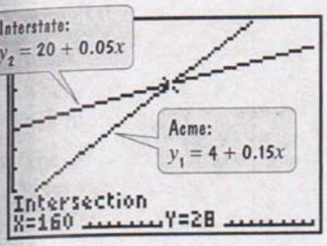
Technology

Graphic Connections

The graphs of the daily cost models for the car rental agencies

$$y_1 = 4 + 0.15x$$
$$\text{and } y_2 = 20 + 0.05x$$

are shown in a $[0, 300, 10]$ by $[0, 40, 4]$ viewing rectangle. The graphs intersect at $(160, 28)$.



To the left of $x = 160$, the graph of Acme's daily cost lies below that of Interstate's daily cost. This shows that for fewer than 160 miles per day, Acme offers the better deal.

Step 4 Solve the inequality and answer the question.

$4 + 0.15x < 20 + 0.05x$	This is the inequality that models the verbal conditions.
$4 + 0.15x - 0.05x < 20 + 0.05x - 0.05x$	Subtract 0.05x from both sides.
$4 + 0.1x < 20$	Simplify.
$4 + 0.1x - 4 < 20 - 4$	Subtract 4 from both sides.
$0.1x < 16$	Simplify.
$\dfrac{0.1x}{0.1} < \dfrac{16}{0.1}$	Divide both sides by 0.1.
$x < 160$	Simplify.

Thus, driving fewer than 160 miles per day makes Acme the better deal.

Step 5 Check the proposed solution in the original wording of the problem. One way to do this is to take a mileage less than 160 miles per day to see if Acme is the better deal. Suppose that 150 miles are driven in a day.

$$\text{Cost for Acme} = 4 + 0.15(150) = 26.50$$

$$\text{Cost for Interstate} = 20 + 0.05(150) = 27.50$$

Acme has a lower daily cost, making Acme the better deal.

Check Point 11 A car can be rented from Basic Rental for \$260 per week with no extra charge for mileage. Continental charges \$80 per week plus 25 cents for each mile driven to rent the same car. How many miles must be driven in a week to make the rental cost for Basic Rental a better deal than Continental's?

Exercise Set 1.7

Practice Exercises

In Exercises 1–14, express each interval in set-builder notation and graph the interval on a number line.

1. $(1, 6]$ **2.** $(-2, 4]$
3. $[-5, 2)$ **4.** $[-4, 3)$
5. $[-3, 1]$ **6.** $[-2, 5]$
7. $(2, \infty)$ **8.** $(3, \infty)$
9. $[-3, \infty)$ **10.** $[-5, \infty)$
11. $(-\infty, 3)$ **12.** $(-\infty, 2)$
13. $(-\infty, 5.5)$ **14.** $(-\infty, 3.5]$

In Exercises 15–26, use graphs to find each set.

15. $(-3, 0) \cap [-1, 2]$ **16.** $(-4, 0) \cap [-2, 1]$
17. $(-3, 0) \cup [-1, 2]$ **18.** $(-4, 0) \cup [-2, 1]$
19. $(-\infty, 5) \cap [1, 8)$ **20.** $(-\infty, 6) \cap [2, 9)$
21. $(-\infty, 5) \cup [1, 8)$ **22.** $(-\infty, 6) \cup [2, 9)$
23. $[3, \infty) \cap (6, \infty)$ **24.** $[2, \infty) \cap (4, \infty)$
25. $[3, \infty) \cup (6, \infty)$ **26.** $[2, \infty) \cup (4, \infty)$

In all exercises, other than ∅, use interval notation to express solution sets and graph each solution set on a number line.

In Exercises 27–50, solve each linear inequality.

27. $5x + 11 < 26$ **28.** $2x + 5 < 17$
29. $3x - 7 \ge 13$ **30.** $8x - 2 \ge 14$
31. $-9x \ge 36$ **32.** $-5x \le 30$
33. $8x - 11 \le 3x - 13$ **34.** $18x + 45 \le 12x - 8$
35. $4(x + 1) + 2 \ge 3x + 6$
36. $8x + 3 > 3(2x + 1) + x + 5$
37. $2x - 11 < -3(x + 2)$ **38.** $-4(x + 2) > 3x + 20$
39. $1 - (x + 3) \ge 4 - 2x$ **40.** $5(3 - x) \le 3x - 1$
41. $\dfrac{x}{4} - \dfrac{3}{2} \le \dfrac{x}{2} + 1$ **42.** $\dfrac{3x}{10} + 1 \ge \dfrac{1}{5} - \dfrac{x}{10}$
43. $1 - \dfrac{x}{2} > 4$ **44.** $7 - \dfrac{4}{5}x < \dfrac{3}{5}$
45. $\dfrac{x-4}{6} \ge \dfrac{x-2}{9} + \dfrac{5}{18}$ **46.** $\dfrac{4x-3}{6} + 2 \ge \dfrac{2x-1}{12}$
47. $4(3x - 2) - 3x < 3(1 + 3x) - 7$
48. $3(x - 8) - 2(10 - x) > 5(x - 1)$
49. $5(x - 2) - 3(x + 4) \ge 2x - 20$
50. $6(x - 1) - (4 - x) \ge 7x - 8$

In Exercises 51–58, solve each compound inequality.

51. $6 < x + 3 < 8$ **52.** $7 < x + 5 < 11$
53. $-3 \le x - 2 < 1$ **54.** $-6 < x - 4 \le 1$
55. $-11 < 2x - 1 \le -5$ **56.** $3 \le 4x - 3 < 19$
57. $-3 \le \dfrac{2}{3}x - 5 < -1$ **58.** $-6 \le \dfrac{1}{2}x - 4 < -3$

In Exercises 59–94, solve each absolute value inequality.

59. $|x| < 3$ **60.** $|x| < 5$

61. $|x - 1| \le 2$

62. $|x + 3| \le 4$

63. $|2x - 6| < 8$

64. $|3x + 5| < 17$

65. $|2(x - 1) + 4| \le 8$

66. $|3(x - 1) + 2| \le 20$

67. $\left|\frac{2x + 6}{3}\right| < 2$

68. $\left|\frac{3(x - 1)}{4}\right| < 6$

69. $|x| > 3$

70. $|x| > 5$

71. $|x - 1| \ge 2$

72. $|x + 3| \ge 4$

73. $|3x - 8| > 7$

74. $|5x - 2| > 13$

75. $\left|\frac{2x + 2}{4}\right| \ge 2$

76. $\left|\frac{3x - 3}{9}\right| \ge 1$

77. $\left|3 - \frac{2}{3}x\right| > 5$

78. $\left|3 - \frac{3}{4}x\right| > 9$

79. $3|x - 1| + 2 \ge 8$

80. $5|2x + 1| - 3 \ge 9$

81. $-2|x - 4| \ge -4$

82. $-3|x + 7| \ge -27$

83. $-4|1 - x| < -16$

84. $-2|5 - x| < -6$

85. $3 \le |2x - 1|$

86. $9 \le |4x + 7|$

87. $5 > |4 - x|$

88. $2 > |11 - x|$

89. $1 < |2 - 3x|$

90. $4 < |2 - x|$

91. $12 < \left|-2x + \frac{6}{7}\right| + \frac{3}{7}$

92. $1 < \left|x - \frac{11}{3}\right| + \frac{7}{3}$

93. $4 + \left|3 - \frac{x}{3}\right| \ge 9$

94. $\left|2 - \frac{x}{2}\right| - 1 \le 1$

In Exercises 95–102, use interval notation to represent all values of x satisfying the given conditions.

95. $y_1 = \frac{x}{2} + 3$, $y_2 = \frac{x}{3} + \frac{5}{2}$, and $y_1 \le y_2$.

96. $y_1 = \frac{2}{3}(6x - 9) + 4$, $y_2 = 5x + 1$, and $y_1 > y_2$.

97. $y = 1 - (x + 3) + 2x$ and y is at least 4.

98. $y = 2x - 11 + 3(x + 2)$ and y is at most 0.

99. $y = |3x - 4| + 2$ and $y < 8$.

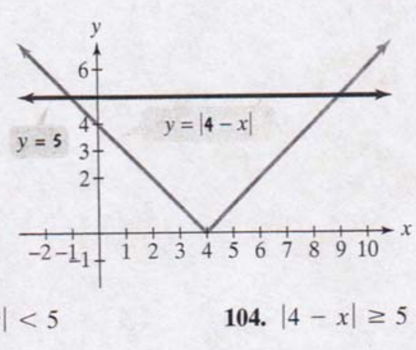
100. $y = |2x - 5| + 1$ and $y > 9$.

101. $y = 7 - \left|\frac{x}{2} + 2\right|$ and y is at most 4.

102. $y = 8 - |5x + 3|$ and y is at least 6.

Practice Plus

In Exercises 103–104, use the graph of $y = |4 - x|$ to solve each inequality.



103. $|4 - x| < 5$

104. $|4 - x| \ge 5$

In Exercises 105–106, use the table to solve each inequality.

105. $-2 \le 5x + 3 < 13$

$y_1 = 5x + 3$

X	Y1
-3	-12
-2	-7
-1	-2
0	3
1	8
2	13
3	18

X=-3

106. $-3 < 2x - 5 \le 3$

$y_1 = 2x - 5$

X	Y1
-1	-7
0	-5
1	-3
2	-1
3	1
4	3
5	5

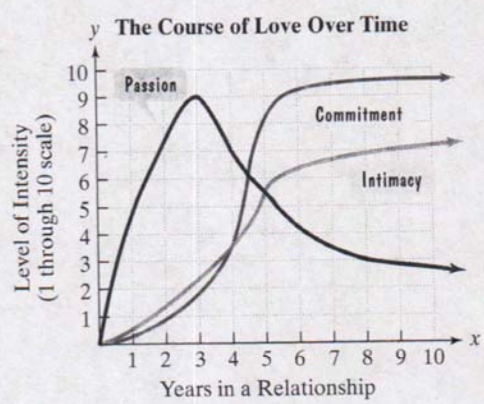
X=-1

107. When 3 times a number is subtracted from 4, the absolute value of the difference is at least 5. Use interval notation to express the set of all numbers that satisfy this condition.

108. When 4 times a number is subtracted from 5, the absolute value of the difference is at most 13. Use interval notation to express the set of all numbers that satisfy this condition.

Application Exercises

The graphs show that the three components of love, namely passion, intimacy, and commitment, progress differently over time. Passion peaks early in a relationship and then declines. By contrast, intimacy and commitment build gradually. Use the graphs to solve Exercises 109–116.



Source: R. J. Sternberg. A Triangular Theory of Love, *Psychological Review*, 93, 119–135.

109. Use interval notation to write an inequality that expresses for which years in a relationship intimacy is greater than commitment.

110. Use interval notation to write an inequality that expresses for which years in a relationship passion is greater than or equal to intimacy.

111. What is the relationship between passion and intimacy on the interval [5, 7)?

112. What is the relationship between intimacy and commitment on the interval [4, 7)?