}$
$AC = |3 - 5| = 2$; $AE = |-1 - 5| = 6$
$\frac{AB}{AD} = \frac{AC}{AE} = \frac{1}{3}$. $\angle A \cong \angle A$ by the Reflex. Prop. of ≅.
So $\triangle JKL \sim \triangle JMN$ by SAS ~.

12.


COLLEGE ENTRANCE EXAM PRACTICE, PAGE 509

1. A
$\frac{BC}{CD} = \frac{AB}{DE}$
$\frac{BC}{9 - BC} = \frac{4}{8} = \frac{1}{2}$
$2BC = 9 - BC$
$3BC = 9$
$BC = 3$
Since $\overline{BD}$ is horiz., y-coord. of C is 1;
so $C = (1 + 3, 1) = (4, 1)$.

2. C
$\frac{x}{21} = \frac{6}{14}$
$14x = 126$
$x = 9$

3. D; $x + y + z = 750{,}000$ and $x:y:z = 4:5:6$
$\frac{z}{750{,}000} = \frac{6}{4 + 5 + 6} = \frac{2}{5}$
$5z = 1{,}500{,}000$
$z = 300{,}000$

4. D
$\frac{35}{9} = \frac{h}{1.2}$
$42 = 9h$
$h = 4\frac{2}{3}$ ft = 4 ft 8 in.

5. D
In any square, all ∠s are rt ∠s, so ≅; all sides are ≅.