17. $2x + 1 < 5x - 8$

18. $1 + 5x > 5 - 3x$

19. $-1 < 2x - 5 < 7$

20. $1 < 3x + 4 \leq 16$

21. $0 \leq 1 - x < 1$

22. $-5 \leq 3 - 2x \leq 9$

23. $4x < 2x + 1 \leq 3x + 2$

24. $2x - 3 < x + 4 < 3x - 2$

25. $1 - x \geq 3 - 2x \geq x - 6$

26. $x > 1 - x \geq 3 + 2x$

27. $(x - 1)(x - 2) > 0$

28. $(2x + 3)(x - 1) \geq 0$

29. $2x^2 + x \leq 1$

30. $x^2 < 2x + 8$

31. $x^2 + x + 1 > 0$

32. $x^2 + x > 1$

33. $x^2 < 3$

34. $x^2 \geq 5$

35. $x^3 - x^2 \leq 0$

36. $(x + 1)(x - 2)(x + 3) \geq 0$

37. $x^3 > x$

38. $x^3 + 3x < 4x^2$

39. $\dfrac{1}{x} < 4$

40. $-3 < \dfrac{1}{x} \leq 1$

41. $\dfrac{4}{x} < x$

42. $\dfrac{x}{x + 1} > 3$

43. $\dfrac{2x + 1}{x - 5} < 3$

44. $\dfrac{2 + x}{3 - x} \leq 1$

45. $\dfrac{x^2 - 1}{x^2 + 1} \geq 0$

46. $\dfrac{x^2 - 2x}{x^2 - 2} > 0$

47. The relationship between the Celsius and Fahrenheit temperature scales is given by $C = \frac{5}{9}(F - 32)$, where C is the temperature in degrees Celsius and F is the temperature in degrees Fahrenheit. What interval on the Celsius scale corresponds to the temperature range $50 \leq F \leq 95$?

48. Use the relationship between C and F given in Exercise 47 to find the interval on the Fahrenheit scale corresponding to the temperature range $20 \leq C \leq 30$.

49. As dry air moves upward, it expands and in so doing cools at a rate of about 1°C for each 100-m rise, up to about 12 km.

(a) If the ground temperature is 20°C, write a formula for the temperature at height h.

(b) What range of temperature can be expected if a plane takes off and reaches a maximum height of 5 km?

50. If a ball is thrown upward from the top of a building 128 ft high with an initial velocity of 16 ft/s, then the height h above the ground t seconds later will be

$$h = 128 + 16t - 16t^2$$

During what time interval will the ball be at least 32 ft above the ground?

51–54 ■ Solve the equation for x.

51. $|2x| = 3$

52. $|3x + 5| = 1$

53. $|x + 3| = |2x + 1|$

54. $\left|\dfrac{2x - 1}{x + 1}\right| = 3$

55–68 ■ Solve the inequality.

55. $|x| < 3$

56. $|x| \geq 3$

57. $|x - 4| < 1$

58. $|x - 6| < 0.1$

59. $|x + 5| \geq 2$

60. $|x + 1| \geq 3$

61. $|2x - 3| \leq 0.4$

62. $|5x - 2| < 6$

63. $1 \leq |x| \leq 4$

64. $0 < |x - 5| < \frac{1}{2}$

65. $|x| > |x - 1|$

66. $|2x - 5| \leq |x + 4|$

67. $\left|\dfrac{x}{2 + x}\right| < 1$

68. $\left|\dfrac{2 - 3x}{1 + 2x}\right| \leq 4$

69–70 ■ Solve for x, assuming a, b, and c are positive constants.

69. $a(bx - c) \geq bc$

70. $a \leq bx + c < 2a$

71–72 ■ Solve for x, assuming a, b, and c are negative constants.

71. $ax + b < c$

72. $\dfrac{ax + b}{c} \leq b$

73. Suppose that $|x - 2| < 0.01$ and $|y - 3| < 0.04$. Use the Triangle Inequality to show that $|(x + y) - 5| < 0.05$.

74. Show that if $|x + 3| < \frac{1}{2}$, then $|4x + 13| < 3$.

75. Show that if $a < b$, then $a < \dfrac{a + b}{2} < b$.

76. Use Rule 3 to prove Rule 5 of (2).

77. Prove that $|ab| = |a||b|$. [*Hint:* Use Equation 4.]

78. Prove that $\left|\dfrac{a}{b}\right| = \dfrac{|a|}{|b|}$.

79. Show that if $0 < a < b$, then $a^2 < b^2$.

80. Prove that $|x - y| \geq |x| - |y|$. [*Hint:* Use the Triangle Inequality with $a = x - y$ and $b = y$.]

81. Show that the sum, difference, and product of rational numbers are rational numbers.

82. (a) Is the sum of two irrational numbers always an irrational number?

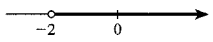
(b) Is the product of two irrational numbers always an irrational number?

Exercises A ■ page A9

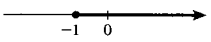
1. 18 **3.** π **5.** $5 - \sqrt{5}$ **7.** $2 - x$

9. $|x + 1| = \begin{cases} x + 1 & \text{for } x \geqslant -1 \\ -x - 1 & \text{for } x < -1 \end{cases}$ **11.** $x^2 + 1$

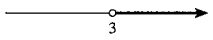
13. $(-2, \infty)$



15. $[-1, \infty)$

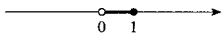


17. $(3, \infty)$

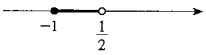


19. $(2, 6)$

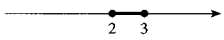
21. $(0, 1]$



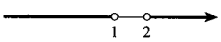
23. $[-1, \frac{1}{2})$



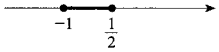
25. $[2, 3]$



27. $(-\infty, 1) \cup (2, \infty)$

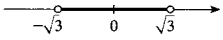


29. $[-1, \frac{1}{2}]$

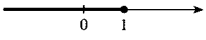


31. $(-\infty, \infty)$

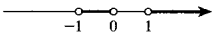
33. $(-\sqrt{3}, \sqrt{3})$



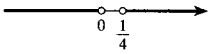
35. $(-\infty, 1]$



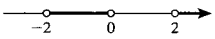
37. $(-1, 0) \cup (1, \infty)$



39. $(-\infty, 0) \cup (\frac{1}{4}, \infty)$

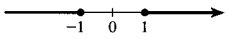


41. $(-2, 0) \cup (2, \infty)$



43. $(-\infty, 5) \cup (16, \infty)$

45. $(-\infty, -1] \cup [1, \infty)$



47. $10 \leqslant C \leqslant 35$ **49.** (a) $T = 20 - 10h$, $0 \leqslant h \leqslant 12$
(b) $-30\,^\circ\text{C} \leqslant T \leqslant 20\,^\circ\text{C}$ **51.** $\pm\frac{3}{2}$ **53.** $2, -\frac{4}{3}$
55. $(-3, 3)$ **57.** $(3, 5)$ **59.** $(-\infty, -7] \cup [-3, \infty)$
61. $[1.3, 1.7]$ **63.** $[-4, -1] \cup [1, 4]$ **65.** $(\frac{1}{2}, \infty)$
67. $(-1, \infty)$ **69.** $x \geqslant (a + b)c/(ab)$ **71.** $x > (c - b)/a$