Technology

Graphic Connections

The graphs of

$$y_1 = -16x^2 + 96x + 190$$

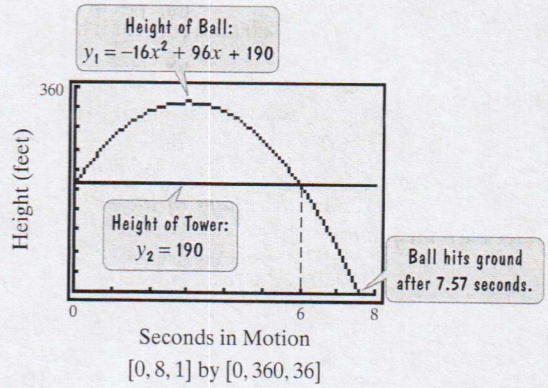
and

$$y_2 = 190$$

are shown in a

$$[0, 8, 1] \text{ by } [0, 360, 36]$$

seconds in motion — height, in feet



viewing rectangle. The graphs show that the ball's height exceeds that of the tower between 0 and 6 seconds.

Check Point 4 An object is propelled straight up from ground level with an initial velocity of 80 feet per second. Its height at time t is modeled by

$$s(t) = -16t^2 + 80t,$$

where the height, $s(t)$, is measured in feet and the time, t, is measured in seconds. In which time interval will the object be more than 64 feet above the ground?

Exercise Set 3.6

Practice Exercises

Solve each polynomial inequality in Exercises 1–42 and graph the solution set on a real number line. Express each solution set in interval notation.

1. $(x-4)(x+2) > 0$
2. $(x+3)(x-5) > 0$
3. $(x-7)(x+3) \le 0$
4. $(x+1)(x-7) \le 0$
5. $x^2 - 5x + 4 > 0$
6. $x^2 - 4x + 3 < 0$
7. $x^2 + 5x + 4 > 0$
8. $x^2 + x - 6 > 0$
9. $x^2 - 6x + 9 < 0$
10. $x^2 - 2x + 1 > 0$
11. $3x^2 + 10x - 8 \le 0$
12. $9x^2 + 3x - 2 \ge 0$
13. $2x^2 + x < 15$
14. $6x^2 + x > 1$
15. $4x^2 + 7x < -3$
16. $3x^2 + 16x < -5$
17. $5x \le 2 - 3x^2$
18. $4x^2 + 1 \ge 4x$
19. $x^2 - 4x \ge 0$
20. $x^2 + 2x < 0$
21. $2x^2 + 3x > 0$
22. $3x^2 - 5x \le 0$
23. $-x^2 + x \ge 0$
24. $-x^2 + 2x \ge 0$
25. $x^2 \le 4x - 2$
26. $x^2 \le 2x + 2$
27. $9x^2 - 6x + 1 < 0$
28. $4x^2 - 4x + 1 \ge 0$
29. $(x-1)(x-2)(x-3) \ge 0$
30. $(x+1)(x+2)(x+3) \ge 0$
31. $x(3-x)(x-5) \le 0$
32. $x(4-x)(x-6) \le 0$
33. $(2-x)^2\left(x - \frac{7}{2}\right) < 0$
34. $(5-x)^2\left(x - \frac{13}{2}\right) < 0$
35. $x^3 + 2x^2 - x - 2 \ge 0$
36. $x^3 + 2x^2 - 4x - 8 \ge 0$
37. $x^3 - 3x^2 - 9x + 27 < 0$
38. $x^3 + 7x^2 - x - 7 < 0$
39. $x^3 + x^2 + 4x + 4 > 0$
40. $x^3 - x^2 + 9x - 9 > 0$
41. $x^3 \ge 9x^2$
42. $x^3 \le 4x^2$

Solve each rational inequality in Exercises 43–60 and graph the solution set on a real number line. Express each solution set in interval notation.

43. $\frac{x-4}{x+3} > 0$
44. $\frac{x+5}{x-2} > 0$
45. $\frac{x+3}{x+4} < 0$
46. $\frac{x+5}{x+2} < 0$
47. $\frac{-x+2}{x-4} \ge 0$
48. $\frac{-x-3}{x+2} \le 0$
49. $\frac{4-2x}{3x+4} \le 0$
50. $\frac{3x+5}{6-2x} \ge 0$
51. $\frac{x}{x-3} > 0$
52. $\frac{x+4}{x} > 0$
53. $\frac{(x+4)(x-1)}{x+2} \le 0$
54. $\frac{(x+3)(x-2)}{x+1} \le 0$
55. $\frac{x+1}{x+3} < 2$
56. $\frac{x}{x-1} > 2$
57. $\frac{x+4}{2x-1} \le 3$
58. $\frac{1}{x-3} < 1$
59. $\frac{x-2}{x+2} \le 2$
60. $\frac{x}{x+2} \ge 2$

Practice Plus

In Exercises 61–64, find the domain of each function.

61. $f(x) = \sqrt{2x^2 - 5x + 2}$
62. $f(x) = \frac{1}{\sqrt{4x^2 - 9x + 2}}$
63. $f(x) = \sqrt{\frac{2x}{x+1} - 1}$
64. $f(x) = \sqrt{\frac{x}{2x-1} - 1}$

Solve each inequality in Exercises 65–70 and graph the solution set on a real number line.

65. $|x^2 + 2x - 36| > 12$

66. $|x^2 + 6x + 1| > 8$

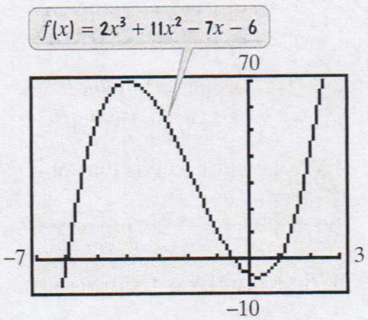
67. $\dfrac{3}{x + 3} > \dfrac{3}{x - 2}$

68. $\dfrac{1}{x + 1} > \dfrac{2}{x - 1}$

69. $\dfrac{x^2 - x - 2}{x^2 - 4x + 3} > 0$

70. $\dfrac{x^2 - 3x + 2}{x^2 - 2x - 3} > 0$

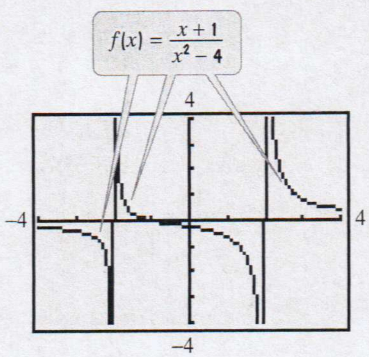
In Exercises 71–72, use the graph of the polynomial function to solve each inequality.



71. $2x^3 + 11x^2 \geq 7x + 6$

72. $2x^3 + 11x^2 < 7x + 6$

In Exercises 73–74, use the graph of the rational function to solve each inequality.



73. $\dfrac{1}{4(x + 2)} \leq -\dfrac{3}{4(x - 2)}$

74. $\dfrac{1}{4(x + 2)} > -\dfrac{3}{4(x - 2)}$

Application Exercises

Use the position function

$$s(t) = -16t^2 + v_0 t + s_0$$

(v_0 = initial velocity, s_0 = initial position, t = time)

to answer Exercises 75–76.

75. Divers in Acapulco, Mexico, dive headfirst at 8 feet per second from the top of a cliff 87 feet above the Pacific Ocean. During which time period will the diver's height exceed that of the cliff?

76. You throw a ball straight up from a rooftop 160 feet high with an initial velocity of 48 feet per second. During which time period will the ball's height exceed that of the rooftop?

The functions

$$f(x) = 0.0875x^2 - 0.4x + 66.6$$

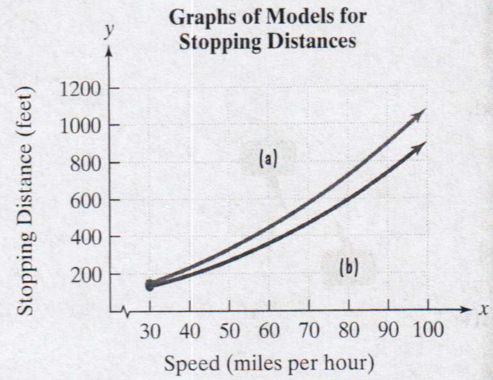
Dry pavement

and

Wet pavement

$$g(x) = 0.0875x^2 + 1.9x + 11.6$$

model a car's stopping distance, $f(x)$ or $g(x)$, in feet, traveling at x miles per hour. Function f models stopping distance on dry pavement and function g models stopping distance on wet pavement. The graphs of these functions are shown for $\{x | x \geq 30\}$. Notice that the figure does not specify which graph is the model for dry roads and which is the model for wet roads. Use this information to solve Exercises 77–78.



77. a. Use the given functions to find the stopping distance on dry pavement and the stopping distance on wet pavement for a car traveling at 35 miles per hour. Round to the nearest foot.

b. Based on your answers to part (a), which rectangular coordinate graph shows stopping distances on dry pavement and which shows stopping distances on wet pavement?

c. How well do your answers to part (a) model the actual stopping distances shown in **Figure 3.41** on page 384?

d. Determine speeds on dry pavement requiring stopping distances that exceed the length of one and one-half football fields, or 540 feet. Round to the nearest mile per hour. How is this shown on the appropriate graph of the models?

78. a. Use the given functions to find the stopping distance on dry pavement and the stopping distance on wet pavement for a car traveling at 55 miles per hour. Round to the nearest foot.

b. Based on your answers to part (a), which rectangular coordinate graph shows stopping distances on dry pavement and which shows stopping distances on wet pavement?

c. How well do your answers to part (a) model the actual stopping distances shown in **Figure 3.41** on page 384?

d. Determine speeds on wet pavement requiring stopping distances that exceed the length of one and one-half football fields, or 540 feet. Round to the nearest mile per hour. How is this shown on the appropriate graph of the models?

79. The perimeter of a rectangle is 50 feet. Describe the possible lengths of a side if the area of the rectangle is not to exceed 114 square feet.

80. The perimeter of a rectangle is 180 feet. Describe the possible lengths of a side if the area of the rectangle is not to exceed 800 square feet.

Writing in Mathematics

81. What is a polynomial inequality?

82. What is a rational inequality?

83. If f is a polynomial or rational function, explain how the graph of f can be used to visualize the solution set of the inequality $f(x) < 0$.