5. Step 1 Solve for x.

$RS = ST$

$-2x = -3x - 2$

$+3x \quad +3x$

$x = -2$

Step 2 Find RS, ST, and RT.

$RS = -2x$

$= -2(-2) = 4$

$ST = -3x - 2$

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

$RT = RS + ST$

$= 4 + 4 = 8$

THINK AND DISCUSS, PAGE 16

1. Since R is the mdpt. of $\overline{ST}$, you know $SR = RT$. Also, $ST = SR + RT$. By subst., $ST = SR + SR = 2SR$. So ST is twice SR.

2.

B is between *A* and *C*.	*B* is the mdpt. of $\overline{AC}$.
A B C	A B C
$AB + BC = AC$	$AC = 2BC = 2AB$ $AB = BC$

EXERCISES, PAGES 17–19

GUIDED PRACTICE, PAGE 17

1. $\overline{XM}$ and $\overline{MY}$

2. distance

3. $AB = |1 - (-2.5)|$

$= |3.5|$

$= 3.5$

4. $BC = |3.5 - 1|$

$= |2.5|$

$= 2.5$

5. Check students' work.

6. $AC = AB + BC$

$15.8 = 9.9 + BC$

$-9.9 \quad -9.9$

$5.9 = BC$

7. $MP = MN + NP$

$5y + 9 = 17 + 3y$

$-3y \quad -3y$

$2y + 9 = 17$

$-9 \quad -9$

$\frac{2y}{2} = \frac{8}{2}$

$y = 4$

$MP = 5y + 9$

$= 5(4) + 9 = 29$

8. Let road sign be R, Sacramento be S, Oakland be O, and location of picnic area be P.

$RS + SO = RO$

$23 + SO = 110$

$-23 \quad -23$

$SO = 87$

$RP = RS + SP$

$= RS + \frac{1}{2}SO$

$= 23 + \frac{1}{2}(87) = 66.5$ mi

9. Step 1 Solve for x.

$JL = 2JK$

$4x - 2 = 2(7)$

$4x - 2 = 14$

$+2 \quad +2$

$\frac{4x}{4} = \frac{16}{4}$

$x = 4$

Step 2 Find KL and JL.

$KL = JK = 7$

$JL = 4x - 2$

$= 4(4) - 2 = 14$

10. Step 1 Solve for y.

$DE = EF$

$2y = 8y - 3$

$-8y \quad -8y$

$-6y = -3$

$\frac{-6y}{-6} = \frac{-3}{-6}$

$y = 0.5$

Step 2 Find DE, EF, and DF.

$DE = 2y$

$= 2(0.5) = 1$

$EF = 8y - 3$

$= 8(0.5) - 3 = 1$

$DF = DE + EF$

$= 1 + 1 = 2$

PRACTICE AND PROBLEM SOLVING, PAGES 17–18

11. $DB = \left|\frac{2}{3} - \left(-5\frac{1}{4}\right)\right|$

$= \left|\frac{8}{12} + 5\frac{3}{12}\right|$

$= \left|5\frac{11}{12}\right|$

$= 5\frac{11}{12}$

12. $CD = \left|-5\frac{1}{4} - (-2)\right|$

$= \left|-3\frac{1}{4}\right|$

$= 3\frac{1}{4}$

13. Check students' work.

14. $AE = AD + DE$

$17.1 = CD + 8$

$-8 \quad -8$

$9.1 = CD$

15. $MR = MN + NR$

$5x - 3 = 2.5x + x$

$5x - 3 = 3.5x$

$-5x \quad -5x$

$-3 = -1.5x$

$\frac{-3}{-1.5} = \frac{-1.5x}{-1.5}$

$2 = x$

$MN = 2.5x$

$= 2.5(2) = 5$

16. Total yards = pass + run

$= (24 - 9) + \frac{1}{2}(50 - 24) = 28$ yd

17. Step 1 Solve for x.

$DE = EF$

$2x + 4 = 3x - 1$

$-2x \quad -2x$

$4 = x - 1$

$+1 \quad +1$

$5 = x$

Step 2 Find DE, EF, and DF.

$DE = 2x + 4$

$= 2(5) + 4 = 14$

$EF = 3x - 1$

$= 3(5) - 1 = 14$

$DF = DE + EF$

$= 14 + 14 = 28$

18. $PQ = \frac{1}{2}PR$

$3y = \frac{1}{2}(42)$

$3y = 21$

$\frac{3y}{3} = \frac{21}{3}$

$y = 7$

$QR = \frac{1}{2}PR$

$= \frac{1}{2}(42) = 21$

19a. C is the mdpt. of $\overline{AE}$.

b. $EF = 2(AC) + 2$

$= 2(7) + 2 = 16$

$AB = 2(EF) - 16$

$= 2(16) - 16 = 16$

20. $GH = 9\frac{1}{3}$

16. $m\angle RSU = m\angle RST + m\angle TSU$
$83.5° = m\angle RST + 46.7°$
$m\angle RST = 36.8°$

17. **Step 1** Find x.
$m\angle RSP = m\angle PST$
$(3x - 2)° = (9x - 26)°$
$-2 = 6x - 26$
$24 = 6x$
$x = 4$

Step 2 Find $m\angle RST$.
$m\angle RST = 2m\angle RSP$
$= 2(3x - 2)$
$= 2\big(3(4) - 2\big)$
$= 20°$

18. **Step 1** Find y.
$m\angle PST = \frac{1}{2}m\angle RST$
$(y + 5)° = \frac{1}{2}\left(\frac{5}{2}y\right)°$
$y + 5 = \frac{5}{4}y$
$5 = \frac{1}{4}y$
$y = 20$

Step 2 Find $m\angle RSP$.
$m\angle RSP = m\angle PST$
$= y + 5$
$= 20 + 5$
$= 25°$

19. acute

20. rt.

21. acute

22. obtuse

23–26. Check students' drawings.

27. Let x be the measure of $\angle BSC$.
$m\angle ASB + m\angle BSC = m\angle ASC$
$3x + x = 90$
$4x = 90$
$\frac{4x}{4} = \frac{90}{4}$
$x = 22.5$
$m\angle ASB = 3x = 3(22.5) = 67.5°$
$m\angle BSC = x = 22.5°$

28. First construct the bisector of the given $\angle$. Then choose one of the smaller $\angle$s that was constructed and construct its bisector. The resulting $\angle$ will have $\frac{1}{4}$ the measure of the original $\angle$.

29. $m\angle AOC + m\angle DOC + m\angle EOD = 180°$
$7x - 2 + 2x + 8 + 27 = 180$
$9x + 33 = 180$
$9x = 147$
$x = \frac{147}{9} = 16\frac{1}{3}$

30. $m\angle AOB + m\angle BOC + m\angle COD + m\angle DOE = 180°$
$4x - 2 + 5x + 10 + 3x - 8 + 5x + 10 = 180$
$17x + 10 = 180$
$17x = 170$
$x = 10$

31. $m\angle AOB + m\angle BOC = m\angle AOC$
$6x + 5 + 4x - 2 = 8x + 21$
$10x + 3 = 8x + 21$
$2x + 3 = 21$
$2x = 18$
$x = 9$

32. Let $m\angle QRS = x$. Then $m\angle PRQ = 4x$.
Step 1 Find x.
$m\angle PRQ + m\angle QRS = m\angle PRS$
$4x + x = 90$
$5x = 90$
$x = 18$
$m\angle PRQ = 4\big(m\angle QRS\big) = 4(18) = 72°$

33a. $m\angle LOK = 57°$
$3x + 2x + 12 = 57$
$5x + 12 = 57$
$5x = 45$
$x = 9$

b. $\angle LOJ \cong \angle JOK$
$m\angle LOJ = m\angle JOK$
$3x = 2x + 12$
$x = 12$

c. Think: $m\angle LOJ = 3x° > 0°$; so $x > 0$.
$m\angle LOK < 90°$
$5x + 12 < 90$
$5x < 78$
$x < 15.6$
$0 < x < 15.6$

34. $m\angle AOB = (360) \cdot 0.25 = 90°$; rt.
$m\angle BOC = (360) \cdot 0.35 = 126°$; obtuse
$m\angle COD = (360) \cdot 0.10 = 36°$; acute
$m\angle DOA = (360) \cdot 0.30 = 108°$; obtuse

35. $m\angle COD = 2(36) = 72°$
$m\angle BOC = 126 - 36 = 90°$

36. $m\angle = \frac{360}{5} = 72°$

37. No; an obtuse $\angle$ measures greater than 90°, so it cannot be $\cong$ to an acute $\angle$ (less than 90°).

38. $5x + 45 < 180$
$5x < 135$
$x < 27$

39. $m\angle EFG = m\angle EFH + m\angle HFG = 2m\angle EFH$, so
$m\angle EFH = \frac{1}{2}m\angle EFG$

40. Check students' constructions. Each $\angle$ should measure 35°.

TEST PREP, PAGE 26

41. D
$m\angle VOY = m\angle VOW + m\angle WOX + m\angle XOY$
$= \frac{1}{2}m\angle UOW + m\angle WOX + m\angle XOY$
$= \frac{1}{2}(50) + 90 + 40$
$= 155°$

42. H
$m\angle UOX = m\angle UOW + m\angle WOX$
$= 50 + 90$
$= 140°$

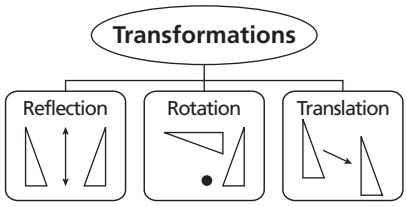
43. C
$m\angle ABC = m\angle ABD + m\angle DBC = 2m\angle ABD$
$4x + 5 = 2(3x - 1)$
$4x + 5 = 6x - 2$
$5 = 2x - 2$
$7 = 2x$
$x = 3.5$

44. J
$\frac{1}{2}m\angle + 30 = 90$
$\frac{1}{2}m\angle = 60$
$2\left(\frac{1}{2}m\angle\right) = 2(60)$
$m\angle = 120°$

45. The $\triangle$s are acute. An obtuse $\angle$ measures between 90° and 180°. Since $\frac{1}{2}$ of 180 is 90, the resulting $\triangle$ must measure less than 90°.

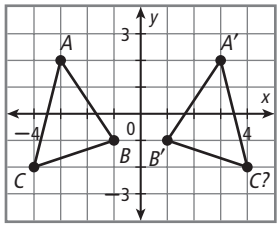
THINK AND DISCUSS, PAGE 52

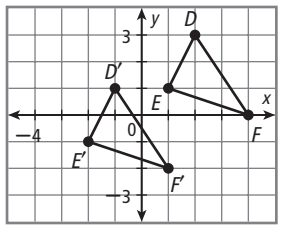
1. Possible answer: The preimage and image will be mirror images of each other.

2. 

EXERCISES, PAGES 53–55

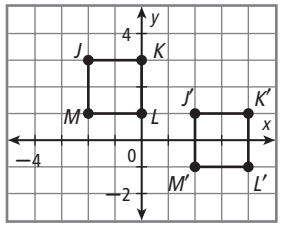
GUIDED PRACTICE, PAGE 53

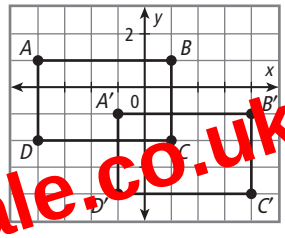
1. Preimage is $\triangle XYZ$; image is $\triangle X'Y'Z'$.
2. translation; reflection; rotation
3. transformation is a reflection; $\triangle ABC \rightarrow \triangle A'B'C'$
4. transformation is a translation; $PQRS \rightarrow P'Q'R'S'$
5. 

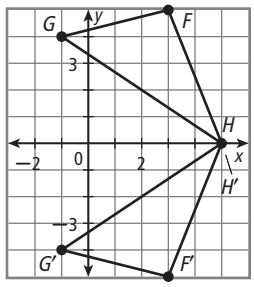
The transformation is a reflection across the *y*-axis because each pt. and its image are the same dist. from the *y*-axis.
6. **Step 1** State the coordinates of $\triangle DEF$.
The vertices of $\triangle DEF$ are $D(2, 3)$, $E(1, 1)$, and $F(4, 0)$.
Step 2 Apply the rule to find the vertices of the image.
$D'(2 - 3, 3 - 2) = D'(-1, 1)$
$E'(1 - 3, 1 - 2) = E'(-2, -1)$
$F'(4 - 3, 0 - 2) = F'(1, -2)$
Step 3 

7. **Step 1** Choose 2 pts.
Choose a pt. *A* on the preimage and a corr. pt. *A′* on the image. *A* has coords. (0, 0) and *A′* has coords. (4, 4).
Step 2 Translate.
To translate *A* to *A′*, 4 units are added to both the *x*-coord. and the *y*-coord. Therefore, the translation rule is $(x, y) \rightarrow (x + 4, y + 4)$.

PRACTICE AND PROBLEM SOLVING, PAGES 53–54

8. rotation: $DEFG \rightarrow D'E'F'G'$
9. reflection: $WXYZ \rightarrow W'X'Y'Z'$
10. 

translation; each pt. moves the same dist. right and the same dist. down.
11. **Step 1** Apply the rule to find the vertices of the image.
$A'(-4 + 3, 1 - 2) = A'(-1, -1)$
$B'(1 + 3, 1 - 2) = B'(4, -1)$
$C'(1 + 3, -2 - 2) = C'(4, -4)$
$D'(-4 + 3, -2 - 2) = D'(-1, -4)$
Step 2 

12. **Step 1** Choose 2 pts.
Choose a pt. *A* on the preimage and a corr. pt. *A′* on the image. *A* has coords. (−5, 1) and *A′* has coords. (6, −3).
Step 2 Translate.
To translate *A* to *A′*, 11 units are added to the *x*-coord. and 4 units are subtracted from the *y*-coord. Therefore, the translation rule is $(x, y) \rightarrow (x + 11, y - 4)$.
13. reflection
14. translation
15. reflection
16. Vertices of image are $F'(3, -5)$, $G'(-1, -4)$, and $H'(5, 0)$.


27. $P = a + b + c$
$= 8 + x - 5 + 12$
$= x + 15$

$A = \frac{1}{2}bh$
$= \frac{1}{2}(x - 5)(8)$
$= 4x - 20$

28. $P = 2\ell + 2w$
$= 2(5x + 7) + 2(20)$
$= 10x + 54$

$A = \ell w$
$= (5x + 7)(20)$
$= 100x + 140$

29. $C = 2\pi r$
$= 2\pi(21)$
$= 42\pi \approx 131.9$ m

$A = \pi r^2$
$= \pi(21)^2$
$= 441\pi$
≈ 1385.4 m^2

30. $r = \frac{14}{2} = 7$ ft

$C = 2\pi r$
$= 2\pi(7)$
$= 14\pi \approx 44.0$ ft

$A = \pi r^2$
$= \pi(7)^2$
$= 49\pi \approx 153.9$ ft^2

31. $A = \frac{1}{2}bh$
$102 = \frac{1}{2}(17)h$
$h = \frac{2}{17}(102) = 12$ m

LESSON 1-6, PAGE 63

32. $Y\left(\frac{3 + (-1)}{2}, \frac{2 + 4}{2}\right) = \left(\frac{2}{2}, \frac{6}{2}\right) = (1, 3)$

33. **Step 1** Let coords. of B equal (x, y).
Step 2 Use Mdpt. Formula.
$(-2, 3) = \left(\frac{5 + x}{2}, \frac{0 + y}{2}\right)$
Step 3 Find x-coord.
$-2 = \frac{5 + x}{2}$
$-4 = 5 + x$
$-9 = x$

Find y-coord.
$3 = \frac{0 + y}{2}$
$6 = 0 + y$
$6 = y$

The coordinates of B are $(-9, 6)$.

34. **Step 1** Let coords. of A equal (x, y).
Step 2 Use Mdpt. Formula.
$(-2, 3) = \left(\frac{x + (-4)}{2}, \frac{y + 4}{2}\right)$
Step 3 Find x-coord.
$-2 = \frac{x + (-4)}{2}$
$-4 = x - 4$
$0 = x$

Find y-coord.
$3 = \frac{y + 4}{2}$
$6 = y + 4$
$2 = y$

The coordinates of A are $(0, 2)$.

35. **Method 1** Use Dist. Formula. Subst. values for coords. of X and Y into Dist. Formula.
$XY = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
$= \sqrt{(6 - (-2))^2 + (1 - 4)^2}$
$= \sqrt{8^2 + (-3)^2}$
$= \sqrt{64 + 9} = \sqrt{73} \approx 8.5$

Method 2 Use Pyth. Thm. Count the units for the legs of the rt. $\triangle$ formed by X and Y.
$a = 8$ and $b = 3$
$c^2 = a^2 + b^2$
$= 8^2 + 3^2$
$= 64 + 9$
$= 73$
$c = \sqrt{73} \approx 8.5$

36. **Method 1** Use Dist. Formula. Subst. values for coords. of H and K into Dist. Formula.
$HK = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
$= \sqrt{(-2 - 0)^2 + (-4 - 3)^2}$
$= \sqrt{(-2)^2 + (-7)^2}$
$= \sqrt{4 + 49} = \sqrt{53} \approx 7.3$

Method 2 Use Pyth. Thm. Count the units for the legs of the rt. $\triangle$ formed by H and K.
$a = 2$ and $b = 7$
$c^2 = a^2 + b^2$
$= 2^2 + 7^2$
$= 4 + 49$
$= 53$
$c = \sqrt{53} \approx 7.3$

37. **Method 1** Use Dist. Formula. Subst. values for coords. of L and M into Dist. Formula.
$LM = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
$= \sqrt{(3 - (-4))^2 + (-2 - 2)^2}$
$= \sqrt{7^2 + (-4)^2}$
$= \sqrt{49 + 16} = \sqrt{65} \approx 8.1$

Method 2 Use Pyth. Thm. Count the units for the legs of the rt. $\triangle$ formed by L and M.
$a = 7$ and $b = 4$
$c^2 = a^2 + b^2$
$= 7^2 + 4^2$
$= 49 + 16$
$= 65$
$c = \sqrt{65} \approx 8.1$

LESSON 1-7, PAGE 63

38. 90° rotation; $DEFG \rightarrow D'E'F'G'$

39. translation; $PQRS \rightarrow P'Q'R'S'$

40. $X'(-5 + 4, -4 + 5) = X'(-1, 1)$
$Y'(-3 + 4, -1 + 5) = Y'(1, 4)$
$Z'(-2 + 4, -2 + 5) = Z'(2, 3)$