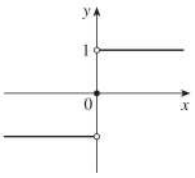
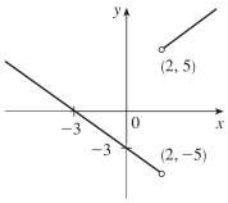
EXERCISES 2.3 ■ PAGE 102

1. (a) -6 (b) -8 (c) 2 (d) -6
(e) Does not exist (f) 0
3. 75 **5.** 88 **7.** 5 **9.** $-\frac{1}{27}$ **11.** -13
13. 6 **15.** Does not exist **17.** $\frac{5}{7}$ **19.** $\frac{9}{2}$
21. -6 **23.** $\frac{1}{6}$ **25.** $-\frac{1}{9}$ **27.** 1 **29.** $\frac{1}{128}$
31. $-\frac{1}{2}$ **33.** $3x^2$ **35.** (a), (b) $\frac{2}{3}$ **39.** 7 **43.** 8
45. -4 **47.** Does not exist
49. (a)



(b) (i) 1
(ii) -1
(iii) Does not exist
(iv) 1

51. (a) (i) 5 (ii) -5 (b) Does not exist
(c)



53. 7
55. (a) (i) -2 (ii) Does not exist (iii) -3
(b) (i) $n-1$ (ii) n (c) a is not an integer.
61. 8 **67.** 15; -1

EXERCISES 2.4 ■ PAGE 113

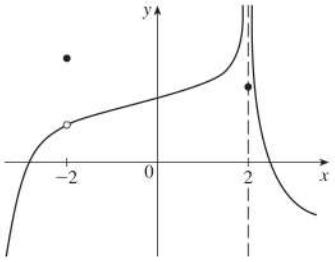
1. 0.1 (or any smaller positive number)
3. 1.44 (or any smaller positive number)
5. 0.4269 (or any smaller positive number)
7. 0.0219 (or any smaller positive number);
0.011 (or any smaller positive number)
9. (a) 0.01 (or any smaller positive number)
(b) $\lim_{x\to 2^+} \dfrac{1}{\ln(x-1)} = \infty$

11. (a) $\sqrt{1000/\pi}$ cm (b) Within approximately 0.0445 cm
(c) Radius; area; $\sqrt{1000/\pi}$; 1000; 5; ≈ 0.0445
13. (a) 0.025 (b) 0.0025
35. (a) 0.093 (b) $d = (B^{2/3} - 12)/(6B^{1/3}) - 1$, where
$B = 216 + 108\varepsilon + 12\sqrt{336 + 324\varepsilon + 81\varepsilon^2}$
41. Within 0.1

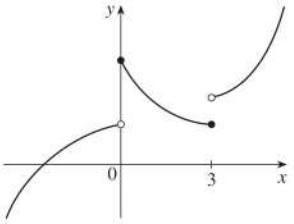
EXERCISES 2.5 ■ PAGE 124

1. $\lim_{x\to 4} f(x) = f(4)$
3. (a) $-4, -2, 2, 4$; $f(-4)$ is not defined and $\lim_{x\to a} f(x)$ does not exist for $a = -2$, 2, and 4
(b) -4, neither; -2, left; 2, right; 4, right
5. (a) 1 (b) 1, 3 (c) 3

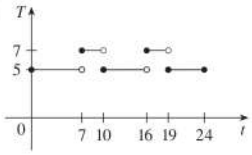
7.



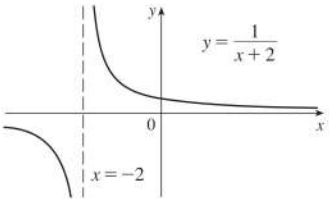
9.



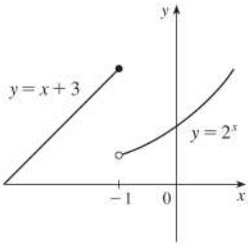
11. (a)



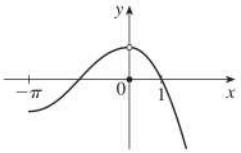
19. $f(-2)$ is undefined.



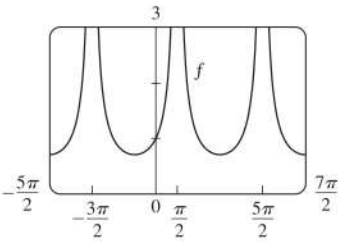
21. $\lim_{x\to -1} f(x)$ does not exist.



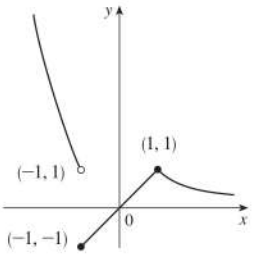
23. $\lim_{x\to 0} f(x) \neq f(0)$



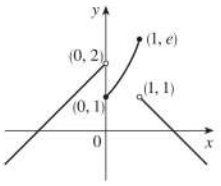
25. (b) Define $f(3) = \frac{1}{6}$. **27.** $(-\infty, \infty)$ **29.** $(-\infty, 0) \cup (0, \infty)$
31. $(-1, 1)$ **33.** $(-\infty, -1] \cup (0, \infty)$ **35.** 8 **37.** $\ln 2$
39. $x = \dfrac{\pi}{2} + 2n\pi$, n any integer



43. -1, right



45. 0, right; 1, left



47. $\frac{2}{3}$ **49.** 4

51. (a) $g(x) = x^3 + x^2 + x + 1$ (b) $g(x) = x^2 + x$

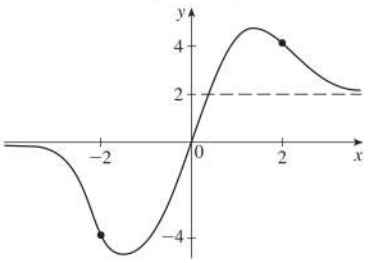
59. (b) (0.86, 0.87) **61.** (b) 70.347 **71.** None

EXERCISES 2.6 ■ PAGE 137

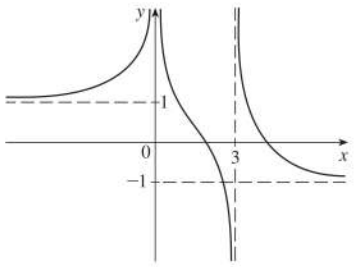
1. (a) As x becomes large, $f(x)$ approaches 5.
(b) As x becomes large negative, $f(x)$ approaches 3.

3. (a) -2 (b) 2 (c) ∞ (d) $-\infty$
(e) $x = 1, x = 3, y = -2, y = 2$

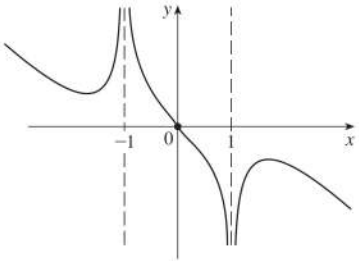
5.



7.



9.

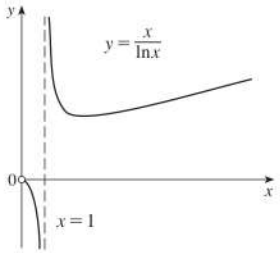


11. 0 **13.** $\frac{2}{5}$ **15.** $\frac{4}{5}$ **17.** 0 **19.** $-\frac{1}{3}$ **21.** -1

23. $\frac{\sqrt{3}}{4}$ **25.** -2 **27.** $-\infty$ **29.** 0 **31.** $\frac{1}{2}(a - b)$

33. $-\infty$ **35.** 0 **37.** $-\frac{1}{2}$ **39.** 0 **41.** ∞

43. (a) (i) 0 (ii) $-\infty$ (iii) ∞ (b) ∞
(c)



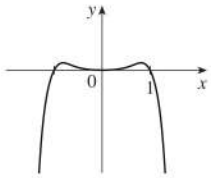
45. (a), (b) $-\frac{1}{2}$ **47.** $y = 4, x = -3$

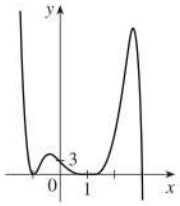
49. $y = 2; x = -2, x = 1$ **51.** $x = 5$ **53.** $y = 3$

55. (a) 0 (b) $\pm\infty$

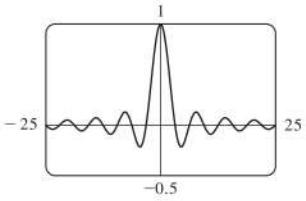
57. $f(x) = \dfrac{2 - x}{x^2(x - 3)}$ **59.** (a) $\frac{5}{4}$ (b) 5

61. $-\infty, -\infty$ **63.** $-\infty, \infty$



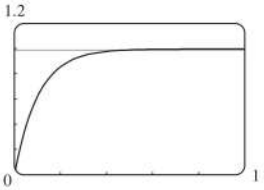


65. (a) 0 (b) An infinite number of times



67. 5

69. (a) v^* (b) 1.2 ≈ 0.47 s



71. $N \geqslant 15$ **73.** $N \leqslant -9, N \leqslant -19$

75. (a) $x > 100$

EXERCISES 2.7 ■ PAGE 149

1. (a) $\dfrac{f(x) - f(3)}{x - 3}$ (b) $\lim\limits_{x \to 3} \dfrac{f(x) - f(3)}{x - 3}$

3. (a) 1 (b) $y = x - 1$ (c)