

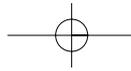
# Apêndice B

## 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)  $\phi$ ;      n)  $\phi$ ;      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;  $\neq$ ;  $\neq$ ; b) [2, 8]; c)  $-4t^2 - 16t - 7; [-7/2, -1/2]$ ; d) 9;  $\neq$

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

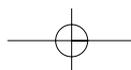
(c)  $\mathbb{R}, (-\infty, 0] \cup \{1\} \cup [4, +\infty)$

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:  $0$

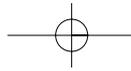
Intervalo de crescimento:  $(-\infty, +\infty)$

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

Conjunto imagem:  $\mathbb{R}$

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

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


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(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)  $\pm(x^2 - 3x + 5)$

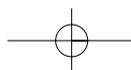
22.  $2e^{-3}; -2e^9$

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

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)  $P = 1$

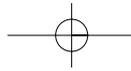
45.  $c(x) = 4x^2 + \frac{6}{10x}$

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.


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(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)  $-40\text{ °C} \approx -40\text{ °F}$

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.

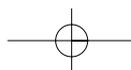
58. (a)  $M = M_0 e^{-0,0004279 t}$     (b) aproximadamente 74%

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)  $\neq$     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)  $\neq$     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

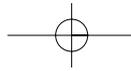
1. a) 2 b) 2 c) 2 d) 8 e) 8 f) 8
2. 4 3. a) 0 b) 0 c) 0
4. a) 2 b) 2 c) 2 5. b)  $1, -1$  e  $\neq$  7.  $\frac{\pi}{2}$  e  $\frac{-\pi}{2}$
9. a)  $-1$  b) 1 c) 0 d)  $-\infty$  e)  $\neq$  f) 0 g) 0 h) 0
10. a) 5 b) 10 c) 0 d) 10 e) 0

## 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.  $bla$  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



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- |                |               |                 |               |                     |
|----------------|---------------|-----------------|---------------|---------------------|
| 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. $+\infty$   |               |                     |

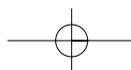
**Seção 3.16**

- |                           |                               |  |
|---------------------------|-------------------------------|--|
| 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. $alb$               | 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)  $-3e - 2$  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)  $16 + 2b + hm/s$

b)  $22,1m/s; 22,01m/s; 22,001m/s$

c)  $16 + 2tm/s$

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

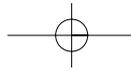
1.  $f'(3^+) = 2; f'(3^-) = -2$

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


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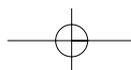
6. b) é contínua      c) 2; -2; 2; -2      d)  $f'(x) = \begin{cases} 2x, & \text{se } |x| < 1, \\ -2x, & \text{se } |x| > 1, \end{cases} D = \mathbb{R} - \{-1, 1\}$

**Seção 4.12**

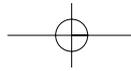
1.  $2\pi r$       2.  $6x + 6$       3.  $2aw$
4.  $\frac{3}{2x^4}$       5.  $18x^2 + 6x + 12$       6.  $14x + 27$
7.  $-27x^8 + 30x^4 + 4x^3$       8.  $\frac{-20}{(5x-3)^2}$       9.  $2x$
10.  $(s^2 - 1)(3s - 1)(15s^2 + 2) + 3(s^2 - 1)(5s^3 + 2s) + 2s(3s - 1)(5s^3 + 2s)$
11.  $7(2ax + b)$       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)  $-16 \text{ m}$       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.  $2t(2t + 1)^{t-1}\ln(2t + 1) + 2(2t + 1)^{t-2}(t^2 - 1)$       21.  $\frac{b(a + bs)^{\ln(a+bs)}\ln(a + bs)}{a + bs}$       22.  $\sin\left(\frac{\pi}{2} - u\right)$
23.  $4\cos^2\theta\cos 2\theta - 4\theta\sin 2\theta\sin \theta^2$       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.  $\frac{6x\sec^2x\operatorname{tg}x - 3\sec^2x}{x^2}$
27.  $e^{2x}(2\cos 3x - 3\sin 3x)$       28.  $6\theta^2\operatorname{cosec}^2\theta^3 \cdot \operatorname{cotg}\theta^3$       29.  $\frac{-ab\sin bx}{2\sqrt{\cos bx}}$
30.  $2u^2\sec^2u\operatorname{tg}u + 2u\operatorname{tg}^2u$       31.  $-a^{\operatorname{cotg}\theta}\ln a\operatorname{cosec}^2\theta$       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.  $\frac{x\operatorname{cotgh}x - \ln(\sinh x)}{x^2}$
38.  $\frac{-(t + 1)\operatorname{cosech}^2(t + 1)^2}{\sqrt{\operatorname{cotgh}(t + 1)^2}}$       39.  $\frac{3}{x^2}\left(\operatorname{cosech}\frac{3x + 1}{x}\right)^3\operatorname{cotgh}\left(\frac{3x + 1}{x}\right)$       40.  $\operatorname{arg}\cosh x$
41.  $\frac{2x^2}{1 - x^4} + \operatorname{arg}\operatorname{cotgh}x^2$       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.**  $\frac{1}{(s+1)^2} \left( \frac{s+1}{\sqrt{4-s^2}} - \operatorname{arcsen} \frac{s}{2} \right)$

**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.**  $\frac{2 \arg \operatorname{senh} x}{\sqrt{x^2+1}}$

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

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

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

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

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

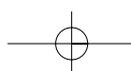
**81.**  $-1$

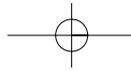
**82.**  $\frac{3+2\sqrt{3}}{6}$

**83.**  $1-x$

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

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.  $y^{viii} = -a^7 \cos ax$   
 10.  $y^v = \frac{1}{16} \operatorname{sen} \frac{x}{2}$  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)  $\operatorname{sen} x$  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)

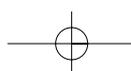
23. a)  $\frac{3}{2}t, t > 0$  b)  $-\cotg 2t, t \in (0, \pi/2)$  c)  $-4/3 \cotg t, t \in (\pi, 2\pi)$   
 d)  $-\operatorname{tg} t, t \in (-\pi/2, 0)$  e)  $\frac{3}{2}t^2, t \in \mathbb{R}$  f)  $-\operatorname{tg} t, t \in (0, \pi/2) \cup (\pi/2, \pi)$

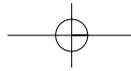
24.  $2y + 3x - 6\sqrt{2} = 0$  25.  $2\sqrt{3}x - 2y + \sqrt{3} = 0$ ;  $x + \sqrt{3}y - 1 = 0$

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<sup>3</sup>

33. 0,0044209

34. 11,3097 cm<sup>3</sup>

35. ±24.000 m<sup>2</sup>

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 ... °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 1/hora

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

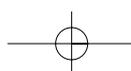
18. (a) 120

(b) 410

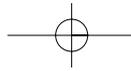
(c) 5,44; 1,2

 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


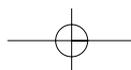


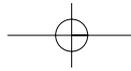

**432** Cálculo A – Funções, limite, derivação e integração

- h)  $\text{tgh } 2; \text{tgh } -2$                       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

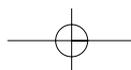




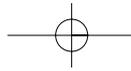
5.  $a/6$
6. raio da base  $\sqrt[3]{\frac{V}{2\pi}}$ ; altura  $\sqrt[3]{\frac{4V}{\pi}}$
7. 8 km do encontro da canalização  $l$  com a perpendicular que passa por  $A$ .
8. (a)  $q = 650$  (b)  $q \cong 82$  (c)  $q = 0$
9. (a)  $F$  representa o custo fixo  
 (b) O custo marginal decresce à medida 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.  $\infty$
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.  $\infty$
16. 1
17.  $\infty$
18. 0







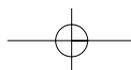
## Capítulo 6

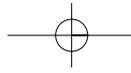
### Seção 6.2

11.  $x - \arctg x + c$       12.  $x - \frac{1}{x} + c$       13.  $\sec x + c$
14.  $3 \arcsen x + c$       15.  $2 \arccos x + c$
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.  $\frac{2^t}{\ln 2} - \sqrt{2} e^t + \operatorname{senht} + c$       23.  $\operatorname{sen} x + \operatorname{tg} x + c$       24.  $\frac{1}{a^2} \operatorname{arctg} x + c$
25.  $x - 2 \operatorname{arctg} x + c$       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.  $-2 \ln |\cos x| - 5x + c$




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

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

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

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

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.  $\frac{3}{4} \operatorname{sen}^{4/3} \theta + c$

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

22.  $\frac{\operatorname{senh} 2ax}{a} + 2x + c$

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.  $-\ln|3 - \operatorname{sen} x| + c$

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.  $\frac{1}{2} \operatorname{sen} t^2 + c$

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

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

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

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

46.  $\ln |\operatorname{sen} u| + c$

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

48.  $2 \operatorname{sen} \sqrt{x} + c$

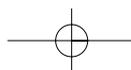
49.  $\frac{2}{5} (t-4)^2 \sqrt{t-4} + \frac{8}{3} (t-4) \sqrt{t-4} + c$

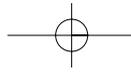
50.  $\frac{-1}{6} \cos 2x^3 + x^4 + c$

**Seção 6.6**

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

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





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

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

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

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

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

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

11.  $-x \cotg x + \ln |\operatorname{sen} x| + c$

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

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

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

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

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

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

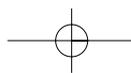
28.  $\frac{x^2}{2} \operatorname{arc} \operatorname{tg} x - \frac{1}{2} x + \frac{1}{2} \operatorname{arc} \operatorname{tg} x + c$

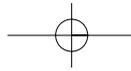
29.  $e^{x^2} \left[\frac{x^4}{4} - x^2 + 1\right] + c$

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

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

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





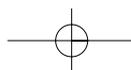
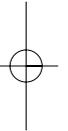
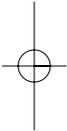
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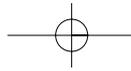
33.  $\frac{1}{2}x \cos(\ln x) + \frac{1}{2}x \sin(\ln x) + c$     34.  $x \arccos x - \sqrt{1-x^2} + c$

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) $\theta \operatorname{sen} \theta$ |
| 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.

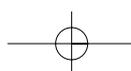
10.  $\frac{1}{2}$  u.a.

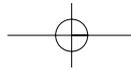
11. 1.200 milhares de barris.

12. a) Converge; 1

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

c) Diverge





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- d) Converge;  $\frac{\pi}{3}$
- e) Converge;  $e$
- f) Diverge
- g) Converge; 1
- h) Converge; 0

13. 4 u.a.

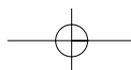
- 14. a) Converge; 2
- b) Diverge
- c) Converge;  $\frac{\pi}{2}$
- d) Converge; 5
- e) Diverge
- f) Converge; 2
- g) Diverge

16.  $n \geq 0$ .

## Capítulo 7

### Seção 7.4

- 1.  $-2 \cos \sqrt{x} + c$
- 2.  $\text{sen}(\text{sen } x) + c$
- 3.  $-2 \cos x + c$
- 4.  $\frac{1}{2} \ln |\sec(x^2 + 1)| + c$
- 5.  $-\ln |\text{sen } 1/x| + c$
- 6.  $\ln |\sec(x + 1) + \text{tg}(x + 1)| + c$
- 7.  $\frac{-1}{w} \cos(wt + \theta) + c$
- 8.  $\frac{1}{2} \ln |\text{cosec } x^2 - \text{cotg } x^2| + c$
- 9.  $\ln |\sec(\text{sen } x)| + c$
- 10.  $-\frac{1}{2} \cos(2x + 1) + \frac{1}{6} \cos^3(2x + 1) + c$
- 11.  $\frac{-1}{3} \text{sen}(3 - 3x) + \frac{2}{9} \text{sen}^3(3 - 3x) - \frac{1}{15} \text{sen}^5(3 - 3x) + c$
- 12.  $-\frac{1}{4} \text{sen}^3(x^2 - 1) \cos(x^2 - 1) - \frac{3}{8} \text{sen}(x^2 - 1) \cos(x^2 - 1) + \frac{3}{8}(x^2 - 1) + c$
- 13.  $\frac{1}{4}(e^{2x} - 1) + \frac{1}{8} \text{sen}(2e^{2x} - 2) + c$
- 14.  $\frac{-1}{10} \cos^5 2\theta + \frac{1}{14} \cos^7 2\theta + c$
- 15.  $-\frac{1}{8} \text{sen}^4(1 - 2\theta) + \frac{1}{12} \text{sen}^6(1 - 2\theta) + c$
- 16.  $\frac{1}{20} \text{sen}^{20}(t - 1) + c$
- 17.  $\frac{1}{2} \text{tg}^2(\ln \theta) + \ln |\cos(\ln \theta)| + c$
- 18.  $\frac{1}{4} \text{sen}^4 x + c$
- 19.  $\frac{1}{4} \cos^3 x \text{sen } x + \frac{3}{8} \cos x \text{sen } x + \frac{3}{8} x + c$



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.  $5 \operatorname{sen}^3 x - 3 \operatorname{sen}^5 x + c$

24.  $2 \cos^3 x \operatorname{sen} x - 8 \cos^5 x \operatorname{sen} x + 3 \operatorname{sen} x \cos x + 3x + c$

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

26.  $\operatorname{cotg}^3 x + c$

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

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

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

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

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

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

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

38. 2 u.a.

39. 8 u.a.

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

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

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

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

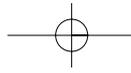
49.  $2 \operatorname{arc} \operatorname{sen} \frac{x}{2} + \frac{x\sqrt{4 - x^2}}{2} - \frac{x(4 - x^2)\sqrt{4 - x^2}}{4} + c$

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


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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**74.** Diverge

**75.** Diverge

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

**Seção 7.6**

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

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

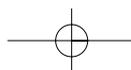
**3.**  $\frac{1}{12}\ln|x-2|+\frac{2}{3}\ln|x+1|-\frac{3}{4}\ln|x+2|+c$

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

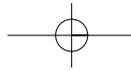
**7.**  $\ln\left(\frac{x-2}{x-1}\right)^2+\frac{1}{x-2}-\frac{5}{2(x-2)^2}+c$



8.  $\frac{1}{16} \ln \left| \frac{x-4}{x} \right| + \frac{1}{4x} + c$       9.  $\frac{x^2}{4} + x - \frac{1}{4} \ln(x^2 + 1) + \operatorname{arc\,tg} x + c$
10.  $\frac{5}{4} \left[ \ln|x| - \frac{1}{2} \ln(x^2 + 4) \right] + c$       11.  $\frac{3}{2} \ln|x^2 - x + 1| + \frac{1}{\sqrt{3}} \operatorname{arc\,tg} \frac{2x-1}{\sqrt{3}} + c$
12.  $\frac{1}{12} \ln|x+2| - \frac{1}{24} \ln|x^2 - 2x + 4| + \frac{1}{4\sqrt{3}} \operatorname{arc\,tg} \frac{x-1}{\sqrt{3}} + c$
13.  $\frac{-x-2}{2(x^2+2x+3)} - \frac{1}{2\sqrt{2}} \operatorname{arc\,tg} \frac{x+1}{\sqrt{2}} + c$
14.  $\ln|x| - \frac{1}{2} \ln|x^2 - x + 1| + \frac{5\sqrt{3}}{9} \operatorname{arc\,tg} \frac{2x-1}{\sqrt{3}} + \frac{x+1}{3(x^2-x+1)} + c$
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.  $\frac{1}{3} \operatorname{arc\,tg} x - \frac{1}{6} \operatorname{arc\,tg} \frac{x}{2} + c$
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.  $\ln|x-1| - \frac{1}{x-1} - \frac{1}{2} \ln(x^2 + 1) - \operatorname{arc\,tg} x + c$
25.  $\frac{4}{3} \ln 2$  u.a.      26.  $\frac{1}{2} \left[ \operatorname{arc\,tg} \frac{3}{2} - \operatorname{arc\,tg} \left( -\frac{1}{2} \right) \right]$  u.a.
27.  $\left[ \frac{2}{25} \ln 4 + \frac{3}{20} \right]$  u.a.      28.  $\left[ \frac{\sqrt{3}}{9} \operatorname{arc\,tg} \frac{2}{\sqrt{3}} + \frac{2}{21} \right]$  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.  $\frac{1}{3} \ln \left| \frac{\operatorname{tg} \frac{x}{2} + 3}{\operatorname{tg} \frac{x}{2} - 3} \right| + c$



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$$5. \frac{\sqrt{2}}{2} \operatorname{arc\,tg} \left( \frac{\operatorname{tg} \frac{x}{2}}{\sqrt{2}} \right) + c \quad 6. \frac{-1}{\operatorname{tg} \frac{x}{2}} + c$$

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

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

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

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

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

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

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

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

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

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

$$17. -\sqrt{\frac{2}{3}} \operatorname{arc\,tg} \sqrt{\frac{2(3-x)}{3(x-2)}} + c$$

$$18. \frac{1}{3} \ln \left| \frac{\sqrt{x^2 + 4x + 9} - x - 7}{\sqrt{x^2 + 4x + 9} - x - 1} \right| + c \quad 19. \frac{2}{\sqrt{3}} \operatorname{arc\,tg} \left( \frac{\sqrt{4x^2 + x - 3} - 2x}{\sqrt{3}} \right) + c$$

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

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

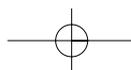
$$22. \frac{-1}{\sqrt{2x+x^2-x}} - \frac{1}{\sqrt{2x+x^2-x-2}} + c$$

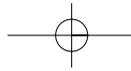
$$23. \operatorname{arc\,tg} \left( \frac{\sqrt{x^2 - 2x - 3} - x + 1}{2} \right) + c \quad 24. \frac{1}{4} \ln \left| \frac{\sqrt{1+x+x^2} - x + 1}{\sqrt{1+x+x^2} - x - 1} \right| - \frac{3}{2(\sqrt{1+x+x^2} - x + 1)} + c$$

$$25. \frac{1}{4} \ln \left| \frac{x+1 + \sqrt{x^2+3x+2}}{x+1 - \sqrt{x^2+3x+2}} \right| + c \quad 26. -\ln |\sqrt{x^2+2x-3} - x - 1| + c$$

$$27. \operatorname{arc\,tg} (2\sqrt{x^2+x-2x-1}) + c \quad 28. \frac{-1}{3} \ln |2 - \sqrt{9x^2+12x+5} + 3x| + c$$

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





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

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

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

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

## Capítulo 8

### Seção 8.4

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

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

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

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

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

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

$$7. \operatorname{senh} 1 \text{ u.c.}$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

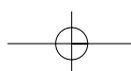
$$33. \frac{1}{2} \pi \text{ u.a.}$$

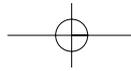
$$34. \frac{5\pi}{2} \text{ u.a.}$$

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

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

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




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

**39.**  $7\pi$  u.a.

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

**41.**  $6\pi$  u.a.

**42.**  $3\pi k^2$  u.a.

**Seção 8.7**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**20.**  $9\pi^2$  u.v.

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

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

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

**24.** 53,226 u.a.

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

**26.**  $4\pi$  u.a.

**27.**  $48\pi$  u.a.

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

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

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

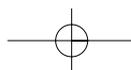
**Seção 8.11**

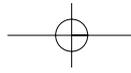
**2.** a)  $\left(-2, \frac{5\pi}{4}\right); \left(2, \frac{-7\pi}{4}\right)$

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

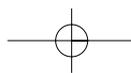
c)  $\left(5, \frac{5\pi}{3}\right); \left(-5, \frac{-4\pi}{3}\right)$

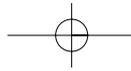
d)  $\left(-4, \frac{11\pi}{6}\right); \left(4, \frac{-7\pi}{6}\right)$





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)  $r \operatorname{sen} \theta = 2$   
 d)  $\theta = \frac{3\pi}{4} + k\pi, k \in \mathbb{Z}$       e)  $r = 2 \cos \theta$       f)  $r = 6 \operatorname{sen} \theta$
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.  $18 \int_0^{\pi/6} \sqrt{9 \cos^2 3\theta + \operatorname{sen}^2 3\theta} d\theta$
41.  $64 \int_0^{\pi/8} \sqrt{16 \operatorname{sen}^2 4\theta + \cos^2 4\theta} d\theta$       42.  $12 \int_0^{\pi/4} \frac{d\theta}{\sqrt{\operatorname{sen} 2\theta}}$
43.  $2 \int_0^{\pi} \sqrt{13 - 12 \cos \theta} d\theta$       44.  $4 \int_{-\pi/2}^{\pi/2} \sqrt{5 - 4 \operatorname{sen} \theta} d\theta$
45.  $2 \int_0^{\pi} \sqrt{13 + 12 \cos \theta} d\theta$       46.  $4 \int_{-\pi/2}^{\pi/2} \sqrt{5 - 4 \operatorname{sen} \theta} d\theta$
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.  $11\pi$  u.a.
53.  $24\pi$  u.a.      54.  $24\pi$  u.a.      55.  $24\pi$  u.a.




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56.  $24\pi$  u.a.                      57.  $\frac{a^2(\pi - 2)}{2}$  u.a.                      58.  $4\pi$  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.  $(100\text{arc cos } 3/5 - 48)$  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)  $1,8\text{kg} \cdot \text{m}^2$                       b)  $7,2\text{kg} \cdot \text{m}^2$                       7. 49,07 kg; 4 m
8. a)  $443,73\text{kg} \cdot \text{m}^2$                       b)  $1.228,8\text{kg} \cdot \text{m}^2$
9. Para barra do ex.1:                      a)  $12.672\text{kg} \cdot \text{cm}^2$                       b)  $29.952\text{kg} \cdot \text{cm}^2$                       c)  $5.328\text{kg} \cdot \text{cm}^2$   
 Para barra do ex. 3:                      a)  $20,83\text{kg} \cdot \text{m}^2$                       b)  $145,83\text{kg} \cdot \text{m}^2$                       c)  $20,83\text{kg} \cdot \text{m}^2$
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)  $44.131,5\pi$  J                      b)  $44.131,5\pi$  J
21.  $340.106,66\pi$  J                      22. 746.901,12 J                      23. 117.684 N
24. 14.710,5 N                      25. 167.372,8 u. força                      26.  $2 \times 10^4$  N
27. 588.420 N                      28. 7.322.560 N                      29. 2.615.200 N
30. 197.447,6 N                      31.  $12 \times 10^3$  N                      32. 2.194,28 N
33.  $312 \times 10^2$  N                      34. R\$ 3,77                      35. R\$ 2,24
36. R\$ 6,61 e R\$ 4,96                      37. R\$ 494.189,36

