

Apêndice B

Respostas dos Exercícios

Capítulo 1

Seção 1.6

1. a) $(-1/2, +\infty)$; b) $(-\infty, 68/19)$; c) $(-5/3, 4/3)$;
d) $(-\infty, 0) \cup (20/3, +\infty)$; e) $[-3, 3]$; f) $(-\infty, 1) \cup (2, +\infty)$;
g) $[-1, 1/2]$; h) $(-\infty, -3) \cup (2, +\infty)$; i) $(-1, 1) \cup (1, +\infty)$;
j) $(-\infty, -4] \cup [-1, 1]$; k) $(-\infty, 0]$; l) $(-\infty, -1] \cup [1, +\infty) \cup \{0\}$;
m) $(-\infty, 3) \cup (4, +\infty)$; n) $(-14, -4)$; o) $(-\infty, 5) \cup [13/2, +\infty)$;
p) $(2, +\infty)$; q) $(-\infty, -2] \cup \{1\}$; r) $(-\infty, -5/2] \cup (-1, 2)$;
s) $(-\infty, -1/2)$; t) $[2/3, +\infty) \cup \{1/2\}$.

2. a) $\{-9/5, 3\}$; b) $\{-1/4, 11/12\}$; c) $\{2/5, 8/9\}$;
d) $\{4/3, 3\}$; e) $\{4/11, 4\}$; f) $\{-7/2, 3/4\}$;
g) $\{-11/10, 11/8\}$; h) $\{8\}$.

3. a) $(-19, -5)$; b) $[2/3, 2]$; c) $(-\infty, -2/3] \cup [7/3, +\infty)$;
d) $(-\infty, 1) \cup (4, +\infty)$; i) $(-10, -2/3)$; f) $(-\infty, -2/3] \cup [10, +\infty)$;
g) $(-\infty, -5) \cup (1, +\infty)$; h) $[9/7, 19]$; i) $(-\infty, -5/2] \cup [3/2, +\infty)$;
j) $(-6, -3) \cup (-1, 2)$; k) $(2, 14/3) - \{3\}$; l) $(-\infty, 11/7] \cup [3, +\infty) - \{1/2\}$;
m) ϕ ; n) ϕ ; o) $[-3/2, 0]$;
p) $(-\infty, -2) \cup (2/3, +\infty)$; q) $[-2, 4] - \{-1, 3\}$; r) $(0, +\infty)$;
s) $(-\infty, -7/2] \cup [-1/6, +\infty)$.

Capítulo 2

Seção 2.10

1. a) 4; b) 0; c) $\frac{1-4t}{t-t^2}$; d) $\frac{x^2-4x}{x-3}$; e) $\frac{15}{2}$; f) $\frac{t^4-4}{t^2-1}$.

2. a) $\frac{-263}{98}$; b) $\frac{1}{9}$; c) $\frac{9x-7}{3x-9}$; d) $\frac{-22t^2+38t-88}{-7t^2+53t-28}$; e) $\frac{20}{7(h-7)}$; f) 11/7.

3. 3; -1/2; 2 5. $2a+2+h$ 6. $\frac{1-x}{2+7x}, \frac{2x+7}{x-1}$

10. a) $4\pi x^2$; b) $6x^2$; c) $\frac{4V}{x} + 2x^2$. 11. $2\sqrt{16-x^2}$

12. a) 9; \nexists ; \nexists ; b) [2, 8]; c) $-4t^2 - 16t - 7; [-7/2, -1/2]$; d) 9; \nexists

13. a) \mathbb{R} ; b) $[-2, 2]$; c) $\mathbb{R} - \{4\}$; d) $[2, +\infty)$; e) $(-\infty, 1] \cup [3, +\infty)$ f) $[-3, 7]$; g) \mathbb{R} ;
h) $\mathbb{R} - \{a\}$; i) $[-5, 2]$; j) $(-\infty, -1) \cup [0, +\infty)$; k) $\mathbb{R} - \{0\}$ l) $[0, +\infty)$.

14. (a) $y = 3x - 1, \mathbb{R}, \mathbb{R}$

(b) $y = x^2, \mathbb{R}, \mathbb{R}_+$

(c) Não é função $y = f(x)$

(d) $y = -\sqrt{4-x^2}, [-2, 2], [-2, 0]$

(e) Não é função

(f) $y = \frac{1}{x}, \mathbb{R} - \{0\}, \mathbb{R} - \{0\}$

(g) $y = x^2 + 11, \mathbb{R}, [11, +\infty)$

15. As respostas gráficas não serão apresentadas.

(a) $[-2, 2), [0, 2]$

(b) $\mathbb{R}, \left\{0, \frac{1}{2}, 1\right\}$

(c) $\mathbb{R}, (-\infty, 0] \cup \{1\} \cup [4, +\infty)$

16. (a) $D(f) = \mathbb{R}$

Conjunto imagem: $[-2, +\infty)$

Raízes: $-\sqrt{2} - 4$ e $\sqrt{2} - 4$

Ponto de mínimo em $x = -4$

Valor mínimo: -2

Intervalo de crescimento: $[-4, +\infty)$

Intervalo de decrescimento: $(-\infty, -4]$

(b) $D = \mathbb{R}$

Conjunto imagem: $(-\infty, 3]$

Raízes: $2 - \sqrt{3}$ e $2 + \sqrt{3}$

Ponto de máximo em $x = 2$

Valor máximo: 3

Intervalo de crescimento: $(-\infty, 2]$

Intervalo de decrescimento: $[2, +\infty)$

(c) $D = \mathbb{R}$

Conjunto imagem: $[0, +\infty)$

Raiz: 2

Ponto de mínimo em $x = 2$

Valor mínimo: 0

Intervalo de crescimento: $[2, +\infty)$

Intervalo de decrescimento: $(-\infty, 2]$

(d) $D = \mathbb{R}$

Conjunto imagem: $(-\infty, 0]$

Raiz: -2

Ponto de máximo em $x = -2$

Valor máximo: 0

Intervalo de crescimento: $(-\infty, -2]$

Intervalo de decrescimento: $[-2, +\infty)$

(e) $D = \mathbb{R}$

Conjunto imagem: \mathbb{R}

Raiz: 0

Intervalo de crescimento: $(-\infty, +\infty)$

(f) $D = \mathbb{R}$

Conjunto imagem: \mathbb{R}

Raízes: Uma raiz real com valor aproximado de $1,59$

Intervalo de decrescimento: $(-\infty, +\infty)$

(g) $D = [-3, 3]$

Conjunto imagem: $[0, 3]$

Raiz: 0

Ponto de mínimo em $x = 0$

Valor mínimo: 0

Pontos de máximo em -3 e 3

Valor máximo: 3

Intervalo de crescimento: $[0, 3]$ Intervalo de decrescimento: $[-3, 0]$

(h) $D = \mathbb{R} - \{2\}$

Conjunto imagem: $\mathbb{R} - \{0\}$ Intervalos de decrescimento: $(-\infty, 2)$ e $(2, +\infty)$

(i) $D = \mathbb{R} - \{-3\}$

Conjunto imagem: $\mathbb{R} - \{0\}$ Intervalo de crescimento: $(-\infty, -3)$ e $(-3, +\infty)$

(j) $D = [0, +\infty)$

Conjunto imagem: $[0, +\infty)$ Raiz: $x = 0$ Ponto de mínimo em $x = 0$

Valor mínimo: 0

Intervalo de crescimento: $[0, +\infty)$

18. -6

20. $4x - 21; 4x^2 - 28x + 49; 4x - 14$

21. a) x^2 b) \sqrt{x} c) bx d) $\pm(x^2 - 3x + 5)$

22. 2 e $-3; -2$ e 9

24. $f \circ g(x) = \begin{cases} 5x^3, & x \leq 0 \\ -x^3, & 0 < x \leq 2 \\ \sqrt{x^3}, & x > 2 \end{cases}$

25. $D(f) = [2, +\infty); \quad D(g) = [-2, +\infty); \quad D(h) = [2, +\infty); \quad D(p) = [2, +\infty); \quad D(q) = [2, +\infty)$

26. $\sqrt{x}; -\sqrt{x}$ 27. $2x - 3; -2x + 3$

28. $x - 1$ 30. $x < 1$ 31. $x \in (-1, 1)$

32. (a) Na 2ª semana (b) Na 4ª semana

(c) O número de pessoas infectadas cresce lentamente no início da epidemia; num segundo momento esse número cresce rapidamente e depois volta a crescer lentamente até que a epidemia fique controlada.

33. $L = -x^2 + 602x - 1.200$

34. $C_t = 2.000 + 0,10x$

35. $P_n = 5 \times 2^n$, n = número de horas

36. 72

Seção 2.17

5. $f(x) = \frac{1}{3}x + \frac{7}{3}$

6. a) par b) ímpar c) não é par nem ímpar d) par
e) par f) ímpar g) não é par nem ímpar h) par i) ímpar j) ímpar

30. a) $[-1/3, 1]$ b) $1 \leq x \leq 100$ c) $\bigcup_{n \in \mathbb{Z}} \left[n\pi, n\pi + \frac{\pi}{2} \right]$

39. $q = 24 - 3x$; (a) 9; (b) R\$ 4,00

40. (a) 1,6 unidades monetárias

41. (a) $f(x) = \frac{3}{25}x + 25$; (b) R\$ 22.225,00

42. (a) $R(q) = 27q$; (b) R\$ 38.000,00 (c) R\$ 3.000,00

43. (a) 7.300 unidades monetárias; $x = 90$

44. (a) $P = 1,6$; (b) $P = 1$

45. $c(x) = 4x^2 + \frac{6}{10x}$

47. Quando $a > 0$, o gráfico de $g(x)$ coincide com o gráfico de $f(x)$, deslocado a unidades para a esquerda. Quando $a < 0$, o gráfico de $g(x)$ coincide com o gráfico de $f(x)$, deslocado a unidades para a direita.

48. O gráfico de $g(x)$ coincide com o gráfico de $f(x)$, deslocado verticalmente: a unidades para cima quando $a > 0$ ou a unidades para baixo quando $a < 0$.

49. (a) $f(x) = (x - 3)^2$; deslocamento horizontal de 3 unidades para a direita.

(b) $f(x) = (x + 2)^2$; deslocamento horizontal de 2 unidades para a esquerda.

422 Cálculo A – Funções, limite, derivação e integração

(c) $f(x) = (x - 3)^2 - 4$; deslocamento horizontal de 3 unidades para a direita e deslocamento vertical de 4 unidades para baixo.

50. (a) $y = \frac{1}{2}(x + 1)$ (b) $y = 2x + 2$ (c) $y = \sqrt[3]{x}$ (d) $y = 1 + \sqrt[3]{x - 4}$

51. (a) $y = \sqrt{x}$ (b) $y = 1 + \sqrt{x}$ (c) $y = \frac{3}{2} + \sqrt{\frac{x}{2} + \frac{29}{4}}$ (d) $y = \ln x$

52. Se pretendo me deslocar mais de 100 km devo escolher a locadora B e em caso contrário a locadora A.

53. Quadrado de lado igual a 20 cm.

54. (a) $y = 1,8x + 32$ (c) 77°F (d) $-40^\circ\text{C} \approx -40^\circ\text{F}$

55. Aproximadamente 47 anos.

56. (a) $1,2q_1 + 1,5q_2 = 180$, sendo q_1 a quantidade de latinhas de refrigerante e q_2 a quantidade de cachorros quente.

(c) 120 cachorros quentes.

57. (a) $C_T = 12.400 + 262x$

(c) O custo fixo é o coeficiente linear da reta e o custo variável, o coeficiente angular.

58. (a) $M = M_0 e^{-0,0004279 t}$ (b) aproximadamente 74%

59. (a) $M = M_0 e^{-0,005108 t}$ (b) $t \cong 135,7$ anos (c) $t \cong 371,4$ anos.

Capítulo 3

Seção 3.6

1. a) -1 b) 3 c) \nexists d) -1 e) 3 f) 3

2. a) 0 b) 0 c) 0 d) $+\infty$

3. a) 0 b) 0 c) 0 d) $+\infty$ e) $-\infty$ f) 4

4. a) 0 b) 0 c) $+\infty$ d) $-\infty$ e) 1

5. a) $+\infty$ b) $1/2$ c) \nexists d) $1/2$ e) $-\infty$

11. 0,005 12. 0,166... 13. 0,1 14. 1 15. 0,75

16. (a) \neq (b) 0 (c) 0 (d) 0
18. 3 19. 8 20. 9 21. 8 22. 27
23. 4.096 24. $6/5$ 25. $5/4$ 26. 2 27. 5
28. -1 29. $9/2$ 30. $\sqrt[3]{11}$ 31. $\sqrt[3]{23^2}$ 32. $\frac{2\sqrt{2}-1}{3}$
33. $\frac{\sqrt{2}}{2}$ 34. 2 35. $e^4 + 16$ 36. $\sqrt[4]{7/3}$ 37. $\frac{\sinh 2}{4}$

Seção 3.8

1. a) 2 b) 2 c) 2 d) 8 e) 8 f) 8
2. 4 3. a) 0 b) 0 c) 0
4. a) 2 b) 2 c) 2 5. b) $1, -1$ e \neq 7. $\frac{\pi}{2}$ e $\frac{-\pi}{2}$
9. a) -1 b) 1 c) 0 d) $-\infty$ e) \neq f) 0 g) 0 h) 0
10. a) 5 b) 10 c) 0 d) 10 e) 0

Seção 3.10

1. a) 12 b) $-1/4$ c) $8/3$ d) 17 e) $-1/9$ f) 12
3. a) 6 b) $-9/4$ c) $2/3$ d) $1/3$
4. $-3/2$ 5. 0 6. 1 7. $7/2$ 8. $a + 1$
9. 1 10. $-4/5$ 11. -2 12. 4 13. $1/8$
14. 32 15. 8 16. $3/10$ 17. $b/2a$ 18. $1/2$
19. -1 20. $1/12$ 21. $-1/2$ 22. b/a 23. $1/3\sqrt[3]{a^2}$
24. $4/3$ 25. $1/9$ 26. $-1/3$ 27. 1

Seção 3.13

1. a) 2 b) $1/6$ 2. a) $+\infty$ b) 0

424

Cálculo A – Funções, limite, derivação e integração

- | | | | | |
|----------------|---------------|-----------------|---------------|---------------------|
| 3. $+\infty$ | 4. 2 | 5. 0 | 6. 0 | 7. $1/2$ |
| 8. $-\infty$ | 9. $+\infty$ | 10. $-5/7$ | 11. $+\infty$ | 12. 0 |
| 13. $+\infty$ | 14. $2/3$ | 15. $+\infty$ | 16. 1 | 17. -1 |
| 18. 0 | 19. $-1/2$ | 20. $+\infty$ | 21. $10/3$ | 22. $-\infty$ |
| 23. 0 | 24. -1 | 25. $-\sqrt{2}$ | 26. $+\infty$ | 27. $\sqrt[3]{3/2}$ |
| 28. $\sqrt{2}$ | 29. $-1/2$ | 30. $1/2$ | 31. $+\infty$ | 32. $-\infty$ |
| 33. $+\infty$ | 34. $-\infty$ | 35. $+\infty$ | 36. $-\infty$ | 37. $-\infty$ |
| 38. $+\infty$ | 39. $+\infty$ | 40. $+\infty$ | | |

Seção 3.16

- | | | |
|---------------------------|-------------------------------|--|
| 1. a) $y = 0; x = 4$ | b) $y = 0; x = -2$ | c) $y = 0; x = 2; x = 1$ |
| d) $y = 0; x = 3; x = -4$ | e) $y = 0; x = -4$ | f) $y = 0; x = 3$ |
| g) $x = \pm 4$ | h) $y = \pm 1; x = 3; x = -4$ | i) $y = 1; x = 0$ |
| j) $y = -1$ | k) $x = 0$ | l) $x = (2n + \pi/2)$ para $n = 0 \pm 1, \pm 2, \pm 3 \dots$ |

- | | | | | |
|--------------|-----------------|------------------------------|------------------------|-------------|
| 5. 9 | 6. $4/3$ | 7. $10/7$ | 8. a/b | 9. a |
| 10. $1/64$ | 11. 0 | 12. $1/2$ | 13. $-1/\pi$ | |
| 14. $2/7$ | 15. $5/2$ | 16. -1 | 17. e | 18. e |
| | 19. e | 20. e^{10} | | |
| 21. $\ln 10$ | 22. $2/5 \ln 2$ | 23. $25 \ln 5$ | 24. $\frac{\ln 3}{20}$ | 25. $b - a$ |
| 26. a | 27. 1 | 28. a) e b) e^2 c) $1/e$ | | |

Seção 3.18

1. b) c) d) e) i) são contínuas; a) f) g) h) j) não são contínuas
2. a) -1 b) \neq c) \neq d) -3 e) -2 e) 0 f) \neq g) 1 h) \neq
4. a) $-8/3$ b) 1 c) 2
5. a) 3, -7 b) $x \in (3, 6)$ c) $x = -\frac{\pi}{6} + 2k\pi, x = \frac{7\pi}{6} + 2k\pi, k \in \mathbb{Z}$ d) \neq

Capítulo 4

Seção 4.7

1. a) $2x - y - 2 = 0; y = -1; 2ax - y - a^2 - 1 = 0$
 b) $5x + y - 5 = 0; x - y + 2 = 0$
 c) $8x + 4y + 3 = 0; (6a - 5)x - y - 3a^2 = 0$
2. a) $x + 2y - 1 = 0; x = 0; x + 2ay - 2a^3 + a = 0$
 b) $x - 5y + 51 = 0; x + y - 6 = 0$
 c) $x - 2y - 4 = 0; x - (5 - 6a)y - 18a^3 + 45a^2 - 26a = 0$
3. $4x + 4y - 5 = 0$ 4. $6x + y + 3 = 0; x - 6y + 56 = 0$
5. a) $16 + 2b + h \text{ m/s}$ b) $22,1 \text{ m/s}; 22,01 \text{ m/s}; 22,001 \text{ m/s}$ c) $16 + 2t \text{ m/s}$
 d) 22 m/s e) 2 m/s^2
6. a) $\frac{-b}{4} + c$ b) $\frac{2b}{t^3}$
7. a) 4 b) 8 c) -1 d) -1 e) 2/15
8. a) $-8x$ b) $4x - 1$ c) $\frac{-1}{(x+2)^2}$ d) $\frac{-4}{(x+3)^2}$ e) $\frac{-1}{(2x-1)\sqrt{2x-1}}$ f) $\frac{1}{3\sqrt[3]{(x+3)^2}}$
9. a) $\frac{(x-1)^2}{-x^2+2x-2}$ b) $-\left(\frac{x-1}{2-x}\right)^2$ c) $\frac{2}{(x-1)^4} - 3$ d) $\frac{-4}{(x-1)^2}$
 e) $\frac{4x^3 - 8x^2 + 4x - 1}{(x-1)^2}$ f) $\frac{-1 - 8x(x-1)^2}{(x-1)^2}$ g) $\frac{-4x}{x-1}$
12. a) $(3/4, +\infty)$ b) $(-\infty, 3/4)$
13. $(2, 4), y = 4x - 4;$ $(-2, 4), y = -4x - 4$ 14. $2, (2, \frac{4}{3}), (-2, 4)$

Seção 4.10

1. $f'(3^+) = 2; f'(3^-) = -2$ 2. $f'(1^+) = 2; f'(1^-) = 1$
3. $f'(-2^+) = 2; f'(-2^-) = -2$ 4. $f'(-1^+) = 0; f'(-1^-) = 2; f'(1^+) = -2; f'(1^-) = 0$
5. $f'(-2^+) = 0; f'(-2^-) = 4; f'(2^+) = 2; f'(2^-) = 0$

6. b) é contínua c) 2; -2; 2; -2 d) $f'(x) = \begin{cases} 2x, & \text{se } |x| < 1, \\ -2x, & \text{se } |x| > 1, \end{cases} D = \mathbb{R} - \{-1, 1\}$

Seção 4.12

1. $2\pi r$ 2. $6x + 6$ 3. $2aw$
4. $\frac{3}{2x^4}$ 5. $18x^2 + 6x + 12$ 6. $14x + 27$
7. $-27x^8 + 30x^4 + 4x^3$ 8. $\frac{-20}{(5x-3)^2}$ 9. $2x$
10. $(s^2 - 1)(3s - 1)(15s^2 + 2) + 3(s^2 - 1)(5s^3 + 2s) + 2s(3s - 1)(5s^3 + 2s)$
11. $7(2a x + b)$ 12. $-24u^2 + 8au + 2a$ 13. $\frac{-14}{(3x-1)^2}$
14. $\frac{2}{(t+1)^2}$ 15. $\frac{3t^2 - 6t - 4}{(t-1)^2}$ 16. $\frac{-t^2 + 4t - 2}{t^2 - 4t + 4}$
17. $\frac{-x^2 + 8x - 5}{(5-x^2)^2}$ 18. $\frac{-24}{(2x-2)^2}$ 19. $\frac{6x^3 + 27x^2 + 36 + 12}{(x+2)^2}$
20. $\frac{t^2 - 2bt - a^2 + 2ab}{(t-b)^2}$ 21. $\frac{-12}{x^5} - \frac{25}{x^6}$ 22. $2x^3 - \frac{12}{x^7}$
24. $A = B = 1/2$ 25. $4t + 1$ 26. $11x + 49y + 4 = 0$
27. $x + 64y - 1026 = 0$ 28. $x - y - 2\sqrt{2} + 2 = 0; x - y + 2 + 2\sqrt{2} = 0$
29. $(2, 2/3); (1, 5/6)$ 30. $a = 3; b = 2$

Seção 4.16

1. a) $9x + y - 6 = 0; x + 9y - 6 = 0$
 b) $x + (2 + a)^2y + 4 + a = 0; x + (4 - a)^2y - 8 + a = 0$
 c) $x = 0; x - \sqrt{3}y + 3 = 0; x - \sqrt{a}y + a = 0$
2. $3\sqrt{3}x - 3\sqrt{3}y - 3\sqrt{3} - 2 = 0; 3\sqrt{3}x - 3\sqrt{3}y - 3\sqrt{3} + 2 = 0$
3. a) -16 m b) $3 \text{ m/s}; 0 \text{ m/s}; -9 \text{ m/s}; -24 \text{ m/s}$ c) $0 \text{ m/s}^2; -6 \text{ m/s}^2; -12 \text{ m/s}^2; -18 \text{ m/s}^2$

4. $-4,9 \text{ m}; -9,8 \text{ m e } -19,6 \text{ m}; -19,6 \text{ m}$

5. $100 (3x^2 + 7x - 3)^9 (6x + 7)$

6. $\frac{3}{a} (bx^2 + ax)^2 (2bx + a)$

7. $(7t^2 + 6t)^6 (3t - 1)^3 [12 (7t^2 + 6t) + 7(3t - 1)(14t + 6)]$

8. $\frac{3(7t + 1)^2 (-14t^2 - 4t + 21)}{(2t^2 - 3)^4}$

9. $\frac{4(x + 1)}{\sqrt[3]{3x^2 + 6x - 2}}$

10. $\frac{3x - 2}{(3x - 1)\sqrt{3x - 1}}$

11. $\frac{-3}{2(t - 1)^{3/2} (2t + 1)^{1/2}}$

12. $-\frac{1}{3} e^{3-x}$

13. $2^{3x^2+6x} 6(x + 1) \ln 2$

14. $6[(7s^2 + 6s - 1)^2 (7s + 3) - e^{-3s}]$

15. $e^{t/2} (1/2t^2 + 9/2t + 5)$

16. $\frac{2}{2x + 4} \log_2 e$

17. $\frac{\log_3 e}{2(s + 1)}$

18. $\frac{-x - 2}{x(x + 1)}$

19. $\frac{3(\ln a)a^{3x} - a^{3x} (6x - 6)\ln b}{b^{3x^2-6x}}$

20. $2t(2t + 1)^{t^2-1} \ln(2t + 1) + 2(2t + 1)^{t^2-2} (t^2 - 1)$

21. $\frac{b(a + bs)^{\ln(a+bs)} \ln(a + bs)}{a + bs}$

22. $\sin\left(\frac{\pi}{2} - u\right)$

23. $4\cos\theta^2 \cos 2\theta - 4\theta \sin 2\theta \sin \theta^2$

24. $3\sin^2(3x^2 + 6x) \cos(3x^2 + 6x)(6x + 6)$

25. $6 \sec^2(2x + 1) + \frac{1}{2\sqrt{x}}$

26. $\frac{6x \sec^2 x \operatorname{tg} x - 3 \sec^2 x}{x^2}$

27. $e^{2x}(2\cos 3x - 3\sin 3x)$

28. $6 \theta^2 \operatorname{cosec}^2 \theta^3 \cdot \cotg \theta^3$

29. $\frac{-ab \sin bx}{2\sqrt{\cos bx}}$

30. $2u^2 \sec^2 u \operatorname{tg} u + 2u \operatorname{tg}^2 u$

31. $-a^{\cotg \theta} \ln a \operatorname{cosec}^2 \theta$

32. $\frac{2 \operatorname{arc} \sin x}{\sqrt{1 - x^2}}$

33. $\frac{-3t}{\sqrt{1 - 9t^2}} + \operatorname{arc} \cos 3t$

34. -1

35. $\frac{1}{2x\sqrt{x - 1}}$

36. $\frac{-2t^2}{|2t + 3|\sqrt{(2t + 3)^2 - 1}} + 2t \operatorname{arc} \operatorname{cosec} (2t + 3)$

37. $\frac{x \cotgh x - \ln(\sinh x)}{x^2}$

38. $\frac{-(t + 1) \operatorname{cosech}^2(t + 1)^2}{\sqrt{\cotgh(t + 1)^2}}$

39. $\frac{3}{x^2} \left(\operatorname{cosech} \frac{3x + 1}{x} \right)^3 \cotgh \left(\frac{3x + 1}{x} \right)$

40. $\operatorname{arg} \cosh x$

41. $\frac{2x^2}{1 - x^4} + \operatorname{arg} \cotgh x^2$

42. $\frac{2x \operatorname{arg} \cosh x^2}{\sqrt{x^4 - 1}}$

43. $\frac{10}{3} (2x^5 + 6x^{-3})^4 (5x^4 - 9x^{-4})$

44. $60(3x^2 + 6x)^9 (x + 1) + \frac{2}{x^3}$

45. $(5x - 2)^5 (3x - 1)^2 (135x - 48)$

46. $8(2x - 5)^3 - \frac{1}{(x + 1)^2} - \frac{1}{2\sqrt{x}}$

47. $-\frac{1}{3} (4t^2 - 5t + 2)^{-4/3} (8t - 5)$

428 Cálculo A – Funções, limite, derivação e integração

$$48. -\frac{21}{10}x^2(3x+1)^{-6/5} + 7x(3x+1)^{-1/5} + \frac{3}{2}(3x+1)^{-1/2}$$

$$49. 12e^{3x^2+6x+7}(x+1)$$

$$50. \frac{e^{\sqrt{x}}}{2\sqrt{x}}$$

$$51. \frac{2^{\ln 2x} \ln 2}{x}$$

$$52. \frac{-2t^2 e^{-t^2} - e^{-t^2} - 1}{t^2}$$

$$53. \sqrt{\frac{e^t+1}{e^t-1}} \cdot \frac{e^t}{(e^t+1)^2}$$

$$54. \frac{2bx^2 - a}{ax}$$

$$55. \frac{7x}{7x^2 - 4}$$

$$56. \frac{2}{1-x^2}$$

$$57. \left(\frac{a}{b}\right)^{\sqrt{t}} \ln\left(\frac{a}{b}\right) \cdot \frac{1}{2\sqrt{t}}$$

$$58. (e^{x^2} + 4)^{\sqrt{x}} \ln(e^{x^2} + 4) \frac{1}{2\sqrt{x}} + 2x\sqrt{x} (e^{x^2} + 4)^{\sqrt{x}-1} e^{x^2}$$

$$59. 2\cos(2x+4)$$

$$60. -2\sin(2\theta^2 - 3\theta + 1)(4\theta - 3)$$

$$61. -\sin 2\alpha$$

$$62. 0$$

$$63. -16(2s-3)\cot^3(2s-3)^2 \operatorname{cosec}^2(2s-3)^2$$

$$64. \frac{-2\cos x}{\sin^3 x}$$

$$65. \frac{\cos(x+1) - \sin(x+1)}{e^x}$$

$$66. -\sin^3 \frac{x}{2} \cos \frac{x}{2} + \cos^3 \frac{x}{2} \sin \frac{x}{2}$$

$$67. -2\operatorname{tg} t$$

$$68. \frac{3+2\sin 2x}{3x - \cos 2x} \log_2 e$$

$$69. -4\sin 2te^{2\cos 2t}$$

$$70. \frac{-2}{\sqrt{9-4x^2}}$$

$$71. \frac{1}{(s+1)^2} \left(\frac{s+1}{\sqrt{4-s^2}} - \arcsen \frac{s}{2} \right)$$

$$72. \frac{2x}{x^4 - 2x^2 + 2}$$

$$73. 2\cosh(2x-1)$$

$$74. 2t \operatorname{tgh}(t^2-1)$$

$$75. 16t(4t^2-3)\operatorname{sech}^2(4t^2-3)^2$$

$$76. \frac{-\operatorname{sech}(\ln x) \operatorname{tgh}(\ln x)}{x}$$

$$77. \frac{2 \arg \sinh x}{\sqrt{x^2+1}}$$

$$78. \frac{4x}{4-x^4}$$

$$79. \frac{-(x+1)}{x\sqrt{1-4x^2}} + \arg \operatorname{sech} 2x$$

$$80. \text{a) } f'(x) = \begin{cases} -1, & x \leq 0 \\ -e^{-x}, & x > 0 \end{cases}$$

$$\text{b) } \frac{4}{4x-3}$$

$$\text{c) } f'(x) = \begin{cases} 2e^{2x-1}, & x > 1/2 \\ -2e^{1-2x}, & x < 1/2 \end{cases}$$

$$81. -1$$

$$82. \frac{3+2\sqrt{3}}{6}$$

$$83. 1-x$$

$$94. \text{a) } \frac{\pi(2k+1)}{4}, k \in \mathbb{Z}$$

$$\text{b) } k\pi, k \in \mathbb{Z}$$

95. a) duas

b) reta tangente 1: $(1, 2), (-1, -2)$ c) $y = 2x; y = -2x$ reta tangente 2: $(-1, 2), (1, -2)$ 96. (a) $y = 3 + \sqrt{x+4}, x \geq -4$ (b) $y = 4x - 20$ (c) $y = \frac{1}{4}x + 5$

Seção 4.21

1. $y^v = 0$

2. $y''' = 6a$

3. $y^{(10)} = 0$

4. $y'' = \frac{-3}{(3-x^2)\sqrt{3-x^2}}$

5. $y^{iv} = \frac{24}{(x-1)^5}$

6. $y''' = 8e^{2x+1}$

7. $y^{iv} = \frac{1}{e^x}$

8. $y'' = \frac{-1}{x^2}$

9. $y^{vii} = -a^7 \cos ax$

10. $y^v = \frac{1}{16} \sin \frac{x}{2}$

11. $y''' = 2 \sec^4 x + 4 \sec^2 x \cdot \operatorname{tg}^2 x$

12. $y'' = \frac{-2x}{(1+x^2)^2}$

13. a) $\sin x$ b) $\cos x$

18. a) $\frac{-x^2}{y^2}$

b) $\frac{-3x^2 - 2xy}{x^2 + 2y}$

c) $-\sqrt{\frac{y}{x}}$

d) $\frac{1-y^3}{3xy^2 + 4y^3 + 1}$

e) -1

f) $\frac{y}{\sec^2 y - x}$

g) $\frac{1}{e^y - 1}$

19. retas tangentes: $x - \sqrt{3}y + 2 = 0$ e $x + \sqrt{3}y + 2 = 0$ retas normais: $\sqrt{3}x + y - 2\sqrt{3} = 0$ e $\sqrt{3}x - y - 2\sqrt{3} = 0$ 21. $(1/8; -1/16)$

23. a) $\frac{3}{2}t, t > 0$

b) $-\cotg 2t, t \in (0, \pi/2)$

c) $-4/3 \cotg t, t \in (\pi, 2\pi)$

d) $-\operatorname{tg} t, t \in (-\pi/2, 0)$

e) $\frac{3}{2}t^2, t \in \mathbb{R}$

f) $-\operatorname{tg} t, t \in (0, \pi/2) \cup (\pi/2, \pi)$

24. $2y + 3x - 6\sqrt{2} = 0$

25. $2\sqrt{3}x - 2y + \sqrt{3} = 0; x + \sqrt{3}y - 1 = 0$

26. a) $3(\Delta x)^2$

b) $\frac{2\Delta x}{\sqrt{x+\Delta x} + \sqrt{x}} - \frac{\Delta x}{\sqrt{x}}$

c) $\frac{-3\Delta x}{(2x+2\Delta x-1)(2x-1)} + \frac{3\Delta x}{(2x-1)^2}$

27. a) $-0,000998; -0,001$

b) $-0,118; -0,12$

c) $-0,078; -0,075$

28. a) 7,071

b) 3,9895

c) 1,906

430 Cálculo A – Funções, limite, derivação e integração

29. a) $\frac{6x - 4}{3x^2 - 4x} dx$

b) $\frac{-x}{e^x} dx$

c) $10x \cos(5x^2 + 6) dx$

32. 60.000 cm^3

33. $0,0044209$

34. $11,3097 \text{ cm}^3$

35. $\pm 24.000 \text{ m}^2$

36. $2,5\%$

Capítulo 5

Seção 5.3

1. a) 54 gramas/dia

b) 54,5 g

c) 24,4 gramas/dia

2. $-5,444 \dots ^\circ\text{C/hora}$

3. $-c/100 \text{ cm}^3/\text{kgf/cm}^3$

4. a) 6 horas

b) 17.500 1/hora

c) 10.000 1/hora

5. a) $f(t) = 4.500 + 1.550 t$

b) 1.550,00/ano

c) 25,6%

d) Tenderá para zero.

6. a) 0,8 milhares de pessoas/ano

b) 0,068 milhares de pessoas

7. $1/12$

8. $4,875 \text{ 1/hora}$

9. $\frac{1}{\pi} \text{ m/hora ; } 10\pi \text{ horas}$

10. $\frac{d^2}{\sqrt{3}} \text{ m}^2 ; 6\sqrt{3} \text{ m}^3/\text{s}$

11. a) $\frac{4\pi r^2}{3}$

b) $1,066\pi \text{ m}^3/\text{s}$

12. a) $15\sqrt{3} \text{ cm}^2/\text{s}$

b) 7,5 cm/s

13. 18 unidades/min

14. 119,09 km/hora

15. 1,45 m/s

16. $\sqrt[3]{\frac{2\pi}{3V}}$

17. (a) custo fixo

(b) Inicialmente o custo marginal diminui e depois passa a crescer

18. (a) 120

(b) 410

(c) 5,44; 1,2

19. $E = -0,087$; um pequeno aumento no preço acarretará uma diminuição muito baixa da demanda.

20. (a) $\frac{y(60 - 0,12y)}{15 + 60y - 0,06y^2}$

(b) 0,57 ; o aumento de 1% na renda, acarretará um aumento de $\cong 0,57\%$ na demanda

Seção 5.10

1. a) $\sqrt{6}$ c) $\frac{4\sqrt{3}}{3}$ d) $\frac{-2\sqrt{3}}{3}$
 e) $\arcsen 2/\pi$ g) $\arcsen 2/\sqrt{\pi}$ h) $\frac{-\sqrt{2}}{2}$
3. 0; -2; 2
5. a) \nexists ; b) 3/2; c) 1;
 d) -1; e) 0; f) \nexists ;
 g) 0; -3; h) $\frac{\pi}{2} + k\pi, k \in \mathbb{Z}$; i) $k\pi, k \in \mathbb{Z}$;
 j) $\frac{3\pi}{4} + k\pi, k \in \mathbb{Z}$; k) 0; l) 0; 3; -3;
 m) \nexists n) 3/2; o) 0.
6. a) $(-\infty, +\infty)$ crescente b) $(-\infty, +\infty)$ decrescente
 c) $[-1, +\infty)$ crescente; $(-\infty, -1]$ decrescente
 d) $(-\infty, -2] \cup [2/3, +\infty)$ crescente; $[-2, 2/3]$ decrescente
 e) $(-\infty, -\sqrt{7/3}] \cup [\sqrt{7/3}, +\infty)$ crescente; $[-\sqrt{7/3}, \sqrt{7/3}]$ decrescente;
 f) $\left[\frac{2\pi}{3} + 2n\pi, \frac{4\pi}{3} + 2n\pi\right], n \in \mathbb{Z}$ decrescente; $\left[\frac{-2\pi}{3} + 2n\pi, \frac{2\pi}{3} + 2n\pi\right], n \in \mathbb{Z}$ crescente
 g) $(-\infty, +\infty)$ crescente h) $(-\infty, +\infty)$ decrescente
 i) $(-\infty, +1]$ crescente; $[1, +\infty)$ decrescente
 j) $(-\infty, 0] \cup [2, +\infty)$ crescente; $[0, 1] \cup (1, 2]$ decrescente
 k) $(-\infty, 1] \cup [1, +\infty)$ crescente; $[-1, 0] \cup (0, 1]$ decrescente
 l) $\left[0, \frac{3\pi}{4}\right] \cup \left[\frac{7\pi}{4}, 2\pi\right]$ crescente; $\left[\frac{3\pi}{4}, \frac{7\pi}{4}\right]$ decrescente
7. a) 7; -5 b) 5; -4 d) 100; -4/27
 e) 1/2; -1/2 f) 2; 0 g) $\frac{e^2 + e^{-2}}{2}; 1$

- h) $\tanh 2; \tanh -2$ i) $1; -1$ j) $1; 0$
 k) $0; -1$
9. a) $\neq; 3/7$ b) $2; \neq$ c) $-7; 1$
 d) $\neq; 1$ e) $\neq; 0$ f) $8; 0$
 g) $\neq; \neq$ h) $\neq; -3/2$ i) $2; -2$
 j) $-1 + \sqrt{5}; -1 - \sqrt{5}$ k) $-2; -4/5$ l) $64/5; 0$
11. $a = 3; b = -3$ 12. a é qualquer real; $b = -3a$; $c = 0$; d é qualquer real
14. a) $(5/3, f(5/3)); (-\infty, 5/3)$ côncava para cima; $(5/3, +\infty)$ côncava para baixo
 b) $(-1/3, f(-1/3)); (2, f(2)); (-\infty, 1/3) \cup (2, +\infty)$ côncava para cima; $(-1/3, 2)$ côncava para baixo
 c) $\neq; (-4, +\infty)$ côncava para cima; $(-\infty, -4)$ côncava para baixo
 d) $(2/3, f(2/3)); (2/3, +\infty)$ côncava para cima; $(-\infty, 2/3)$ côncava para baixo
 e) $(-2 \pm \sqrt{2}, f(-2 \pm \sqrt{2})); (-\infty, -2 - \sqrt{2}) \cup (-2 + \sqrt{2}, +\infty)$ côncava para cima; $(-2, \sqrt{2}, -2 + \sqrt{2})$ côncava para baixo
 f) $\neq; (-1, +\infty)$ côncava para baixo
 g) $(-6, f(-6)); (-6, +\infty)$ côncava para cima; $(-\infty, -6)$ côncava para baixo
 h) $(\pi, f(\pi)); (0, \pi)$ côncava para cima; $(\pi, 2\pi)$ côncava para baixo
 i) $\neq; (-\infty, 1)$ côncava para baixo
 j) $(2, 0); (-\infty, 2)$ côncava para cima; $(2, +\infty)$ côncava para baixo

Seção 5.12

1. a) 1º pedaço $\frac{4l}{4 + \pi}$; 2º pedaço $\frac{l\pi}{4 + \pi}$
 b) Deve-se fazer somente um círculo de raio $\frac{l}{2\pi}$
2. $(1, 1)$ ou $(-1, -1)$ 3. 67 dias 4. 35; 35

5. $a/6$
6. raio da base $\sqrt[3]{\frac{V}{2\pi}}$; altura $\sqrt[3]{\frac{4V}{\pi}}$
7. 8 km do encontro da canalização l com a perpendicular que passa por A .
8. (a) $q = 650$ (b) $q \cong 82$ (c) $q = 0$
9. (a) F representa o custo fixo
(b) O custo marginal decresce à medida que o nível de produção aumenta
(c) \bar{x} (d) $q = 125.000$
10. quadrado de lado $\sqrt{288}$ cm
11. $(1/\sqrt{2}/1); \sqrt{2}$; equação da tangente pedida é $y + \sqrt{2}x - 2 = 0$
13. $1/3$ da altura do cone dado
14. $(1, 2)$
15. $22,01 \text{ cm} \times 26,91 \text{ cm}$
16. base 0,88 m; altura 0,44 m
17. $\pi/4$
18. 84,56 km da cidade
19. $\sqrt{8}$ m
20. $3x + 4y - 24 = 0$
21. $a = 100 \text{ m}; r = \frac{100}{\pi} \text{ m}$
22. raio da base $7/3$ m; altura 2 m
23. 1.000
24. raio $\sqrt{\frac{2}{3}}R$; altura $\frac{2R}{\sqrt{3}}$
25. $a = \frac{40\sqrt{3}}{3}; b = 10\sqrt{3}$
26. $2\text{m} \times \frac{\sqrt{6}\text{m}}{2} \times \frac{\sqrt{6}\text{m}}{2}$
27. $4,5 \text{ cm} \times 6 \text{ cm}$

Seção 5.14

1. 0
2. -1
3. $6/5$
4. ∞
5. $-11/26$
6. $-1/6$
7. 0
8. $5/2$
9. $+\infty$
10. $-1/2$
11. $+\infty$
12. 0
13. 1
14. $+\infty$
15. ∞
16. 1
17. ∞
18. 0

434

21. 1

24. 1

30. $1/e$

33. 1

39. 1

42. ∞

Seção

2. a) $1 + \frac{x^2}{2} + \frac{x^4}{24}; \frac{\sinh z}{5!} x^5$

$$\text{b) } x - \pi + \frac{(x - \pi)^3}{3}; \frac{[16 \sec^4 z \cdot \operatorname{tg} z + 8 \sec^2 z \operatorname{tg}^3 z](x - \pi)^4}{4!}$$

c) $1 + \frac{1}{2}(x-1) - \frac{1}{8}(x-1)^2 + \frac{1}{16}(x-1)^3; \frac{-15}{16z^3\sqrt{z}} \cdot \frac{1}{24}(x-1)^4$

d) $1 - x^2 + \frac{x^4}{2}; \frac{e^{-z^2}}{120} (160z^3 - 120z - 32z^5) x^5$

3. $-0,6822; |R_4(0,5)| < 0,2$

4. $\frac{1}{2}(x - \pi)^2 - \frac{1}{24}(x - \pi)^4 + \frac{1}{720}(x - \pi)^6; \cos\left(\frac{5\pi}{6}\right) \cong -0,8660331; \left|R_6\left(\frac{5\pi}{6}\right)\right| \leq 0,00002$

7. a) \nexists b) $5/12$ é ponto de mínimo

c) 4 é o ponto de mínimo

d) \nexists

e) 0 é ponto de máximo; $\pm 2/\sqrt{3}$ são pontos de mínimo

f) -5 é ponto de máximo; 5 é ponto de mínimo

Capítulo 6

Seção 6.2

11. $x - \arctg x + c$ 12. $x - \frac{1}{x} + c$ 13. $\sec x + c$
14. $3 \arcsen x + c$ 15. $2 \arcsen x + c$
16. $\frac{8x^3}{3} - \frac{9x^2}{2} + 6x - 2 \ln |x| - \frac{1}{x} + c$ 17. $\frac{1}{2}e^t + \frac{2}{3}t^{3/2} + \ln |t| + c$ 18. $-\cos \theta + c$
19. $2 \cosh x + c$ 20. $\frac{t^2}{2} + \frac{2}{3}t^{3/2} + \frac{3}{4}t^{4/3} + \frac{4}{5}t^{5/4} + \frac{5}{6}t^{6/5} + c$ 21. $\frac{-3}{\sqrt[3]{x}} - 5 \ln |x| + c$
22. $\frac{2^t}{\ln 2} - \sqrt{2}e^t + \operatorname{senh} t + c$ 23. $\operatorname{sen} x + \operatorname{tg} x + c$ 24. $\frac{1}{a^2} \arctg x + c$
25. $x - 2 \arctg x + c$ 26. $\frac{t^4}{2} - \frac{7t^3}{3} + 2t^2 + 4t + c$ 27. $e^t - \frac{8}{5}t^{5/4} - \frac{3}{2t^2} + c$
28. $\frac{1}{2} \ln |x| + c$ 29. $\operatorname{tg} x + c$ 30. $\frac{x^5}{5} - \frac{2}{3}x^3 + x + c$
31. $\begin{cases} 2 \ln |t| + c, & \text{se } n = 1 \\ \frac{t^{1-n}}{(n-1/2)(1-n)} + c, & \text{se } n \neq 1 \end{cases}$ 32. $\frac{3}{5}x^{5/3} + \frac{x^2}{2} - \frac{1}{10}$ 33. $2x - \operatorname{sen} 2x$
34. $-\frac{1}{x} + x - \frac{3}{2}$ 35. $\frac{\pi(\sqrt{2}-2)}{8}$ 36. $\cos x + 1$

Seção 6.4

1. $\frac{1}{22}(2x^2 + 2x + 3)^{11} + c$ 2. $\frac{7}{24}(x^3 - 2)^{8/7} + c$ 3. $\frac{5}{8}(x^2 - 1)^{4/5} + c$
4. $\frac{-5}{9}(4 - 3x^2)^{3/2} + c$ 5. $\frac{1}{6}(1 + 2x^2)^{3/2} + c$ 6. $\frac{3}{8}(e^{2t} + 2)^{4/3} + c$
7. $\ln(e^t + 4) + c$ 8. $-e^{1/x} - \frac{2}{x} + c$ 9. $\frac{\operatorname{tg}^2 x}{2} + c$
10. $\frac{\operatorname{sen}^5 x}{5} + c$ 11. $\frac{1}{4}\sec^4 x + c$ 12. $-2 \ln |\cos x| - 5x + c$

13. $\frac{1}{2} \sin 2e^x + c$

14. $\frac{1}{4} \sin x^2 + c$

15. $\frac{-1}{5} \cos(5\theta - \pi) + c$

16. $\frac{1}{4} (\arcsen y)^2 + c$

17. $\frac{2}{b} \ln |a + b \operatorname{tg} \theta| + c$

18. $\frac{1}{4} \operatorname{arc} \operatorname{tg} \frac{x}{4} + c$

19. $\frac{1}{2-y} + c$

20. $\frac{3}{4} \sin^{4/3} \theta + c$

21. $(\ln x)^2 + c$

22. $\frac{\sinh 2a x}{a} + 2x + c$

23. $\frac{1}{9} (3t^2 + 1)^{3/2} + c$

24. $\frac{2}{3} \operatorname{arc} \operatorname{tg} \frac{2(x + 5/2)}{3} + c$

25. $\frac{-\sqrt{3}}{2} \ln \left| \frac{x + \sqrt{3} - 2}{\sqrt{3} + 2 - x} \right| + c$

26. $\frac{1}{4} \operatorname{arc} \operatorname{tg} \frac{e^x}{4} + c$

27. $2\sqrt{x+3} - 2 \ln \left| \frac{2 + \sqrt{x+3}}{2 - \sqrt{x+3}} \right| + c$

28. $\frac{-3}{\ln 3x} + c$

29. $\frac{-1}{4} \cos 4x + x + c$

30. $\frac{2^{x^2}}{\ln 2} + c$

31. $\frac{1}{6} e^{3x^2} + c$

32. $\frac{-1}{2+t} + c$

33. $\ln |\ln t| + c$

34. $\frac{-4}{3} (1 - 2x^2)^{3/2} + c$

35. $\frac{1}{12} (e^{2x} + 2)^6 + c$

36. $\sqrt{4t^2 + 5} + c$

37. $-\ln|3 - \sin x| + c$

38. $\frac{-1}{2(1 + \sqrt{v})^4} + c$

39. $\frac{2}{7} (1+x)^3 \sqrt{1+x} - \frac{4}{5} (1+x)^2 \sqrt{1+x} + \frac{2}{3} (1+x) \sqrt{1+x} + c$

40. $\frac{-1}{5} e^{-x^5} + c$

41. $\frac{1}{2} \sin t^2 + c$

42. $\frac{8}{27} (6x^3 + 5)^{3/2} + c$

43. $\frac{1}{3} (\sin 2\theta)^{3/2} + c$

44. $\frac{1}{5} \operatorname{tg}(5x + 3) + c$

45. $\frac{-1}{2(5 - \cos \theta)^2} + c$

46. $\ln |\sin u| + c$

47. $-\frac{2}{5a} (1 + e^{-at})^{5/2} + c$

48. $2 \sin \sqrt{x} + c$

49. $\frac{2}{5} (t-4)^2 \sqrt{t-4} + \frac{8}{3} (t-4) \sqrt{t-4} + c$

50. $\frac{-1}{6} \cos 2x^3 + x^4 + c$

Seção 6.6

1. $\frac{-x}{5} \cos 5x + \frac{1}{25} \sin 5x + x$

2. $(x-1) \ln(1-x) - x + c$

3. $\frac{e^{4t}}{4} \left(t - \frac{1}{4}\right) + c$

4. $\frac{(x+1)}{2} \sin 2x + \frac{1}{4} \cos 2x + c$

5. $\frac{x^2}{2} \left[\ln 3x - \frac{1}{2} \right] + c$

6. $\cos^2 x \sin x + \frac{2 \sin^3 x}{3} + c$

7. $\frac{2}{5} e^x \left[\sin \frac{x}{2} + 2 \cos \frac{x}{2} \right] + c$

8. $\frac{2}{3} x \sqrt{x} \ln x - \frac{4}{9} x \sqrt{x} + c$

9. $-\frac{1}{2} \operatorname{cosec} x \cotg x + \frac{1}{2} \ln |\operatorname{cosec} x - \cotg x| + c$

10. $\frac{x^2}{a} \sin ax + \frac{2x}{a^2} \cos ax - \frac{2}{a^3} \sin ax + c$

11. $-x \cotg x + \ln |\sin x| + c$

12. $x \operatorname{arc} \cotg 2x + \frac{1}{4} \ln (1 + 4x^2) + c$

13. $\frac{be^{ax}}{a^2 + b^2} \left[-\cos bx + \frac{a}{b} \sin bx \right] + c$

14. $\frac{2}{a} \sqrt{ax+b} [\ln(ax+b) - 2] + c$

15. $-\frac{x^2}{3} (1-x^2) \sqrt{1-x^2} - \frac{2}{15} (1-x^2)^2 \sqrt{1-x^2} + c$

16. $x [\ln^3 2x - 3 \ln^2 2x + 6 \ln 2x - 6] + c$

17. $x \operatorname{arc} \operatorname{tg} ax - \frac{1}{2a} \ln (1 + a^2 x^2) + c$

18. $-\frac{x^3}{4} \cos 4x + \frac{3}{16} x^2 \sin 4x + \frac{3x}{32} \cos 4x - \frac{3}{128} \sin 4x + c$

19. $-x e^{-x} + c$

20. $\frac{x^3}{3} \left[\ln x - \frac{1}{3} \right] + c$

21. $e^x [x^2 - 2x + 2] + c$

22. $x \operatorname{arc} \operatorname{sen} \frac{x}{2} + \sqrt{4-x^2} + c$

23. $(x-1) \operatorname{tg} x + \ln |\cos x| + c$

24. $\frac{4}{25} \left[e^{3x} \sin 4x + \frac{3}{4} e^{3x} \cos 4x \right] + c$

25. $\frac{x^{n+1}}{n+1} \left[\ln x - \frac{1}{n+1} \right] + c$

26. $x \ln (x^2 + 1) - 2x + 2 \operatorname{arc} \operatorname{tg} x + c$

27. $x \ln (x + \sqrt{1+x^2}) - \sqrt{1+x^2} + c$

28. $\frac{x^2}{2} \operatorname{arc} \operatorname{tg} x - \frac{1}{2} x + \frac{1}{2} \operatorname{arc} \operatorname{tg} x + c$

29. $e^{x^2} \left[\frac{x^4}{4} - x^2 + 1 \right] + c$

30. $\frac{1}{4} \left[x^2 + x \sin 2x + \frac{1}{2} \cos 2x \right] + c$

31. $e^x [x^2 + 4x + 5] + c$

32. $\frac{2}{3} x(x+1) \sqrt{x+1} - \frac{4}{15} (x+1)^2 \sqrt{x+1} + c$

438 Cálculo A – Funções, limite, derivação e integração

33. $\frac{1}{2}x \cos(\ln x) + \frac{1}{2}x \sin(\ln x) + c$

34. $x \arccos x - \sqrt{1-x^2} + c$

35. $\frac{1}{2}[\sec x \operatorname{tg} x + \ln |\sec x + \operatorname{tg} x|] + c$

36. $-\frac{1}{x} e^{1/x} + e^{1/x} + c$

Seção 6.11

1. a) 8

b) $\frac{23}{3}$

c) $-1/6$

d) 43

3. $-\frac{5}{7}$

4. $-\frac{\pi}{4}$

5. a) positivo;

b) nulo;

c) positivo;

d) negativo.

6. a) $\sqrt{x+4}$

b) $\frac{2y}{y^2+9}$

c) $\theta \sin \theta$

7. a) 9

b) 4

c) 2

d) $-1/2$

e) 4

f) 4

11. a) 15 ; 20

b) 0 ; 192

c) 0 ; 9

d) 0 ; 720

12. $\frac{81}{10}$

13. 48

14. $\frac{31}{160}$

15. $\frac{844}{5}$

16. $2/3$

17. 0

18. $\frac{2\sqrt{2}}{3} [\sqrt{5} - 2]$

19. 4

20. 25

21. $\frac{17}{3}$

22. $4 \ln 3$

23. $2/15$

24. $\frac{26}{3}$

25. $\frac{5}{36}$

26. $\frac{116}{15}$

27. $\frac{\pi}{4}$

28. $\frac{15}{64}$

29. 2

30. $2\sqrt{2} + \frac{8\sqrt{5}}{3}$

31. $\frac{31}{2} - 5 \ln 2$

32. $2 \ln 2 - 3/4$

33. $9/2$

34. $-\frac{16}{3}$

36. a) 0

b) 0

c) $\frac{16}{15}$

Seção 6.13

1. $1/3$

2. $4/3$

3. $9/2$

4. 48

5. $\frac{32}{3}$

6. $1/6$

7. $115/6$

8. $1/2$

9. $e - 1$

10. $1/2$

11. $8 \ln 2 - 3$

12. $e^4 - 5$

13. 8

14. 8

15. $e - \frac{1}{e}$

16. $\frac{1}{2} \left[\frac{\pi}{2} - \ln 2 \right]$

17. $e - 3/2$

18. $\frac{1}{8} (\pi^2 + 8\pi - 8)$

19. $32/3$

20. $\frac{\sqrt{3}}{2} - \frac{5\pi}{24} + 1$

21. $\ln 12$

22. $4/3$

23. 72

24. $\frac{125}{6}$

25. $2 \left[8 - \frac{3}{\ln 2} \right]$

26. 1

27. $4 [e - 1/e]$

28. $7/3$

29. $e - 3/2$

30. $\ln 2 ; 16 (1 + 2 \ln 2)$

Seção 6.15

2. a) 0

b) $\frac{7}{2}$

c) 9

3. a) $\frac{\pi}{2}$

b) $\ln 3 + \frac{26}{3}$

c) $\ln \sqrt{2} - \frac{\sqrt{2}}{6}$

4. 1 u.a.

5. Converge e é igual a $\frac{1}{2}$.

7. Converge; $\frac{1}{5}$.

9. $\frac{1}{2}$ u.a.

10. $\frac{1}{2}$ u.a.

11. 1.200 milhares de barris.

12 a) Converge; 1

b) Converge; $-\frac{1}{2}$

c) Diverge

d) Converge; $\frac{\pi}{3}$

e) Converge; e

f) Diverge

g) Converge; 1

h) Converge; 0

13. 4 u.a.

14. a) Converge; 2

b) Diverge

c) Converge; $\frac{\pi}{2}$

d) Converge; 5

e) Diverge

f) Converge; 2

g) Diverge

16. $n \geq 0$.

Capítulo 7

Seção 7.4

1. $-2 \cos \sqrt{x} + c$

2. $\sin(\sin x) + c$

3. $-2 \cos x + c$

4. $\frac{1}{2} \ln |\sec(x^2 + 1)| + c$

5. $-\ln |\sin 1/x| + c$

6. $\ln |\sec(x+1) + \tan(x+1)| + c$

7. $\frac{-1}{w} \cos(wt + \theta) + c$

8. $\frac{1}{2} \ln |\operatorname{cosec} x^2 - \cotg x^2| + c$

9. $\ln |\sec(\sin x)| + c$

10. $-\frac{1}{2} \cos(2x+1) + \frac{1}{6} \cos^3(2x+1) + c$

11. $\frac{-1}{3} \sin(3-3x) + \frac{2}{9} \sin^3(3-3x) - \frac{1}{15} \sin^5(3-3x) + c$

12. $-\frac{1}{4} \sin^3(x^2-1) \cos(x^2-1) - \frac{3}{8} \sin(x^2-1) \cos(x^2-1) + \frac{3}{8} (x^2-1) + c$

13. $\frac{1}{4} (e^{2x} - 1) + \frac{1}{8} \sin(2e^{2x} - 2) + c$

14. $\frac{-1}{10} \cos^5 2\theta + \frac{1}{14} \cos^7 2\theta + c$

15. $-\frac{1}{8} \sin^4(1-2\theta) + \frac{1}{12} \sin^6(1-2\theta) + c$

16. $\frac{1}{20} \sin^{20}(t-1) + c$

17. $\frac{1}{2} \operatorname{tg}^2(\ln \theta) + \ln |\cos(\ln \theta)| + c$

18. $\frac{1}{4} \sin^4 x + c$

19. $\frac{1}{4} \cos^3 x \sin x + \frac{3}{8} \cos x \sin x + \frac{3}{8} x + c$

20. $\frac{1}{3} \operatorname{tg}^3 x - \operatorname{tg} x + x + c$

21. $\frac{1}{3} \operatorname{tg}^3 x + c$

22. $-15 \cos x + 10 \cos^3 x - 3 \cos^5 x + c$

23. $5 \sin^3 x - 3 \sin^5 x + c$

24. $2 \cos^3 x \sin x - 8 \cos^5 x \sin x + 3 \sin x \cos x + 3x + c$

25. $\frac{1}{18} \cos^5 3x \sin 3x + \frac{5}{72} \cos^3 3x \sin 3x + \frac{5}{48} \cos 3x \sin x + \frac{5}{16} x + c$

26. $\cotg^3 x + c$

27. $\frac{-1}{16} \cos 8x + \frac{1}{4} \cos 2x + c$

28. $\frac{1}{5} \operatorname{tg} 5x - x + c$

29. $\frac{1}{2} t \cos \theta - \frac{1}{4w} \sin(2wt + \theta) + c$

30. $\frac{-1}{3 \sin^3 x} + \frac{1}{\sin x} + c$

31. $\frac{1}{8} t - \frac{1}{32} \sin 4t + c$

32. $\frac{1}{2} \operatorname{tg}^2 \sqrt{x^2 - 1} + \ln |\cos \sqrt{x^2 - 1}| + c$

33. $-\frac{1}{8} \sec(1 - 4x) \operatorname{tg}(1 - 4x) - \frac{1}{8} \ln |\sec(1 - 4x) + \operatorname{tg}(1 - 4x)| + c$

34. $\frac{1}{2} \cotg(3 - 2x) + \frac{1}{6} \cotg^3(3 - 2x) + c$

35. $-\frac{1}{6} \cotg^3(x^2 - 1) + c$

38. 2 u.a.

39. 8 u.a.

40. $\left[\frac{\pi}{4} - \frac{1}{2} + \frac{1}{2} \ln 2 \right] \text{ u.a.}$

41. $\frac{5}{16} \pi \text{ u.a.}$

42. $\frac{5}{16} \pi \text{ u.a.}$

43. $\frac{4}{3} \text{ u.a.}$

44. 1 u.a.

45. $\frac{1}{5} \frac{\sqrt{x^2 - 5}}{x} + c$

46. $\frac{1}{4} \operatorname{arc} \operatorname{sen} \frac{4t}{3} + c$

47. $\left(\frac{1}{3} x^2 + 6 \right) \sqrt{x^2 - 9} + c$

48. $\frac{1}{4} t(1 - 4t^2) \sqrt{1 - 4t^2} + \frac{3}{16} \operatorname{arc} \operatorname{sen} 2t + \frac{3}{8} t \sqrt{1 - 4t^2} + c$

49. $2 \operatorname{arc} \operatorname{sen} \frac{x}{2} + \frac{x\sqrt{4 - x^2}}{2} - \frac{x(4 - x^2)\sqrt{4 - x^2}}{4} + c$

50. $\frac{1}{5} \sqrt{(x^2 + 3)^5} - \sqrt{(x^2 + 3)^3} + c$

51. $\frac{-5\sqrt{1+x^2}}{x} - \frac{2\sqrt{1+x^2}}{x^2} - 2 \ln \left| \frac{\sqrt{1+x^2}-1}{x} \right| + c$

52. $\frac{1}{4} x(x^2 + 1) \sqrt{x^2 + 1} + \frac{3}{8} x \sqrt{x^2 + 1} + \frac{2}{3} (x^2 + 1) \sqrt{x^2 + 1} + \frac{3}{8} \ln \left| \sqrt{x^2 + 1} + x \right|$

53. $\frac{1}{5} (t^2 + 16)^2 \sqrt{t^2 + 16} + \frac{32}{3} (t^2 + 16) \sqrt{t^2 + 16} + 256 \sqrt{t^2 + 16} + c$

442 Cálculo A – Funções, limite, derivação e integração

54. $\ln |\sqrt{e^{2x} + 1} + e^x| + C$

56. $\arcsen\left(\frac{e^x}{2}\right) + C$

58. $\ln |x + \sqrt{x^2 - 1}| - \frac{\sqrt{x^2 - 1}}{x} + c$

60. $-\sqrt{4 - x^2} + \arcsen \frac{x}{2} + c$

62. $\sqrt{x^2 + 2x} + 2\ln |x + 1 + \sqrt{x^2 + 2x}| + c$

63. $2 \arcsen \frac{x}{2} + \frac{x\sqrt{4 - x^2}}{2} + c$

65. $\frac{x\sqrt{4 + x^2}}{2} - 2 \ln |\sqrt{4 + x^2} + x| + c$

66. $\frac{1}{2}x\sqrt{1 + x^2} + x^2 + \frac{1}{2} \ln |x + \sqrt{1 + x^2}| + c$

67. $-\cos x + \frac{1}{2}x\sqrt{1 + x^2} - \frac{1}{2} \ln |\sqrt{1 + x^2} + x| + c$

68. $\frac{1}{\sqrt{3}} \ln \left(\frac{\sqrt{3} + \sqrt{5}}{\sqrt{2}} \right)$

69. $\frac{a^2}{b} \left(\frac{\pi}{12} + \frac{\sqrt{3}}{8} \right)$

72. $\frac{1}{9} \left(\frac{\sqrt{27}}{6} - \frac{4}{5} \right)$

75. Diverge

55. $\arcsen\left(\frac{x}{\sqrt{2}}\right) - \frac{1}{2}x\sqrt{2 - x^2} + C$

57. $\sqrt{x^2 - 1} + \ln |x + \sqrt{x^2 - 1}| + c$

59. $\frac{-\sqrt{1 + x^2}}{2x^2} + \frac{1}{2} \ln \left| \frac{\sqrt{1 + x^2} - 1}{x} \right| + c$

61. $\frac{2}{3}\sqrt{9x^2 + 1} + \frac{5}{3} \ln |\sqrt{9x^2 + 1} + 3x| + c$

64. $\frac{x\sqrt{x^2 - 4}}{2} - 2 \ln |x + \sqrt{x^2 - 4}| + c$

70. $\frac{1}{48}(\sqrt{2} + 2\sqrt{5})$

73. $\frac{\sqrt{91}}{90}$

76. $\frac{\ln(\sqrt{5} + 2)}{2}$

71. $-\frac{1}{16} \left(\sqrt{\frac{43}{3}} - \sqrt{17} \right)$

74. Diverge

Seção 7.6

1. $x^2 - 2x + 2 \ln |x + 1| + c$

2. $\frac{2}{5} \ln \left| x - \frac{1}{2} \right| + \frac{3}{5} \ln |x + 2| + c$

3. $\frac{1}{12} \ln |x - 2| + \frac{2}{3} \ln |x + 1| - \frac{3}{4} \ln |x + 2| + c$

4. $\frac{3}{2} \ln |x - 1| + \frac{1}{2} \ln |x + 1| - \frac{1}{2} \ln \left| x - \frac{1}{2} \right| + c$

5. $x + 7 \ln |x - 1| - \frac{10}{x - 1} + c$

6. $3 \ln \left| \frac{x - 2}{x - 3} \right| - \frac{1}{x - 2} - \frac{2}{x - 3} + c$

7. $\ln \left(\frac{x - 2}{x - 1} \right)^2 + \frac{1}{x - 2} - \frac{5}{2(x - 2)^2} + c$

8. $\frac{1}{16} \ln \left| \frac{x-4}{x} \right| + \frac{1}{4x} + c$ 9. $\frac{x^2}{4} + x - \frac{1}{4} \ln(x^2 + 1) + \arctan x + c$
10. $\frac{5}{4} \left[\ln|x| - \frac{1}{2} \ln(x^2 + 4) \right] + c$ 11. $\frac{3}{2} \ln|x^2 - x + 1| + \frac{1}{\sqrt{3}} \arctan \frac{2x-1}{\sqrt{3}} + c$
12. $\frac{1}{12} \ln|x+2| - \frac{1}{24} \ln|x^2 - 2x + 4| + \frac{1}{4\sqrt{3}} \arctan \frac{x-1}{\sqrt{3}} + c$
13. $\frac{-x-2}{2(x^2+2x+3)} - \frac{1}{2\sqrt{2}} \arctan \frac{x+1}{\sqrt{2}} + c$
14. $\ln|x| - \frac{1}{2} \ln|x^2 - x + 1| + \frac{5\sqrt{3}}{9} \arctan \frac{2x-1}{\sqrt{3}} + \frac{x+1}{3(x^2-x+1)} + c$
15. $4x + \frac{4}{9} \ln|x+1| - 4 \ln|x+2| + \frac{68}{9} \ln|x-2| - \frac{16}{3(x-2)} + c$
16. $\frac{1}{3}x + \frac{1}{10} \ln \left| x - \frac{1}{2} \right| - \frac{2}{45} \ln \left| x + \frac{1}{3} \right| + c$
17. $\frac{1}{9} \left[\ln|x| - \frac{1}{2} \ln(x^2 + 9) \right] + c$ 18. $\frac{1}{3} \arctan x - \frac{1}{6} \arctan \frac{x}{2} + c$
19. $x + \frac{5}{3} \ln|x-1| - \frac{1}{3} \ln|x^2 + x + 1| + c$ 20. $\frac{1}{2} \ln(x^2 + 2) + \frac{1}{x^2 + 2} + c$
21. $\ln \left| \frac{x-1}{x} \right| + \frac{1}{x-1} - \frac{1}{2(x-1)^2} + c$ 22. $\frac{1}{4} \left(\frac{1}{x+1} - \frac{1}{x-1} \right) + c$
23. $\ln|x-1| - \frac{1}{x-1} - \frac{1}{2} \ln(x^2 + 1) - \arctan x + c$
25. $\frac{4}{3} \ln 2$ u.a. 26. $\frac{1}{2} \left[\arctan \frac{3}{2} - \arctan \left(-\frac{1}{2} \right) \right]$ u.a.
27. $\left[\frac{2}{25} \ln 4 + \frac{3}{20} \right]$ u.a. 28. $\left[\frac{\sqrt{3}}{9} \arctan \frac{2}{\sqrt{3}} + \frac{2}{21} \right]$ u.a.
29. a) $\frac{\ln 2}{25} - \frac{1}{50}$ b) Diverge c) Diverge
30. $\frac{\pi}{2}$.

Seção 7.9

1. $\frac{1}{4} \operatorname{tg}^2 \frac{x}{2} + \operatorname{tg} \frac{x}{2} + \frac{1}{2} \ln \left| \operatorname{tg} \frac{x}{2} \right| + c$ 2. $\ln \left| \operatorname{tg} \frac{x}{2} + 1 \right| + c$
3. $\ln \left| \operatorname{tg} \frac{x}{2} \right| - \frac{1}{2} \operatorname{tg}^2 \frac{x}{2} + c$ 4. $\frac{1}{3} \ln \left| \frac{\operatorname{tg} \frac{x}{2} + 3}{\operatorname{tg} \frac{x}{2} - 3} \right| + c$

444 Cálculo A – Funções, limite, derivação e integração

$$5. \frac{\sqrt{2}}{2} \arctan \left(\frac{\operatorname{tg} \frac{x}{2}}{\sqrt{2}} \right) + c$$

$$6. \frac{-1}{\operatorname{tg} \frac{x}{2}} + c$$

$$7. -2 \ln \left| \operatorname{tg} \frac{x}{2} - 1 \right| - \frac{2}{\operatorname{tg} \frac{x}{2} - 1} + \ln \left(\operatorname{tg}^2 \frac{x}{2} + 1 \right) + c$$

$$8. \frac{\sqrt{2}}{4} \arctan \left(\frac{3 \operatorname{tg} x + 1}{2\sqrt{2}} \right) + c$$

$$9. -\arctan \left(\operatorname{tg} \frac{2t-1}{2} \right) + \frac{2}{\sqrt{3}} \arctan \left(\sqrt{3} \operatorname{tg} \frac{2t-1}{2} \right) + c$$

$$10. \frac{2}{\sqrt{7}} \arctan \left[\frac{2 \operatorname{tg} \frac{t}{2} + 1}{\sqrt{7}} \right] + c$$

$$11. \frac{1}{5} \ln \left| \frac{\operatorname{tg} \frac{e^x}{2} - \frac{1}{3}}{\operatorname{tg} \frac{e^x}{2} + 3} \right| + c$$

$$12. -\operatorname{tg} \frac{\theta}{2} + 2 \arctan \left(\operatorname{tg} \frac{\theta}{2} \right) + c$$

$$13. \frac{1}{\sqrt{2}} \ln \left| \frac{\operatorname{tg} \frac{x}{2} - 1 + \sqrt{2}}{\operatorname{tg} \frac{x}{2} - 1 - \sqrt{2}} \right| + c$$

$$14. \frac{2}{\sqrt{14}} \arctan \left(\frac{3 \operatorname{tg} \frac{\theta}{2} - 1}{\sqrt{14}} \right) + c$$

$$15. \frac{\pi\sqrt{3}}{9} \text{ u.a.}$$

$$16. \frac{2\sqrt{3}}{9} \pi \text{ u.a.}$$

$$17. -\sqrt{\frac{2}{3}} \arctan \sqrt{\frac{2(3-x)}{3(x-2)}} + c$$

$$18. \frac{1}{3} \ln \left| \frac{\sqrt{x^2 + 4x + 9} - x - 7}{\sqrt{x^2 + 4x + 9} - x - 1} \right| + c$$

$$19. \frac{2}{\sqrt{3}} \arctan \left(\frac{\sqrt{4x^2 + x - 3} - 2x}{\sqrt{3}} \right) + c$$

$$20. -\ln |1 - 2\sqrt{1+x+x^2} + 2x| + c$$

$$21. \frac{1}{\sqrt{2}} \ln \left| 1 - \frac{2\sqrt{2}(\sqrt{2+x-x^2} - \sqrt{2})}{x} \right| + c$$

$$22. \frac{-1}{\sqrt{2x+x^2-x}} - \frac{1}{\sqrt{2x+x^2-x-2}} + c$$

$$23. \arctan \left(\frac{\sqrt{x^2 - 2x - 3} - x + 1}{2} \right) + c$$

$$24. \frac{1}{4} \ln \left| \frac{\sqrt{1+x+x^2} - x + 1}{\sqrt{1+x+x^2} - x - 1} \right| - \frac{3}{2(\sqrt{1+x+x^2} - x + 1)} + c$$

$$25. \frac{1}{4} \ln \left| \frac{x+1+\sqrt{x^2+3x+2}}{x+1-\sqrt{x^2+3x+2}} \right| + c$$

$$26. -\ln |\sqrt{x^2+2x-3} - x - 1| + c$$

$$27. \arctan (2\sqrt{x^2+x-2x-1}) + c$$

$$28. \frac{-1}{3} \ln |2 - \sqrt{9x^2+12x+5} + 3x| + c$$

$$29. \frac{1}{2} \ln \left| \frac{2\sqrt{x^2-x+5/4} - 2x-1}{2\sqrt{x^2-x+5/4} - 2x+3} \right| + c$$

$$30. \frac{2}{\sqrt{3}} \operatorname{arc} \operatorname{tg} \left(\frac{\sqrt{x^2 + x - 3} - x}{\sqrt{3}} \right) + c$$

$$31. \operatorname{arc} \operatorname{tg} \left(\frac{\sqrt{x^2 - 4x - 4} - x}{2} \right) + c$$

$$32. -\frac{1}{2} \frac{1}{\sqrt{x^2 + 2x - x - 1}} + \frac{1}{2} (\sqrt{x^2 + 2x} - x) - 2 \ln |\sqrt{x^2 + 2x} - x - 1| + c$$

$$33. -2 \operatorname{arctg} \left(\frac{\sqrt{3 - 2x - x^2} - \sqrt{3}}{x} \right) + c$$

Capítulo 8

Seção 8.4

$$1. 4\sqrt{26} \text{ u.c.}$$

$$2. \frac{1}{27} \left[(9 \cdot 2^{2/3} + 4)^{3/2} - 13\sqrt{13} \right] \text{ u.c.}$$

$$3. 12 \text{ u.c.}$$

$$4. 12 \text{ u.c.}$$

$$5. \frac{123}{32} \text{ u.c.}$$

$$6. \frac{53}{6} \text{ u.c.}$$

$$7. \sinh 1 \text{ u.c.}$$

$$8. 1 + \frac{1}{2} \ln \frac{3}{2} \text{ u.c.}$$

$$9. \ln \left| \frac{\sqrt{2} - 1}{2 - \sqrt{3}} \right| \text{ u.c.}$$

$$10. \frac{8}{27} (10\sqrt{10} - 1) \text{ u.c.}$$

$$11. \frac{1}{54} (37\sqrt{37} - 1) \text{ u.c.}$$

$$12. (54\sqrt{2} - 17\sqrt{17}) \text{ u.c.}$$

$$13. \frac{80\sqrt{10} - 13\sqrt{13}}{27} \text{ u.c.}$$

$$14. \frac{8}{27} (10\sqrt{10} - 1) \text{ u.c.}$$

$$15. \int_0^2 \sqrt{1 + 4x^2} dx$$

$$16. \int_{1/4}^4 \frac{\sqrt{x^4 + 1}}{x^2} dx$$

$$17. \int_{-2\sqrt{2}}^{2\sqrt{2}} \sqrt{\frac{1 + 2y^2}{1 + y^2}} dy$$

$$18. \int_0^2 \sqrt{1 + e^{2x}} dx$$

$$19. \int_0^1 \sqrt{4x^2 + 8x + 5} dx$$

$$20. \int_2^4 \sqrt{1 + \frac{1}{4x}} dx$$

$$21. \int_0^{2\pi} \sqrt{1 + 9 \cos^2 3x} dx$$

$$22. \frac{1}{27} (85\sqrt{85} - 13\sqrt{13}) \text{ u.c.}$$

$$23. 8 \text{ u.c.}$$

$$24. 2\pi \text{ u.c.}$$

$$25. \left[\frac{\pi}{2} \sqrt{1 + \pi^2} + \frac{1}{2} \ln (\pi + \sqrt{1 + \pi^2}) \right] \text{ u.c.}$$

$$26. 2\sqrt{10} \text{ u.c.}$$

$$27. \frac{1}{3} (5\sqrt{5} - 1) \text{ u.c.}$$

$$28. \sqrt{2}(e^2 - e) \text{ u.c.}$$

$$29. \frac{\pi^2}{4} \text{ u.c.}$$

$$30. 24 \text{ u.c.}$$

$$31. 2a\pi \text{ u.c.}$$

$$32. \frac{7}{2} \pi \text{ u.c.}$$

$$33. \frac{1}{2} \pi \text{ u.a.}$$

$$34. \frac{5\pi}{2} \text{ u.a.}$$

$$35. \frac{1}{6} \text{ u.a.}$$

$$36. \left(\frac{4\pi}{3} - \sqrt{3} \right) \text{ u.a.}$$

$$37. 3\pi \text{ u.a.}$$

446 Cálculo A – Funções, limite, derivação e integração

38. $\left(\pi - \frac{3}{2}\sqrt{3}\right) \text{ u.a.}$

39. $7\pi \text{ u.a.}$

40. $\frac{144 - 27\pi}{32} \text{ u.a.}$

41. $6\pi \text{ u.a.}$

42. $3\pi k^2 \text{ u.a.}$

Seção 8.7

1. $\frac{26\pi}{3} \text{ u.v.}$

2. $\frac{206}{15}\pi \text{ u.v.}$

3. $\frac{2}{35}\pi \text{ u.v.}$

4. $\frac{\pi}{2} \text{ u.v.}$

5. $\frac{2}{7}\pi \text{ u.v.}$

6. $\frac{\pi}{2}\left(e^4 - \frac{1}{e^2}\right) \text{ u.v.}$

7. $\frac{\pi}{10} \text{ u.v.}$

8. $\frac{397}{15}\pi \text{ u.v.}$

9. $\frac{15\pi}{4} \text{ u.v.}$

10. $\frac{95}{2}\pi^2 \text{ u.v.}$

11. $\frac{172}{2}\pi \text{ u.v.}$

12. $\frac{8}{5}\pi \text{ u.v.}$

13. $\frac{152}{15}\pi \text{ u.v.}$

14. $\frac{16}{3}\pi \text{ u.v.}$

15. $\frac{3}{2}\pi \text{ u.v.}$

16. $\frac{2.304}{5}\pi \text{ u.v.}; \frac{1.024}{7}\pi \text{ u.v.}; 64\pi \text{ u.v.}$

17. $\frac{8}{3}\pi \text{ u.v.}$

18. $\frac{412}{15}\pi \text{ u.v.}$

19. $\frac{412}{15}\pi \text{ u.v.}$

20. $9\pi^2 \text{ u.v.}$

21. $\left(\frac{4}{3}\pi - \frac{3}{32}\pi^2\right) \text{ u.v.}$

22. $\frac{\pi}{54}(577\sqrt{577} - 1) \text{ u.a.}$

23. $\frac{\pi}{6}(17\sqrt{17} - 5\sqrt{5}) \text{ u.a.}$

24. $53,226 \text{ u.a.}$

25. $4\sqrt{5}\pi \text{ u.a.}$

26. $4\pi \text{ u.a.}$

27. $48\pi \text{ u.a.}$

28. $\frac{8\pi}{3}(28\sqrt{7} - 3\sqrt{6}) \text{ u.a.}$

29. a) $16\sqrt{17}\pi \text{ u.a.}$

b) $4\sqrt{17}\pi \text{ u.a.}$

Seção 8.11

2. a) $\left(-2, \frac{5\pi}{4}\right); \left(2, \frac{-7\pi}{4}\right)$

b) $\left(-\sqrt{2}, -\frac{4\pi}{3}\right); \left(\sqrt{2}, \frac{5\pi}{3}\right)$

c) $\left(5, \frac{5\pi}{3}\right); \left(-5, \frac{-4\pi}{3}\right)$

d) $\left(-4, \frac{11\pi}{6}\right); \left(4, \frac{-7\pi}{6}\right)$

3. a) $\left(\frac{3}{2}, \frac{3\sqrt{3}}{2}\right)$

b) $\left(-\frac{3}{2}, -\frac{3\sqrt{3}}{2}\right)$

c) $\left(\frac{3}{2}, -\frac{3\sqrt{3}}{2}\right)$

d) $\left(-\frac{3}{2}, \frac{3\sqrt{3}}{2}\right)$

4. a) $(1, -\sqrt{3})$

b) $(-1, 5307; 3, 6955)$

c) $\left(\frac{-3\sqrt{2}}{2}, \frac{-3\sqrt{2}}{2}\right)$

d) $(0, -10)$

e) $(0, 10)$

f) $(1, 0)$

5. a) $\left(\sqrt{2}; \frac{\pi}{4}\right)$

b) $\left(\sqrt{2}, \frac{3\pi}{4}\right)$

c) $\left(\sqrt{2}, \frac{5\pi}{4}\right)$

d) $\left(\sqrt{2}, \frac{7\pi}{4}\right)$

6. a) $P_1\left(2, \frac{11\pi}{6}\right); P_2\left(2, \frac{5\pi}{4}\right)$

b) $P_1\left(-2, \frac{5\pi}{6}\right); P_2\left(-2, \frac{\pi}{4}\right)$

c) $P_1\left(2, \frac{-\pi}{6}\right); P_2\left(2, \frac{-3\pi}{4}\right)$

d) $P_1\left(-2, \frac{-7\pi}{6}\right); P_2\left(-2, \frac{-7\pi}{4}\right)$

7. a) $r = \pm 2$

b) $r \cos \theta = 4$

c) $r \sin \theta = 2$

d) $\theta = \frac{3\pi}{4} + k\pi, k \in \mathbb{Z}$

e) $r = 2 \cos \theta$

f) $r = 6 \sin \theta$

8. a) $x^2 + y^2 - x = 0$

b) $x^2 + y^2 - 2y = 0$

c) $x + y = 1$

d) $x^2 + y^2 = a^2$

33. $\sqrt{2}(e^{\pi/3} - 1)$ u.c.

34. 8 u.c.

35. $2a\pi$ u.c.

36. $\left[\frac{8}{27}(9 + \pi^2)^{3/2} - 8\right]$ u.c.

37. $\frac{\sqrt{5}}{2}(e^{3\pi} - 1)$ u.c.

38. 80 u.c.

39. $12 \int_0^{\pi/4} \frac{d\theta}{\sqrt{\cos 2\theta}}$

40. $18 \int_0^{\pi/6} \sqrt{9 \cos^2 3\theta + \sin^2 3\theta} d\theta$

41. $64 \int_0^{\pi/8} \sqrt{16 \sin^2 4\theta + \cos^2 4\theta} d\theta$

42. $12 \int_0^{\pi/4} \frac{d\theta}{\sqrt{\sin 2\theta}}$

43. $2 \int_0^{\pi} \sqrt{13 - 12 \cos \theta} d\theta$

44. $4 \int_{-\pi/2}^{\pi/2} \sqrt{5 - 4 \sin \theta} d\theta$

45. $2 \int_0^{\pi} \sqrt{13 + 12 \cos \theta} d\theta$

46. $4 \int_{-\pi/2}^{\pi/2} \sqrt{5 - 4 \sin \theta} d\theta$

47. 9 u.a.

48. $\frac{\pi}{4}$ u.a.

49. $\frac{9\pi}{2}$ u.a.

50. 16 u.a.

51. $\frac{9\pi}{2}$ u.a.

52. 11π u.a.

53. 24π u.a.

54. 24π u.a.

55. 24π u.a.

56. 24π u.a.

57. $\frac{a^2(\pi - 2)}{2}$ u.a.

58. 4π u.a.

59. $(32 - 4\pi)$ u.a.

60. $\frac{37\pi^3}{2.592}$ u.a.

61. $\left(\pi - \frac{3\sqrt{3}}{2}\right)$ u.a.

62. $(100\arccos 3/5 - 48)$ u.a.

63. a) $\left(\frac{3\pi}{2} - \frac{9\sqrt{3}}{8}\right)$ u.a.

b) $\frac{14\pi - 9\sqrt{3}}{8}$ u.a.

Seção 8.17

Observação. Nos exercícios que envolvem o centro de massa, é dada a sua posição sobre um eixo coordenado cuja origem coincide com a extremidade esquerda da barra.

1. 444 kg ; 7,62 cm

2. 54 kg ; 2,125 m

3. 10 kg; 3,75 m

4. $\frac{1}{b-a}$

5. $\frac{2}{3}$ kg; $\frac{3}{2}$ m

6. a) 1,8kg · m²

b) 7,2 kg · m²

7. 49,07 kg; 4 m

8. a) 443,73 kg · m²

b) 1.228,8 kg · m²

9. Para barra do ex.1:

a) 12.672 kg · cm²

b) 29.952 kg · cm²

c) 5.328 kg · cm²

Para barra do ex. 3:

a) 20,83 kg · m²

b) 145,83 kg · m²

c) 20,83 kg · m²

10. $\ln 5$ u.m.; $\left(\frac{4}{\ln 5} - 1\right)$ u.c.

11. 12 u.m.i.

12. $(e - 1)$ u.m.; $\frac{1}{e - 1}$ u.c.

13. $(e - 2)$ u.m.i.

14. 2,5 kg/m

15. a) 187,5 J b) 100 J

16. 216 J

17. 4.083,33 J

18. 1875 J

19. 63.549,36 J

20. a) 44.131,5 π J

b) 44.131,5 π J

21. 340.106,66 π J

22. 746.901,12 J

23. 117.684 N

24. 14.710,5 N

25. 167.372,8 u. força

26. 2×10^4 N

27. 588.420 N

28. 7.322.560 N

29. 2.615.200 N

30. 197.447,6 N

31. 12×10^3 N

32. 2.194,28 N

33. 312×10^2 N

34. R\$ 3,77

35. R\$ 2,24

36. R\$ 6,61 e R\$ 4,96

37. R\$ 494.189,36