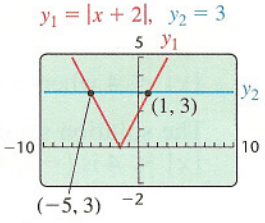
Match each equation or inequality with an equivalent statement from the column on the right. Letters may be used more than once or not at all.

9. $|x-3|=5$ (g)
10. $|x-3|<5$ (h)
11. $|x-3|>5$ (d)
12. $|x-3|<-5$ (a)
13. $|x-3|=-5$ (a)
14. $|x-3|>-5$ (b)

a) The solution set is $\varnothing$.
b) The solution set is $\mathbb{R}$.
c) $x-3>5$
d) $x-3<-5$ *or* $x-3>5$
e) $x-3=5$
f) $x-3<5$
g) $x-3=-5$ *or* $x-3=5$
h) $-5<x-3<5$

Use the following graph to solve Exercises 15–20.



15. $|x+2|=3$ $\{-5,1\}$
16. $|x+2|\le 3$ $[-5,1]$
17. $|x+2|<3$ $(-5,1)$
18. $|x+2|>3$ $(-\infty,-5)\cup(1,\infty)$
19. $|x+2|\ge 3$ $(-\infty,-5]\cup[1,\infty)$
20. $|x+2|=-1$ $\varnothing$

Solve.

21. $|x|=7$ $\{-7,7\}$
22. $|x|=9$ $\{-9,9\}$
23. $|x|=-6$ $\varnothing$ Aha!
24. $|x|=-3$ $\varnothing$
25. $|p|=0$ $\{0\}$
26. $|y|=7.3$ $\{-7.3,7.3\}$
27. $|2x-3|=4$ $\{-\frac{1}{2},\frac{7}{2}\}$
28. $|5x+2|=7$ $\{-\frac{9}{5},1\}$
29. $|3x-5|=-8$ $\varnothing$
30. $|7x-2|=-9$ $\varnothing$
31. $|x-2|=6$ $\{-4,8\}$
32. $|x-3|=8$ $\{-5,11\}$ Aha!
33. $|x-5|=3$ $\{2,8\}$
34. $|x-6|=1$ $\{5,7\}$
35. $|t|+1.1=6.6$ $\{-5.5,5.5\}$
36. $|m|+3=3$ $\{0\}$
37. $|5x|-3=37$ $\{-8,8\}$
38. $|2y|-5=13$ $\{-9,9\}$
39. $7|q|-2=9$ $\{-\frac{11}{7},\frac{11}{7}\}$
40. $7|z|+2=16$ $\{-2,2\}$
41. $\left|\frac{2x-1}{3}\right|=4$ $\{-\frac{11}{2},\frac{13}{2}\}$
42. $\left|\frac{4-5x}{6}\right|=3$ $\{-\frac{14}{5},\frac{22}{5}\}$ Aha!
43. $|5-m|+9=16$ $\{-2,12\}$
44. $|t-7|+1=4$ $\{4,10\}$
45. $5-2|3x-4|=-5$ ⊡
46. $3|2x-5|-7=-1$ ⊡

47. Let $f(x)=|2x+6|$. Find all x for which $f(x)=8$. $\{-7,1\}$
48. Let $f(x)=|2x+4|$. Find all x for which $f(x)=10$. $\{-7,3\}$
49. Let $f(x)=|x|-3$. Find all x for which $f(x)=5.7$. $\{-8.7,8.7\}$
50. Let $f(x)=|x|+7$. Find all x for which $f(x)=18$. $\{-11,11\}$
51. Let $f(x)=\left|\frac{3x-2}{5}\right|$. Find all x for which $f(x)=2$. $\{-\frac{8}{3},4\}$
52. Let $f(x)=\left|\frac{1-2x}{3}\right|$. Find all x for which $f(x)=1$. $\{-1,2\}$

Solve.

53. $|x+4|=|2x-7|$ $\{1,11\}$
54. $|3x+2|=|x-6|$ $\{-4,1\}$
55. $|x+4|=|x-3|$ $\{-\frac{1}{2}\}$
56. $|x-9|=|x+6|$ $\{\frac{3}{2}\}$
57. $|3a-1|=|2a+4|$ $\{-\frac{3}{5},5\}$
58. $|5t+7|=|4t+3|$ $\{-4,-\frac{10}{9}\}$
59. $|n-3|=|3-n|$ $\mathbb{R}$ Aha!
60. $|y-2|=|2-y|$ $\mathbb{R}$
61. $|7-4a|=|4a+5|$ $\{\frac{1}{4}\}$
62. $|6-5t|=|5t+8|$ $\{-\frac{1}{5}\}$

Solve and graph.

63. $|a|\le 9$ ⊡
64. $|x|<2$ ⊡
65. $|t|>0$ ⊡
66. $|t|\ge 1$ ⊡
67. $|x-1|<4$ ⊡
68. $|x-1|<3$ ⊡
69. $|x+2|\le 6$ ⊡
70. $|x+4|\le 1$ ⊡
71. $|x-3|+2>7$ ⊡
72. $|x-4|+5>2$ ⊡
73. $|2y-9|>-5$ ⊡
74. $|3y-4|>8$ ⊡
75. $|3a-4|+2\ge 8$ ⊡
76. $|2a-5|+1\ge 9$ ⊡
77. $|y-3|<12$ ⊡
78. $|p-2|<3$ ⊡
79. $9-|x+4|\le 5$ ⊡
80. $12-|x-5|\le 9$ ⊡
81. $6+|3-2x|>10$ ⊡
82. $7+|4a-5|\le 26$ ⊡
83. $|5-4x|<-6$ $\varnothing$
84. $|7-2y|<-6$ $\varnothing$
85. $\left|\frac{2-5x}{4}\right|\ge\frac{2}{3}$ ⊡
86. $\left|\frac{1+3x}{5}\right|>\frac{7}{8}$ ⊡
87. $|m+3|+8\le 14$ ⊡
88. $|t-7|+3\ge 4$ ⊡
89. $25-2|a+3|>19$ ⊡
90. $30-4|a+2|>12$ ⊡

⊡ Answers to Exercises 45, 46, 63–82, and 85–90 are on pp. IA-9 and IA-10.

91. Let $f(x) = |2x - 3|$. Find all x for which $f(x) \le 4$. ⊡

92. Let $f(x) = |5x + 2|$. Find all x for which $f(x) \le 3$. ⊡

93. Let $f(x) = 5 + |3x - 4|$. Find all x for which $f(x) \ge 16$. ⊡

94. Let $f(x) = |2 - 9x|$. Find all x for which $f(x) \ge 25$. ⊡

95. Let $f(x) = 7 + |2x - 1|$. Find all x for which $f(x) < 16$. ⊡

96. Let $f(x) = 5 + |3x + 2|$. Find all x for which $f(x) < 19$. ⊡

TW **97.** Explain in your own words why -7 is not a solution of $|x| < 5$.

TW **98.** Explain in your own words why $[6, \infty)$ is only part of the solution of $|x| \ge 6$.

SKILL REVIEW

To prepare for Section 4.5, review graphing equations and solving systems of equations (Sections 2.2, 2.3, and 3.2).

Graph.

99. $3x - y = 6$ [2.3] ⊡

100. $y = \frac{1}{2}x - 1$ [2.2] ⊡

101. $x = -2$ [2.3] ⊡

102. $y = 4$ [2.3] ⊡

Solve using substitution or elimination. [3.2]

103. $x - 3y = 8$, $2x + 3y = 4$ $\left(4, -\frac{4}{3}\right)$

104. $x - 2y = 3$, $x = y + 4$ $(5, 1)$

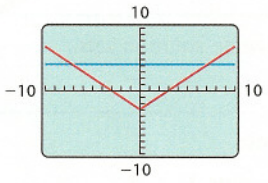
105. $y = 1 - 5x$, $2x - y = 4$ $\left(\frac{5}{7}, -\frac{18}{7}\right)$

106. $3x - 2y = 4$, $5x - 3y = 5$ $(-2, -5)$

SYNTHESIS

TW **107.** Explain why the inequality $|x + 5| \ge 2$ can be interpreted as "the number x is at least 2 units from -5."

TW **108.** Isabel is using the following graph to solve $|x - 3| < 4$. How can you tell that a mistake has been made?



109. From the definition of absolute value, $|x| = x$ only when $x \ge 0$. Solve $|3t - 5| = 3t - 5$ using this same reasoning. $\left\{t \mid t \ge \frac{5}{3}\right\}$, or $\left[\frac{5}{3}, \infty\right)$

Solve.

110. $|3x - 5| = x$ $\left\{\frac{5}{4}, \frac{5}{2}\right\}$

111. $|x + 2| > x$ $\mathbb{R}$, or $(-\infty, \infty)$

112. $2 \le |x - 1| \le 5$ $\{x \mid -4 \le x \le -1 \text{ or } 3 \le x \le 6\}$, or $[-4, -1] \cup [3, 6]$

113. $|5t - 3| = 2t + 4$ $\left\{-\frac{1}{7}, \frac{7}{3}\right\}$

114. $t - 2 \le |t - 3|$ $\left\{t \mid t \le \frac{5}{2}\right\}$, or $\left(-\infty, \frac{5}{2}\right]$

Find an equivalent inequality with absolute value.

115. $-3 < x < 3$ $|x| < 3$

116. $x \le -6$ *or* $6 \le x$ $|x| \ge 6$

117. $x < -8$ *or* $2 < x$ $|x + 3| > 5$

118. $-5 < x < 1$ $|x + 2| < 3$

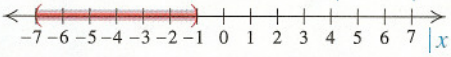
119. x is less than 2 units from 7. $|x - 7| < 2$, or $|7 - x| < 2$

120. x is less than 1 unit from 5. $|x - 5| < 1$, or $|5 - x| < 1$

Write an absolute-value inequality for which the interval shown is the solution.

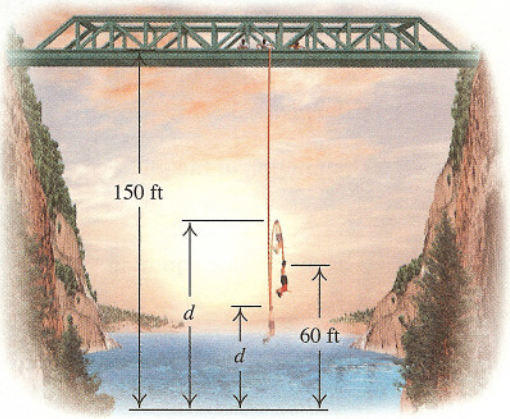
121.  $|x - 3| \le 4$

122.  $|x - 2| < 6$

123.  $|x + 4| < 3$

124.  $|x - 7| \le 5$

125. *Bungee Jumping.* A bungee jumper is bouncing up and down so that her distance d above a river satisfies the inequality $|d - 60 \text{ ft}| \le 10 \text{ ft}$ (see the figure below). If the bridge from which she jumped is 150 ft above the river, how far is the bungee jumper from the bridge at any given time?
Between 80 ft and 100 ft



⊡ Answers to Exercises 91–96 and 99–102 are on p. IA-10.